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RAINS

D1.2. Co-creation Results for Adaptation of RAINS Solutions

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List of Acronyms

RAINS	Resilient Agri-based Integrated Nutrient and irrigation Solutions
D1.2	Deliverable 1.2
EU	European Union
WP	Work Package
FMIS	Farm Management Information Systems
AI	Artificial Intelligence
NbSs	Nature-based Solutions
N-P	Nitrogen–Phosphorus
R&D	Research and Development
NGOs	Non-Governmental Organizations

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- Agricultural water management
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Executive summary

This report constitutes Deliverable D1.2, prepared under Work Package 1 of the RAINS project (*Resilient Agricultural IrrigatioN Systems for water Scarcity in Europe*, Grant Agreement No. 101181890, HORIZON-CL6-2024-CLIMATE-01). It presents the design, implementation, and results of the co-creation activities carried out between May 2025 and March 2026 across the RAINS pilot areas in Greece and Spain, as well as at the European level.

A total of seven co-creation events were organized: three in-person workshops in Greece (Thessaloniki and Lesvos), three in-person workshops in Spain (Guardamar, Orihuela, and Polinyà de Xúquer), and one online workshop involving European stakeholders. Across the six in-person workshops, a total of 113 actors (57 in Greece and 56 in Spain) participated in the co-creation process, using a common questionnaire as the basis for discussion and feedback collection. In both countries, participants included farmers, agricultural advisors, academics, irrigation organizations, policymakers, business actors and NGOs representing the full agricultural value chain in the targeted areas. The online workshop extended the consultation to 43 European stakeholders from 15 countries, with a dedicated questionnaire administered via Mentimeter covering all 10 RAINS solutions.

The co-creation process was designed to engage a diverse range of actors across the agricultural value chain, ensuring that the feedback collected reflects not only the perspectives of primary end users, but also the institutional, technical, and market dimensions that shape the uptake of innovative solutions. The facilitated discussions, combined with structured questionnaires, generated valuable qualitative and quantitative evidence on the local conditions, concerns, expectations, and enabling factors influencing stakeholder engagement with each solution.

The findings presented in this report provide a solid evidence base for the adaptation of the RAINS solutions to end-user needs. They directly support the design of the project's demonstration phase and the development of targeted knowledge transfer, communication, and uptake strategies, thereby helping to ensure that the RAINS solutions are aligned with the practical priorities and operational realities of the agricultural systems they are intended to serve.

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1. Introduction

This document is Deliverable D1.2, “Co-creation Results for Adaptation of RAINS Solutions”, prepared under Work Package 1 (WP1), “RAINS Solutions: Preparation and Adaptation to End User Needs”. WP1 is led by ELGO and brings together all consortium partners during the first 18 months of the project (M1-M18). As such, the deliverable occupies a foundational position within the overall RAINS implementation logic, since it captures the evidence generated at the stage where the project’s solutions are being aligned with the needs, capacities, and expectations of their intended users and enabling actors.

The main objective of WP1 is to ensure that the RAINS solutions are not developed through a top-down process, but are instead continuously shaped and refined through direct engagement with farmers, irrigation organizations, agricultural advisors, researchers, and policymakers who are expected to use, support, regulate, or facilitate their uptake. This participatory approach is implemented through co-creation workshops and structured stakeholder consultation activities carried out in the two main pilot areas, Greece and Spain, as well as at the European level. In this way, the project seeks to embed technical innovation within real agricultural contexts from the outset, ensuring that solution development is informed not only by scientific and engineering considerations, but also by practical farming realities, institutional conditions, and user perceptions.

Deliverable D1.2 documents the results of these co-creation activities and provides a consolidated account of the knowledge generated through stakeholder interaction. In particular, it presents:

- *stakeholder feedback on the relevance, acceptability, and perceived utility of each RAINS solution;*
- *the concerns, reservations, and enabling conditions identified by end users and other relevant actors with respect to adoption; and*
- *recommendations for the adaptation, positioning, and further refinement of the RAINS solutions ahead of the full demonstration phase.*

The report covers co-creation activities carried out between May 2025 and March 2026, including three in-person workshops in Spain (Guardamar, Orihuela, and Polinyà de Xúquer), three in-person workshops in Greece (Thessaloniki and Lesvos), and one online European co-creation workshop involving stakeholders from 15 countries. Together, these activities provide a multi-scalar evidence base that combines local pilot-level insights with broader European perspectives, thereby supporting both the contextual adaptation of individual solutions and the strategic positioning of the RAINS portfolio for wider uptake and replication.

2. Description of Co-creation Activities

2.1 Co-creation Methodology and Events

The co-creation approach adopted within WP1 is grounded in the principles of participatory development and end-user-driven innovation. Rather than presenting pre-defined solutions to stakeholders for passive evaluation, the RAINS co-creation methodology engaged all the types of our stakeholders in a structured dialogue aimed at identifying adoption requirements, local constraints, and adaptation needs for each solution. This approach ensures that the demonstration phase of the project is informed by real-world conditions and stakeholder expectations across different agricultural contexts.

Co-creation activities were carried out through two complementary formats: Six in-person regional workshops held at the pilot sites including 3 workshops in Greece and 3 workshops Spain, plus one online European workshop involving stakeholders from across the EU. In total, **seven co-creation events** were conducted between May 2025 and March 2026, as these are presented in **Table 1**. All sessions combined the presentation of RAINS solutions with facilitated discussion and a common questionnaire, allowing both qualitative insights and quantitative data to be captured systematically. The regional questionnaire (ANNEX I) for the co-creation workshops in the study areas of Greece and Spain was developed in English by ELGO as a common basis for discussion and feedback collection and it was translated into Greek and Spanish for local use in the 2 countries. It was administered both on-site during workshops and digitally via Google Forms, enabling participation from stakeholders unable to attend in person. In Spain, for example the Conselleria de Agricultura of the Valencia Region distributed the questionnaire directly to approximately 50 irrigation associations, yielding 39 paper-format responses. It is noted that not all solutions were evaluated by participants in the project pilot areas, as the questionnaires were tailored to reflect the specific portfolio of solutions planned for demonstration at each site. In case of the on-line EU stakeholders' workshop, the interactive session was designed and administered via Mentimeter, providing targeted linkages with the regional questionnaires that have been used as basis for the co-creation processes in the workshops of Greece and Spain.

The co-creation process engaged a deliberately diverse range of actors across the agricultural value chain, including:

- *Farmers and producers — the primary end users of the RAINS solutions, representing both small-scale holdings and larger commercial operations;*
- *Agricultural advisors and extension services — intermediaries with a key role in knowledge transfer and solution uptake;*
- *Researchers and academics — contributing technical knowledge and independent evaluation of solution performance;*
- *Policymakers and public authorities — including irrigation associations and regional government bodies such as the Conselleria de Agricultura of the Valencia Region;*

- *Business and investor representatives — providing perspective on market potential and scalability;*
- *NGOs and civil society — particularly relevant for the European workshop, where broader societal acceptance was explored.*

It is underlined that 190 stakeholders have been engaged in the participatory activities of co-creation from which more than 50% were farmers or irrigation systems end users.

Table 1: Overview of RAINS co-creation events

A/A	Date	Location	Format	Participants
1	29 May 2025	Guardamar, Alicante (ES)	In-person	26 (20 farmers and 6 other types of stakeholders)
2	24 Jul 2025	Orihuela, Alicante (ES)	In-person	30 (12 farmers and 18 other types of stakeholders)
3	19 May 2025	Thessaloniki (GR)	In-person	25 (13 farmers and 12 other types of stakeholders)
4	05 May 2025	Lesvos, Petra (GR)	In-person	23 (17 farmers and 6 other types of stakeholders)
5	14 Oct 2025	Lesvos, Mytilini (GR)	In-person	20 (10 farmers and 10 other types of stakeholders)
6	18 Sep 2025	Polinyà de Xúquer, Valencia (ES)	In-person	23 (15 farmers and 8 other types of stakeholders)
7	31 Mar 2026	Online (EU-wide)	Online	43 Stakeholders from 15 countries

2.2 Co-creation Activities in Greece

The Greek co-creation activities were coordinated by ELGO and took place across the two Greek pilot areas: Thessaloniki (Chalastra) in Central Macedonia Region, and Lesvos Island in North Aegean Region. Three in-person

workshops were held between May and October 2025, engaging a combined total of 68 participants across diverse stakeholder groups.

2.2.1 Description of co-creation events

Workshop 1 — Lesvos, Petra, 05 May 2025

The first workshop in Petra, Lesvos, was held with 23 participants. The Lesvos pilot context characterized by summer drought and limited conventional irrigation made it the primary site for solutions such as fog collectors, Solid Water, bio-based netting, compost bricks, and WaterIQ. The multi-actor workshop generated rich interdisciplinary discussion on solution performance, local suitability, and cost-benefit trade-offs.



Figure 1: Workshop 1 — Lesvos, Petra, 05 May 2025: Co-creation session with local stakeholders

Workshop 2 — Thessaloniki, 19 May 2025

The second workshop was held in Thessaloniki with 25 participants. The session focused on solutions relevant to the Thessaloniki pilot: reclaimed wastewater reuse, sewage sludge application, biofertilizers, Optifangs-IA, and WaterIQ. Discussions centred on the regulatory framework for reclaimed water and sludge-derived products, and on the practical requirements for integrating digital tools into farm management routines.



Figure 2: Workshop 2 — Thessaloniki, 19 May 2025: Stakeholder engagement and co-creation activities

Workshop 3 — Lesvos, Mytilini, 14 October 2025

The follow-up workshop in Mytilini, Lesvos, brought together 20 participants, for a more focused session building on the outcomes of the first meeting in Lesvos. Participants requested greater technical clarity on specific aspects of the solutions, particularly the polymeric composition of Solid Water, fog collector installation logistics, and the data requirements of WaterIQ.



Figure 3: Workshop 3 — Lesvos, Mytilini, 14 October 2025: Stakeholder consultation and interactive discussion

2.2.2 Themes of co-creation process in Greece

Targeted consistent themes shaped the character of discussions across the three Greek workshops. The sessions reflected the diverse agronomic contexts of the two pilot areas, with the Thessaloniki workshops drawing on the realities of large-scale cereal production, while the Lesvos sessions were anchored in the island's distinct water scarcity challenges and more heterogeneous farming landscape. Participants across both locations engaged with notable depth and critical thinking, demonstrating familiarity with water management constraints and a genuine interest in exploring innovative approaches to address them. The presence of institutional stakeholders, including representatives from local authorities, agricultural cooperatives, and advisory bodies enriched the discussions in a multi-actor environment, by introducing governance and policy dimensions alongside the farm-level perspective of the farmer participants. In Thessaloniki, discussions were particularly focused on the regulatory and institutional prerequisites for implementing nature-based and circular economy solutions, reflecting the more structured and policy-aware profile of the stakeholder group. In Lesvos, the dialogue was shaped by a stronger emphasis on practical feasibility and local adaptability, with participants drawing on direct experience of seasonal water stress to evaluate the relevance of each solution to their specific conditions. Across all three sessions, the co-creation process fostered a constructive exchange between technical knowledge and local expertise, generating actionable insights that directly inform the adaptation of the RAINS solutions for the Greek pilot.

2.3 Co-creation Activities in Spain

The Spanish co-creation activities were led by UMH (Universidad Miguel Hernández de Elche) and took place across two locations in the Valencia and Murcia regions: Guardamar and Orihuela in the province of Alicante, and Polinyà de Xúquer in the province of Valencia. Three in-person workshops were held between May and September 2025, engaging a combined total of 79 participants. The Spanish pilot area is characterised by intensive horticulture and citrus production with high dependence on irrigation, making it a directly relevant context for the majority of RAINS solutions.

2.3.1 Description of co-creation events

Workshop 1 — Guardamar, Alicante, 29 May 2025

The first Spanish workshop was held in Guardamar, Alicante, with 26 participants. As the opening co-creation event for the Spanish pilot, the session introduced all RAINS solutions to local agricultural actors for the first time and established the dialogue framework for subsequent workshops. Discussions reflected the farming reality of the area and focused on the practical applicability of the solutions under these conditions.



Figure 4: Workshop 1 — Guardamar, Alicante, 29 May 2025: Local stakeholder consultation session

Workshop 2 — Orihuela, Alicante, 24 July 2025

The second workshop took place in Orihuela with 30 participants. The inclusion of academic participants enriched the technical dimension of the discussions, particularly regarding the performance evidence base for biofertilizers, compost bricks, and the Optifangs-IA system. Stakeholders from irrigation associations contributed an important institutional perspective, highlighting the operational constraints and water governance challenges specific to the Valencia region.



Figure 5: Workshop 2 — Orihuela, Alicante, 24 July 2025: Knowledge-sharing workshop activities

Workshop 3 — Polinyà de Xúquer, Valencia, 18 September 2025

The third workshop was held at Finca Sinyent in Polinyà de Xúquer, Valencia, with 23 participants. The session benefited from the direct involvement of the Conselleria de Agricultura of the Valencia Regional Government, a RAINS partner with extensive reach across the region's irrigation sector, whose participation strengthened the

institutional dimension of the co-creation dialogue and ensured that the perspectives of organized irrigation communities were well represented.

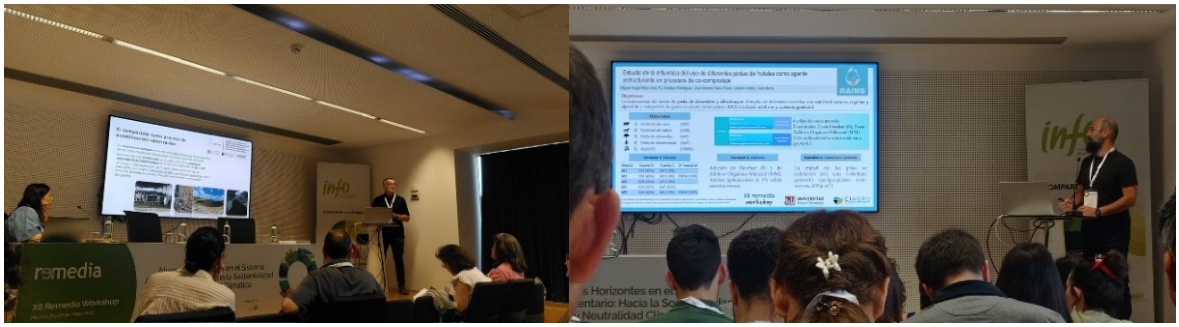


Figure 6 Workshop 3 — Polinyà de Xúquer, Valencia, 18 September 2025

2.3.2 Key Themes of co-creation process in Spain

Several consistent themes shaped the quality and direction of discussions across the three Spanish workshops. The sessions were characterized by strong practical orientation, with participants consistently grounding the dialogue in the specific agronomic and economic realities of intensive horticulture and citrus production in the Valencia and Murcia regions. Farmers demonstrated a high level of familiarity with irrigation management challenges and engaged actively in evaluating the solutions against their day-to-day operational constraints.

The involvement of irrigation association representatives brought an important collective dimension to the discussions, shifting the conversation at times from individual farm-level adoption to broader questions of water governance, shared infrastructure, and coordinated implementation. Academic participants contributed technical perspectives that enriched the evidence base available to farmers during the evaluation process, fostering a productive exchange between research knowledge and practical experience.

Across all three sessions, participants showed genuine openness to innovation, particularly where solutions could be linked to tangible improvements in resource efficiency and production sustainability. The dialogue also reflected a mature understanding of the transition challenges involved, with stakeholders raising questions about training, support structures, and the availability of independent guidance, themes that point to the importance of a well-designed knowledge transfer framework alongside the technical demonstration of the RAINS solutions.

2.4 Co-creation Workshop with EU Stakeholders

A European-level online co-creation workshop was organized by ELGO on 31 March 2026, bringing together a multi-actor group of 43 European stakeholders from 15 countries across Europe (Figure 7). The event represented the third pillar of the RAINS co-creation methodology, complementing the regional in-person workshops in Greece and Spain with a broader, European perspective on the relevance, adoptability, and scaling potential of the RAINS solutions.



Figure 7: Participants per country in the EU stakeholders' workshop

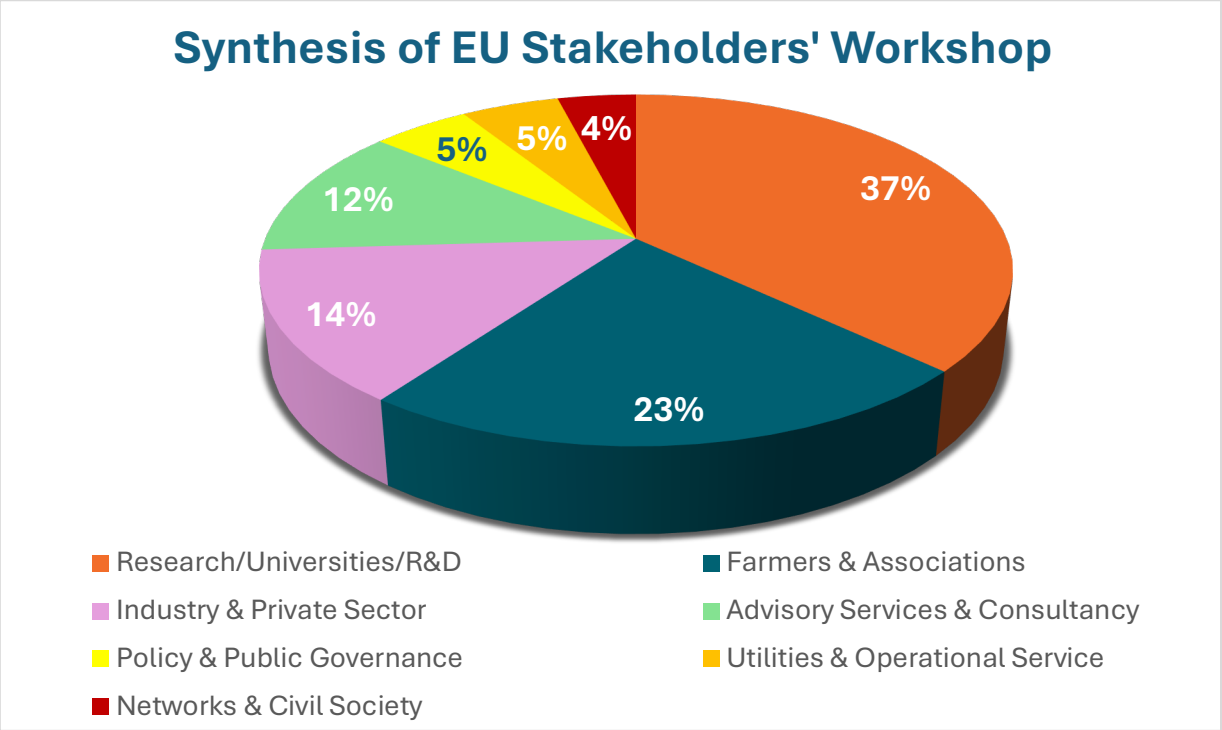


Figure 8: Distribution of stakeholders by category in the EU stakeholders' workshop

Unlike the regional workshops, which focused on the specific conditions of the two pilot areas, the European workshop was designed to capture the diversity of agricultural contexts, policy frameworks, and sectoral priorities across multiple member states and to explore the cross-border transferability of the RAINS solutions. The workshop included an introductory, an informative and an interactive session. The introductory session was aiming to provide an overview of the RAINS project to the participants and set the framework of co-creation. In the informative session, all 10 RAINS solutions were presented to participants prior to the interactive session, ensuring a shared knowledge baseline across the diverse international audience. The interactive session was aiming at real-time audience engagement and structured data collection, using Mentimeter as the primary interactive tool. The Invitation, agenda and photographic documentation of the workshop are provided in ANNEX II.

3. Results of Co-creation Activities in Greece and Spain

This section presents the results of the co-creation processes conducted across six in-person workshops in Greece and Spain, covering both stakeholders' overall perceptions regarding the adoption of new technologies and solutions for agricultural water management, as well as their targeted assessment of each RAINS solution. For each RAINS solution, the level of acceptance by stakeholders was assessed in terms of interest and perceived usefulness, while relevant adoption aspects were explored with stakeholders to identify the main factors (e.g. concerns, drivers, and expectations) influencing the level of acceptance and thereby inform the deployment of RAINS demonstrations in real-life contexts.

3.1 Key Challenges in the Adoption of New Technologies and Solutions

The challenges that are related with the adoption of new agricultural technologies have been explored with the stakeholders across both pilot areas, to reveal the key factors of concern that may act as barriers for the early adopters. High upfront cost emerged as the single most significant concern in both countries, cited by 28% of Greek and 24% of Spanish stakeholders (Figure 9). Lack of education and adequate information ranked second (14% Greece, 18% Spain), reflecting the gap between general awareness of innovations in farm water management and the detailed technical knowledge needed to assess and implement them confidently. Low reliability and uncertainty of results was more prominent in Spain (18%) than in Greece (12%), likely linked to the higher-value, risk-sensitive nature of intensive horticultural and citrus production. Limited access to technology was cited by 13% of Spanish and 9% of Greek stakeholders, while practical integration barriers, including time constraints, difficulty adapting daily routines, and lack of advisory support were raised by approximately 12% in both countries.

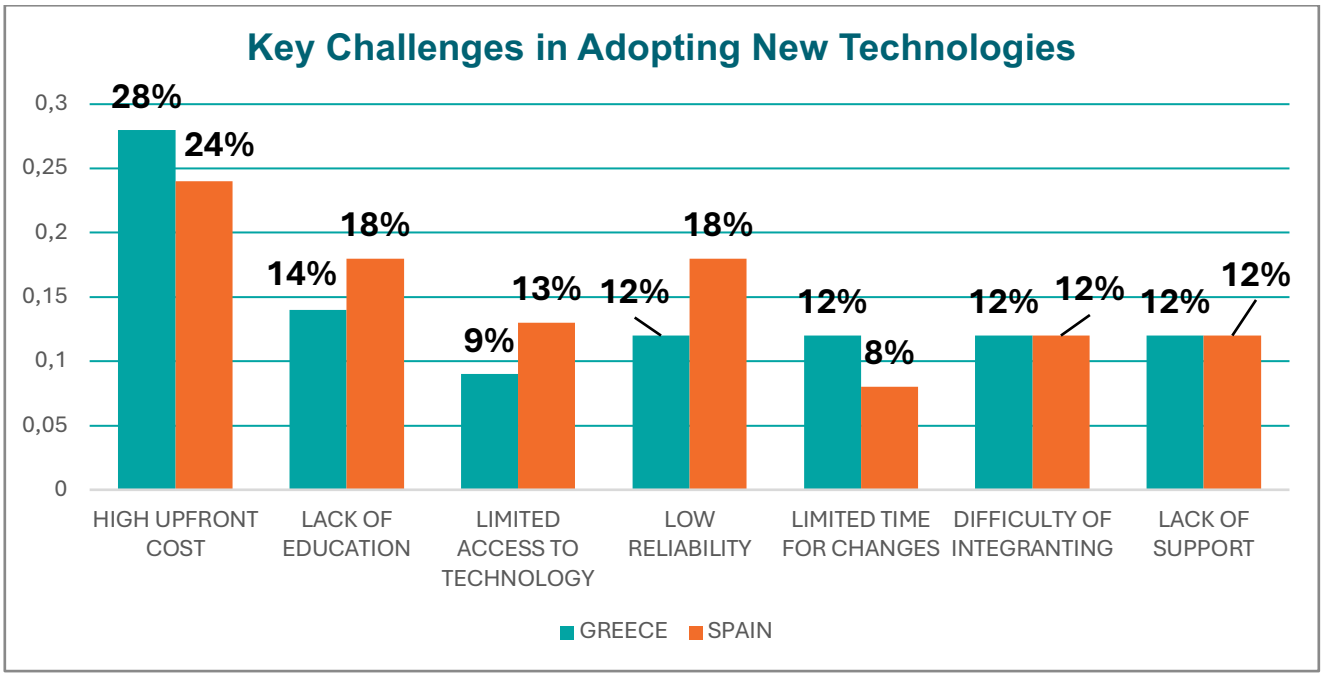


Figure 9: Key challenges in adopting new technologies across Greece and Spain

Furthermore, the key factors that affect the decision of stakeholders to adopt new technologies was further discussed. Results were consistent across both pilot areas, producing the following ranking from the most important to less important: **(1) Cost, (2) Increased productivity, (3) Ease of implementation, (4) Durability and longevity, and (5) Environmental protection.** The dominance of economic and practical criteria over environmental considerations does not indicate indifference to sustainability outcomes, but rather confirms that environmental co-benefits are evaluated after, and in support of an already financially compelling proposition. This has direct implications for how RAINS solutions should be shaped in terms of operational design and consequently how they should be framed in communication and dissemination materials in order to be adopted, replicated and mainstreamed.

3.2 Acceptance and Implementation Aspects of RAINS Solutions

For each of the RAINS solutions, the level of acceptance by stakeholders was assessed in terms of interest and perceived usefulness. To gain a deeper understanding, the main adoption aspects were further explored in collaboration with the stakeholders in order to identify their primary concerns, expectations, and key drivers influencing the level of acceptance.

3.2.1 Solution 1 — Reclaimed Wastewater

Acceptance level

The reclaimed wastewater solution received strong positive evaluations in both pilot areas, making it one of the highest-rated solutions overall. In Greece, 88% of participants assessed it positively, with only 3% negative and 9% had a neutral stance (Figure 10). In Spain, 79% of the stakeholders rated it positively, 5% negatively, and 16% neutrally. The consistently high acceptance across both contexts reflects the immediate relevance of alternative water sources in two regions facing increasing water scarcity pressure.

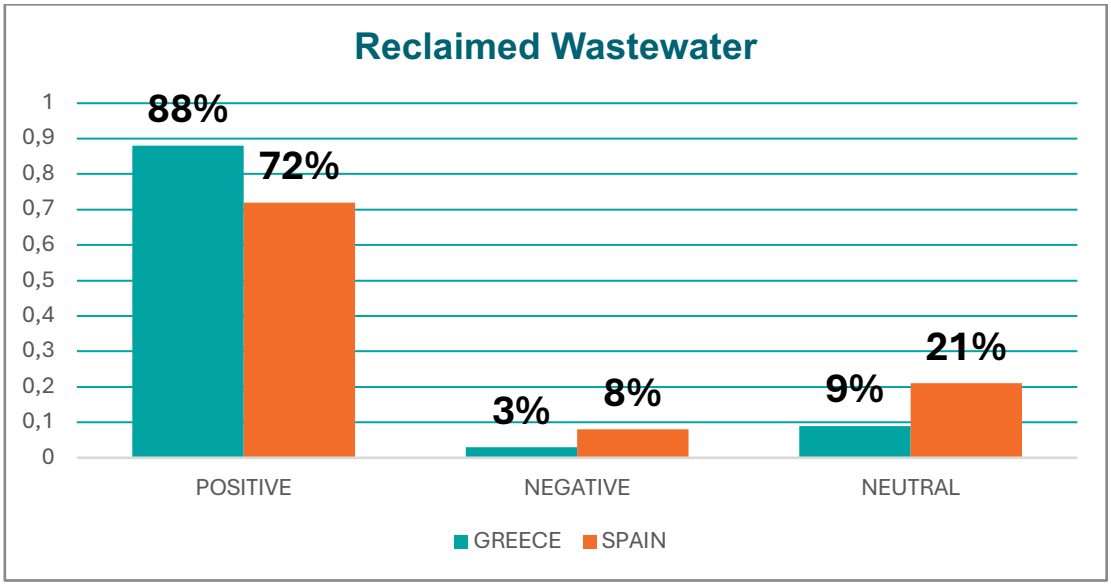


Figure 10: Acceptance level of reclaimed wastewater reuse solution in Greece and Spain

Adoption aspects

Across both pilot areas, participants identified a consistent set of implementation prerequisites that will guide the adaptation of the solution for the demonstration phase. In Greece, the primary concern was installation cost (39%), followed by the need for technical information and guidance (27%), water quality considerations (20%), and difficulty in application (14%). In Spain, water quality considerations emerged as the primary concern (34%), followed by installation cost (28%), the need for technical information (23%), and difficulty in application (14%). The variation in the relative weighting of water quality considerations between the two pilot areas reflects the distinct crop systems and production contexts of each region, and will inform the development of context-specific technical guidelines and communication materials as part of the RAINS Solutions demonstration strategy.

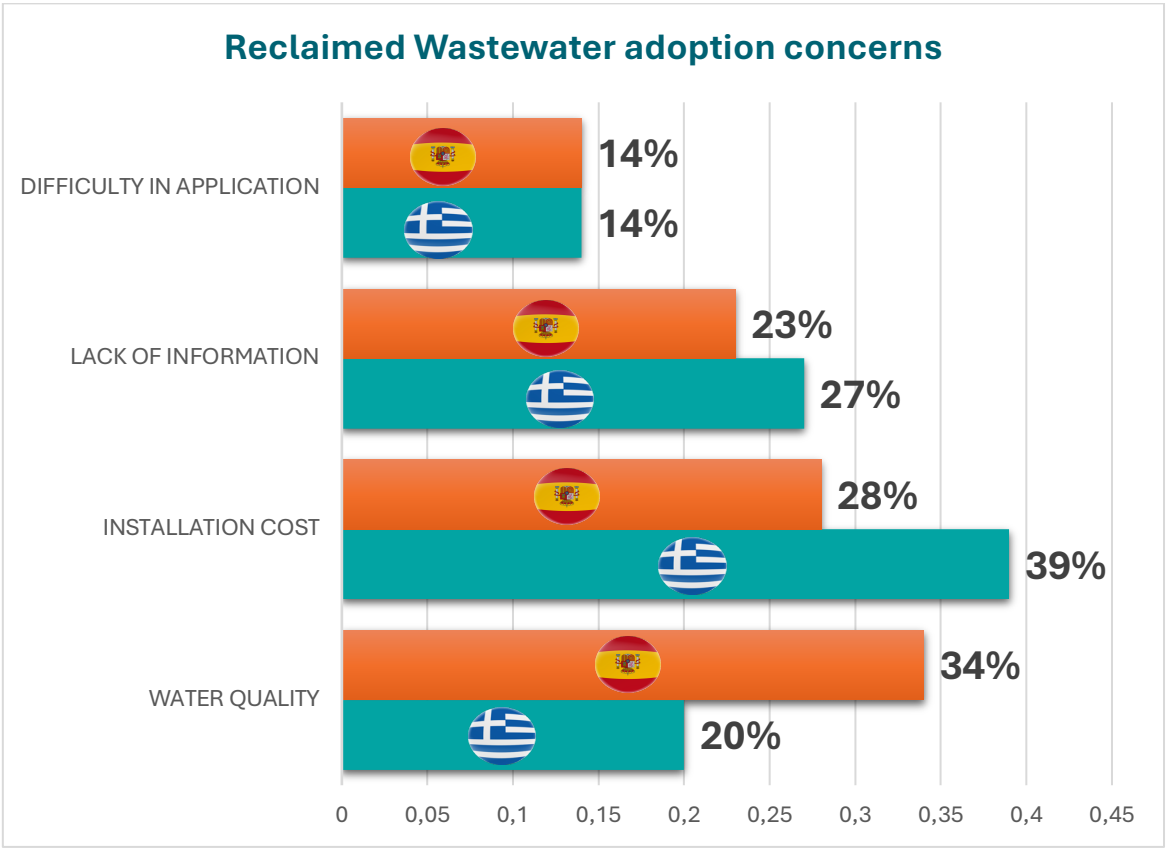


Figure 11: Adoption concerns for reclaimed wastewater reuse in Greece and Spain

3.2.2 Solution 2 — Sludge Application

Acceptance level

Sludge application revealed the most pronounced divergence in perceptions between the two pilot areas. In Greece, 76% of participants evaluated the solution positively, 6% negatively, and 18% neutrally, indicating solid acceptance in the context of large-scale cereal and olive production (Figure 12). In Spain, by contrast, only 40% of the participants expressed a positive view, with 24% negative and 36% neutral, reflecting a markedly more cautious attitude. This contrast is likely linked to differences in crop type and production system, the intensive horticulture and citrus farming that dominates the Spanish pilot involves direct food contact and is subject to stricter consumer and market acceptance standards than the field crops prevalent in the Greek pilot.

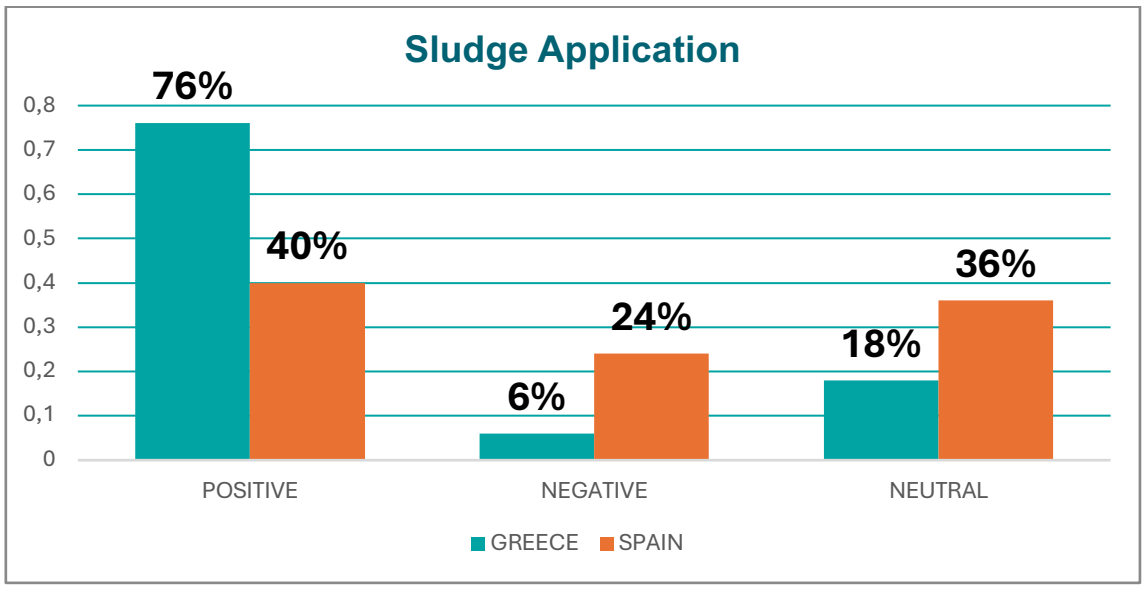


Figure 12: Acceptance level of sludge application solution in Greece and Spain

Adoption aspects

Participants in both pilot areas identified a consistent set of practical considerations regarding the implementation of this solution. In Greece, the primary concern was lack of sufficient technical information and guidance (43%), followed by concerns about potential contaminants and pathogens (28%), social acceptance (21%), and difficulty integrating the solution into existing farming systems (9%). In Spain, concerns about potential contaminants and pathogens ranked first (45%), followed by social acceptance (21%), lack of technical information (19%), and difficulty of integration (15%).The distribution of concerns across both pilot areas confirms that transparent safety communication and accessible technical guidance are the two most critical enabling conditions for advancing stakeholder confidence in this solution.

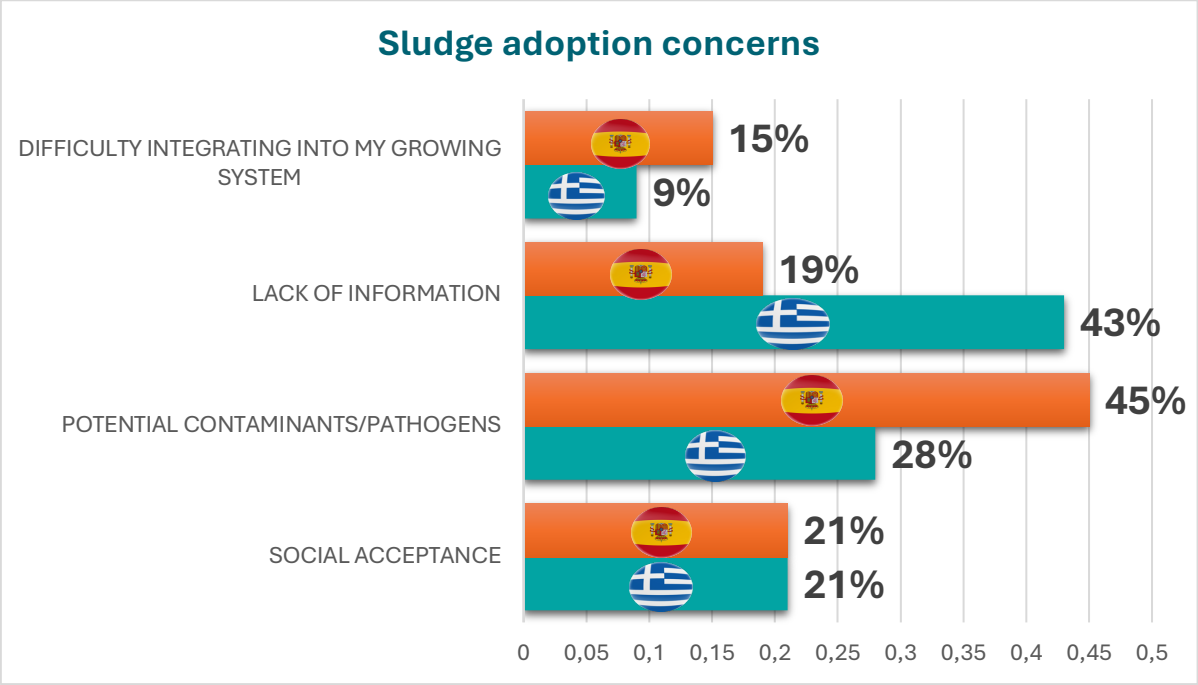


Figure 13: Key adoption concerns for sludge application in Greece and Spain

3.2.3 Solution 3 — Optifangs-IA

Acceptance level

The Optifangs-IA AI-based sludge management system followed a pattern closely mirroring that of sludge application, reflecting its direct functional link to that solution. In Greece, 74% of participants assessed it positively, 6% negatively, and 20% neutrally (Figure 14). In Spain, positive evaluations stood at only 41%, with 12% neutral and a notably high 47% negative, the highest negative rating recorded for any solution in the Spanish pilot. This result reinforces the more cautious Spanish stance towards sludge-related technologies and highlights the additional challenge posed by the AI-based nature of the system in contexts where digital tool adoption remains limited.

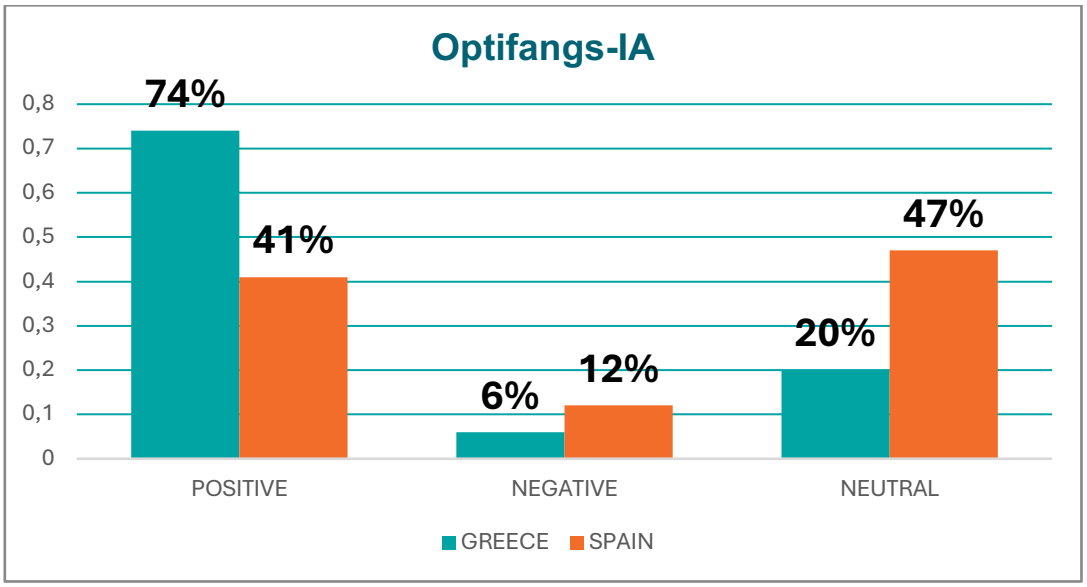


Figure 14: Acceptance level of Optifangs-IA solution in Greece and Spain

Adoption aspects

The AI-based character of this solution was reflected in the adoption concerns expressed by stakeholders across both pilot areas. In Greece, maintenance requirements and lack of sufficient technical information and guidance were jointly the primary concerns (38% each), followed by trust in AI-based decision-making (24%). In Spain, lack of technical information and guidance was the dominant concern (53%), followed by trust in AI-based decision-making (35%) and maintenance requirements (12%). The prominence of technical information needs and AI trust considerations across both pilot areas underlines the importance of transparency, user-friendly design, and structured capacity-building as prerequisites for realizing the strong adoption potential of this solution.

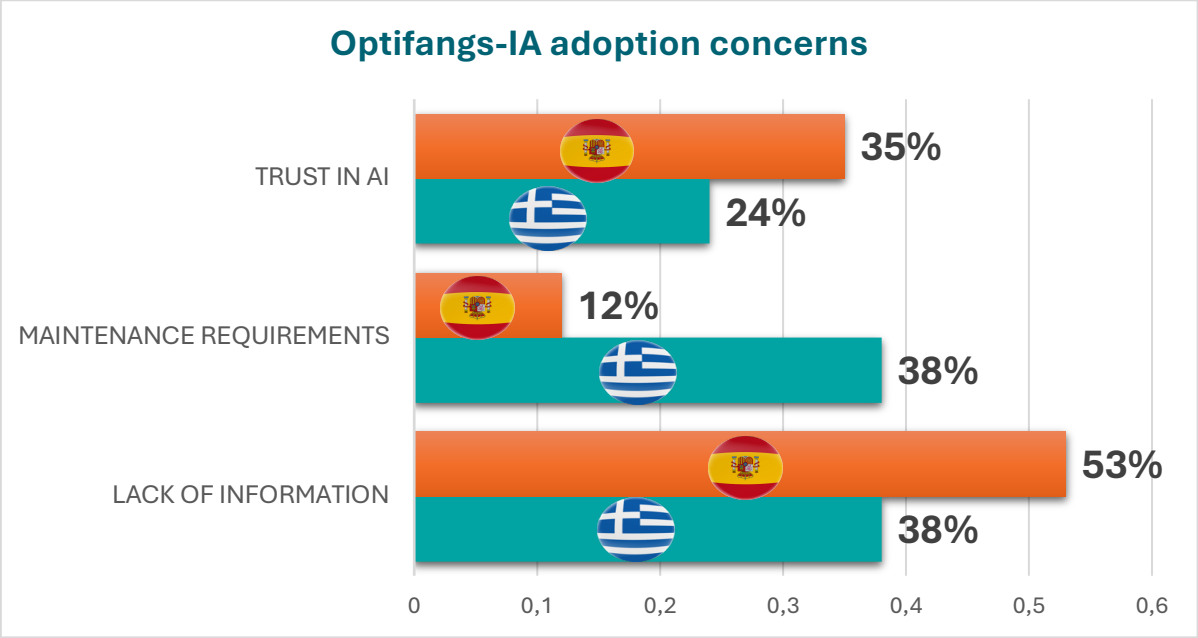


Figure 15: Main concerns to the adoption of Optifangs-IA in Greece and Spain

3.2.4 Solution 4 — Biofertilizer from Microalgae and Hydrolyzed Blood

Acceptance level

Biofertilizers maintained high acceptance levels in both pilot areas, with relatively consistent results across the two countries (Figure 16). In Greece, 71% of participants evaluated the solution positively, 9% negatively, and 21% neutrally. In Spain, 60% rated it positively, 14% negatively, and 26% neutrally. Despite a modest gap between the two pilots, the solution sustains strong overall acceptance, confirming stakeholder interest in bio-based fertilization alternatives as part of a broader shift away from synthetic inputs.

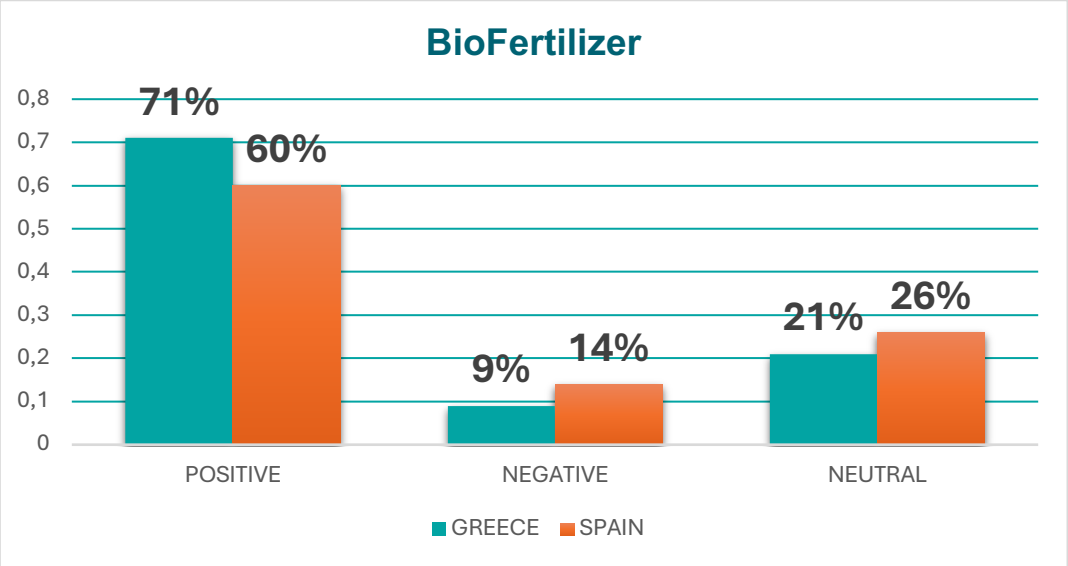


Figure 16: Acceptance levels of biofertilizers in Greece and Spain

Adoption aspects

The bio-based and circular economy character of this solution was reflected in the adoption concerns expressed by stakeholders across both pilot areas. In Greece, the origin of raw materials ranked as the primary concern (35%), followed by lack of sufficient technical information and guidance (33%), concerns about potential contaminants and pathogens (18%), and difficulty of integration into existing farming systems (14%). In Spain, lack of technical information and guidance ranked first (34%), followed by concerns about the origin of raw materials (26%), potential contaminants and pathogens (26%), and difficulty of integration (13%). The consistent prominence of raw material traceability and technical information needs across both pilot areas reflects the innovative biological origin of this solution and the importance of transparent supply chain communication and robust agronomic guidance in supporting stakeholder confidence.

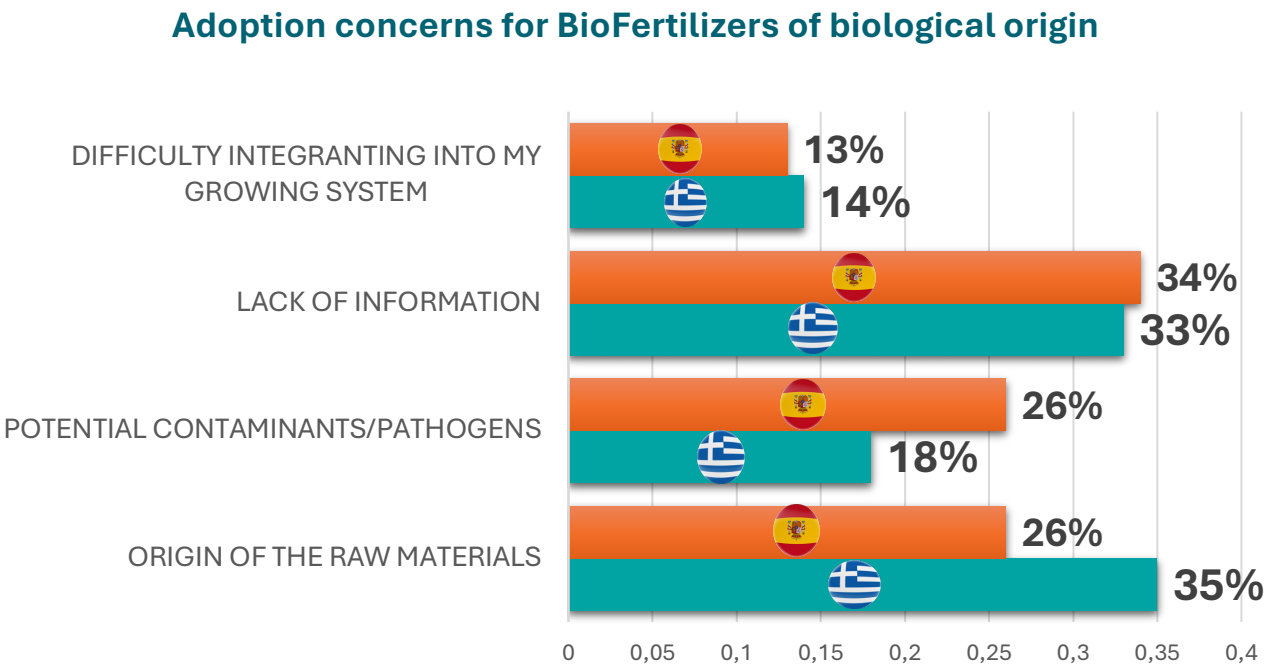


Figure 17: Main considerations related to biofertilizer of biological origin

3.2.5 Solution 5 — Solid Water

Acceptance level

Solid Water was considered useful for their farm by 55% of participants in Greece and 45% in Spain, potentially useful by 40% in Greece and 37% in Spain, and not useful by 5% in Greece and 18% in Spain. The significant proportion of "potentially useful" responses across both pilot areas reflects primarily the innovative and relatively unfamiliar character of the solution rather than skepticism about its merits, a pattern consistent with the finding that the majority of participants had limited or no prior experience with this type of water-retaining technology. This context underlines the importance of on-farm demonstration as a key mechanism for converting informed interest into adoption intent.

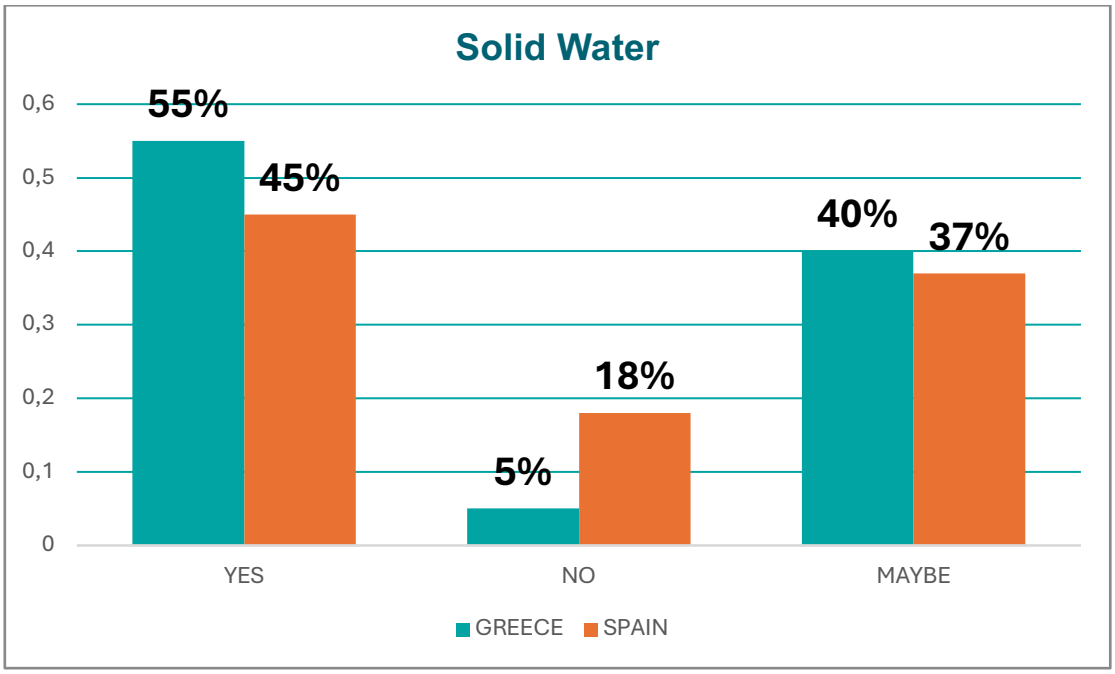


Figure 18: Acceptance level of solid water, in terms of perceived usefulness, across Greece and Spain

Adoption aspects

Participants broadly recognized the potential of Solid Water to reduce water consumption and improve soil moisture retention, particularly in water-stressed environments where conventional irrigation cannot fully compensate for seasonal drought. The questions raised during the workshops centered on application parameters under specific local conditions, including compatibility with tree crop root architectures and existing localized irrigation infrastructure and reflect the natural due diligence process of practitioners evaluating a novel input. Clarification of cost-effectiveness per hectare under different crop systems, and further technical documentation on the product's long-term agronomic and environmental behaviour in soil, were identified as the key information needs that the demonstration phase is well positioned to address.

3.2.6 Solution 6 — Fog Collectors

Acceptance level

Fog collectors were considered useful for their farm by 5% of participants in Greece and 26% in Spain, potentially useful by 35% in both countries, and not useful by 60% in Greece and 39% in Spain. These results reflect primarily the specific agroclimatic profile of the two pilot regions rather than a generalized rejection of the solution's underlying technology. Participants in both countries acknowledged the potential of atmospheric water harvesting to supplement conventional water sources, and the feedback collected provides a valuable evidence

base for identifying the environmental and topographic conditions under which the solution delivers optimal results.

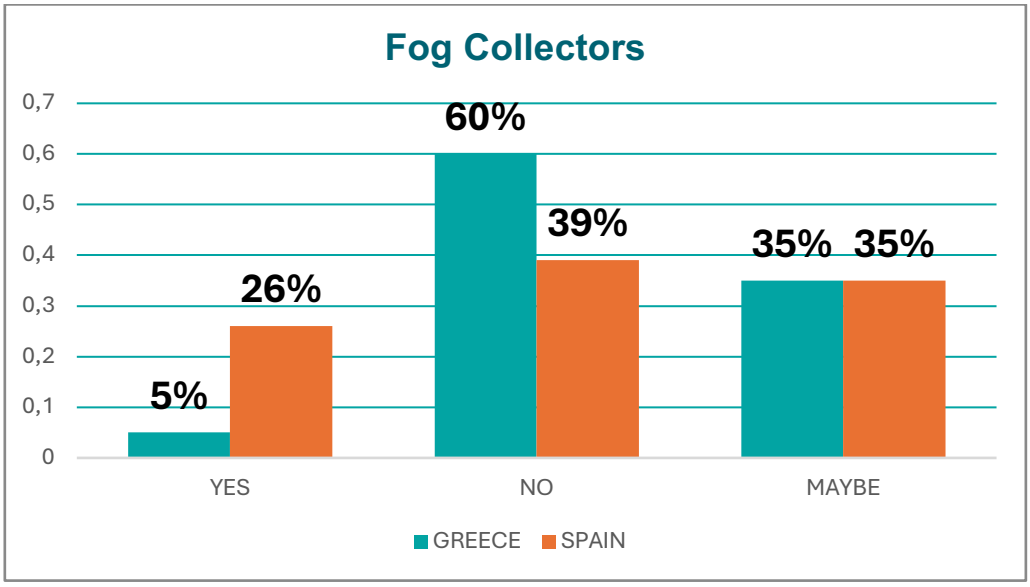


Figure 19: Acceptance level of fog collectors, in terms of perceived usefulness, across Greece and Spain

Adoption aspects

The questions raised by participants centred on the match between the solution's operating requirements, including adequate fog frequency, sheltered installation conditions, and sufficient farm space and the specific characteristics of the pilot areas. This feedback is consistent with the known deployment logic of fog collection technology, which performs best in coastal, elevated, or high-humidity micro-climatic zones and is already successfully implemented in analogous contexts across southern Europe and beyond. The discussions underline the importance of a targeted site-selection methodology and clear applicability criteria as part of the demonstration strategy, ensuring that fog collectors are showcased in the locations where their performance potential is greatest and where stakeholder confidence can be most effectively built.

3.2.7 Solution 7 — Bio-based Netting

Acceptance level

Bio-based netting was considered useful for their farm by 30% of participants in Greece and 21% in Spain, potentially useful by 55% in Greece and 49% in Spain, and not useful by 15% in Greece and 30% in Spain. The high proportion of "potentially useful" responses across both pilot areas reflects the innovative character of the solution and the limited prior exposure of participants to biodegradable soil management materials. Rather than indicating

indifference, this distribution signals a stakeholder base that remains open and receptive to further information and has not formed fixed negative perceptions, a favorable starting point for targeted demonstration and knowledge transfer activities.

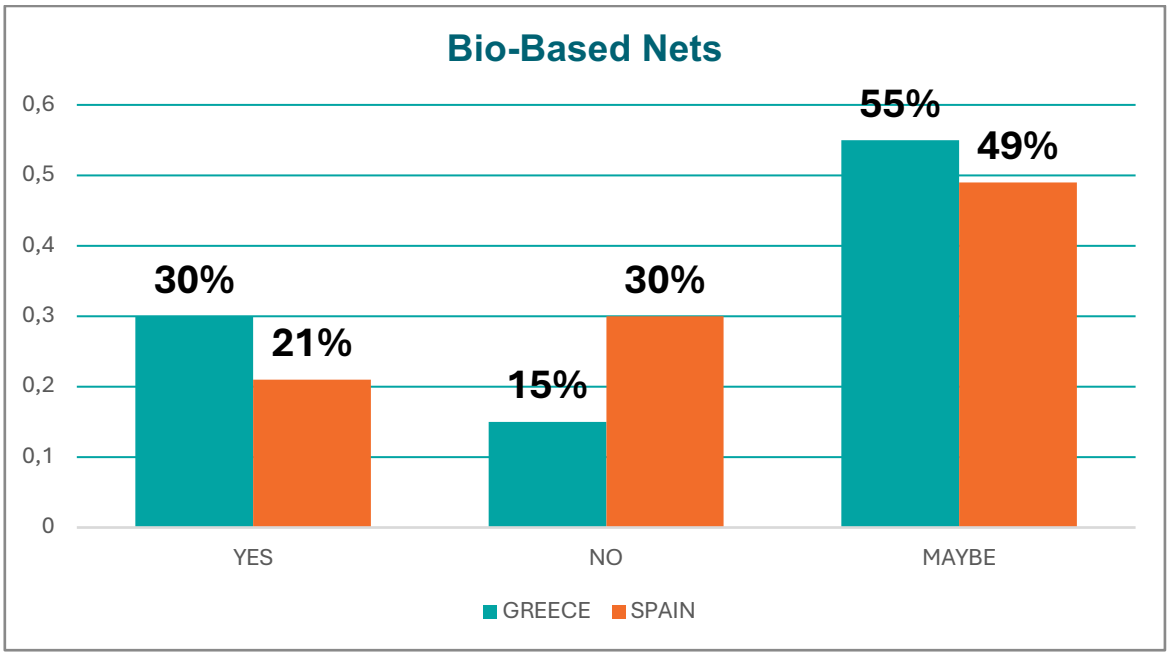


Figure 20: Acceptance level of bio-based nets, in terms of usefulness, across Greece and Spain

Adoption aspects

Participants recognized the water and nutrient retention properties of bio-based netting and responded positively to its biodegradable nature, viewing it as a meaningful alternative to plastic-derived agricultural inputs in the context of growing environmental awareness and regulatory pressure on synthetic materials. The questions raised during the workshops related primarily to the identification of the farm types and terrain configurations where the solution is most effectively deployed particularly sloped terrain and early-stage crop establishment scenarios, which represents precisely the kind of site-specific applicability information that the demonstration phase is designed to generate. Clarification of installation logistics, cost-effectiveness across different crop systems, and compatibility with existing irrigation infrastructure were identified as the key information needs that will support broader stakeholder confidence in the solution.

3.2.8 Solution 8 — Compost Bricks

Acceptance level

Compost bricks were considered useful for their farm by 50% of participants in Greece and 46% in Spain, potentially useful by 40% in Greece and 34% in Spain, and not useful by 10% in Greece and 20% in Spain. In Spain, compost bricks ranked among the most widely considered useful RAINS solutions, a result that reflects the direct relevance of soil health improvement and erosion control to the intensive production systems of the Valencia and Murcia regions and underlines the strong perceived utility of this solution in Mediterranean agricultural contexts.

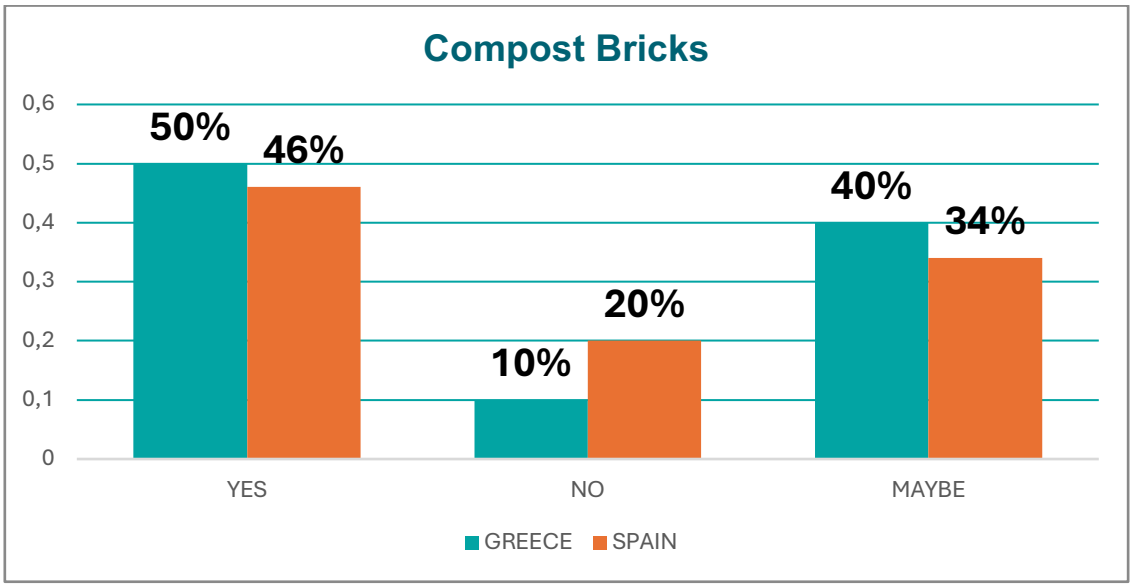


Figure 21: Acceptance level of compost bricks, in terms of perceived usefulness, across Greece and Spain

Adoption aspects

Participants demonstrated a clear understanding of the agronomic value of compost bricks, recognising their potential for soil erosion mitigation, fertility enhancement, and improvement of soil physical properties. The biodegradable nature of the material was consistently highlighted as a significant advantage, positioning the solution favorably in the context of growing demand for plastic-free agricultural inputs. In many cases, participants drew intuitive connections with mulching practices already integrated into their farming routines, which facilitated engagement and lowered the perceived adoption threshold. The questions raised during the workshops centred on cost-effectiveness under different irrigation and terrain configurations, and on the availability of locally adapted implementation guidelines, precisely the type of evidence that demonstration trials are designed to generate and that will further consolidate the already strong stakeholder interest in this solution.

3.2.9 Solution 9 — WaterIQ

Acceptance levels

WaterIQ attracted strong and consistent interest across both pilot areas, demonstrating broad cross-pilot appeal that reflects the universal relevance of smart irrigation decision-support regardless of farming system or crop type.

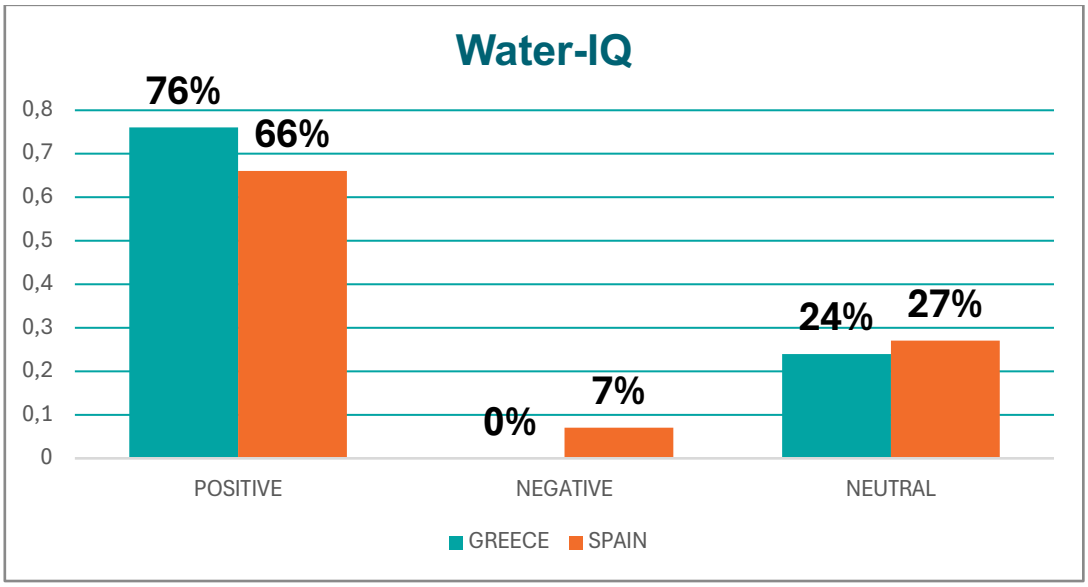


Figure 22: Acceptance level of WaterIQ solution, in terms of perceived usefulness, across Greece and Spain

Adoption aspects

A dedicated question on prior use of Farm Management Information Systems (FMIS) revealed that 87% of participants had no prior experience with such tools, a finding that underlines both the innovative character of WaterIQ and the significant untapped demand for accessible digital decision-support in the agricultural sector. Despite this limited prior exposure, participants engaged with remarkable specificity in identifying the features most relevant to their needs, with high-resolution weather forecasting, user-friendly interface design, and irrigation needs assessment ranking as the most valued functionalities.

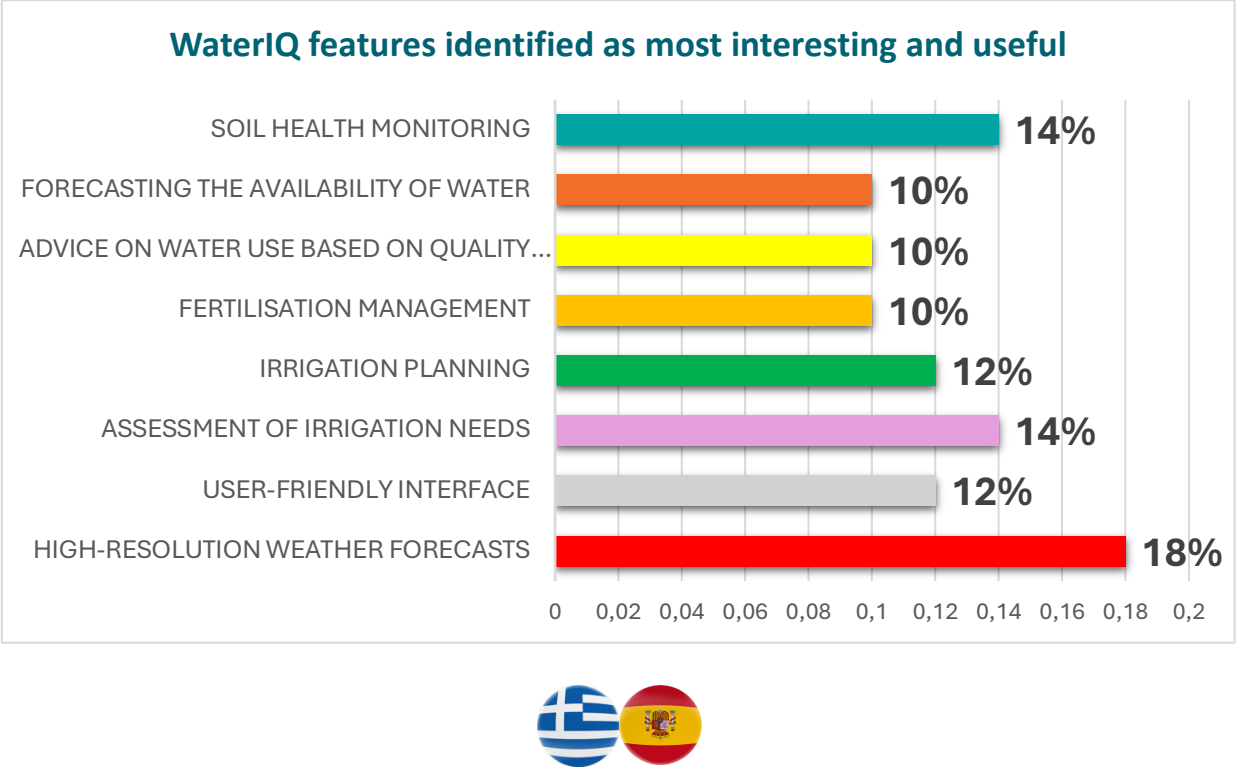


Figure 23: Most interesting and useful WaterIQ features identified by stakeholders

On the other hand, the main concerns of the participants were related to the accessibility and usability of digital tools in general. The availability of independent guidance on tool selection, structured training pathways, and clear cost-benefit information were identified as the key enabling conditions for adoption, which is precisely related to the support framework that the RAINS demonstration and knowledge transfer activities are designed to provide.

3.2.10 Solution 10 — Water-N-P flow model

The Water N–P Flow Modelling tool was presented during the co-creation workshops listed in Table 1. However, workshops 1 to 6 primarily focused on solutions intended to be implemented directly by farmers at the farm level. In contrast, Solution 10 is designed to assess the regional benefits of supporting and scaling up RAINS solutions. This model is conceived as a decision-support tool for policy design aimed at advancing sustainable nutrient and water management, and is therefore more relevant for managers, policymakers, NGOs, and regional and territorial authorities. While straightforward visualizations may also help farmers understand the upscaling effects of these solutions, the tool is not intended for day-to-day farm management. For this reason, the numerical analysis and stakeholder feedback related to Solution 10 were addressed in co-creation workshop 7, which was EU-wide and involved multiple stakeholder groups from several EU countries. Detailed results for Solution 10 in workshop 7 are presented in Section 4 of this deliverable. Nevertheless, Solution 10 also received feedback during these sessions.

Stakeholders highlighted, for example, the importance of incorporating regional-level datasets where available and of considering compliance with relevant policies and legal thresholds. In addition, it was suggested that the Water–N–P model should be capable of simulating nutrient budgets under different irrigation and management regimes, allowing results to be upscaled to support strategic planning and regional decision-making. These points were considered highly relevant and have been taken into account by the RAINS team.

3.2.11 Cross-Pilot Comparative Analysis

The participatory activities reveal a nuanced picture of stakeholder perceptions across the two pilot areas, shaped primarily by the distinct agricultural profiles and production systems of each context rather than by differences in the intrinsic merit of the solutions. The overall stakeholders' interest in RAINS solutions across Greece and Spain, is presented in Table 2. The Greek stakeholders from Thessaloniki operating predominantly larger cereal farms, the olive growers in the climate vulnerable island of Lesvos, and the Spanish participants drawn from intensive horticulture and citrus production, approached the evaluation from different practical standpoints. However, the overall results in the 2 countries present a remarkable similarity, which indicates the common challenges and interests of agricultural farm sector in Mediterranean.

Table 2: The overall stakeholders' interest in RAINS solutions across Greece and Spain (cumulative data from all demo areas).

RAINS solutions	Greece	Spain
Reuse of reclaimed wastewater (artificial wetlands with biochar)	11,19%	10,90%
Application of Wastewater Treatment Plant Sludge	6,58%	5,80%
Optifangs-IA (Application for the Optimized Use of Sludge)	6,58%	5,10%
Biofertilizer (biostimulants from microalgae and hydrolyzed blood)	8,56%	13,80%
WaterIQ (Digital Irrigation Management Tool)	21,46%	15,20%
Solid water (water retaining gel)	19,56%	11,60%

Fog collectors	2,17%	9,40%
Bio-based netting (biodegradable soil netting)	8,69%	8,00%
Compost bricks (compost structures for erosion control)	15,21%	18,80%
No response	0,00%	1,40%
TOTAL	100,00%	100,00%

Reclaimed wastewater reuse, biofertilizers, and WaterIQ, solid water and compost bricks generated strong interest in both countries confirming their broad relevance to the shared challenge of water scarcity and input efficiency that characterises Mediterranean agriculture. Solutions linked to sludge management showed stronger acceptance in Greece and especially in Thessaloniki area than in Spain, a divergence that reflects differences in crop type, market exposure, and the regulatory landscape rather than fundamental reservations about the solutions themselves, and that points to the importance of context-specific communication and trust-building strategies. Solutions with specific climatic and terrain requirements such as fog collectors, generated limited feedback in case of Greece since the fog days in the island of Lesvos are limited. This type of information directly informs the development of the solution, which should be able to collect both fog and morning moisture in order to increase its effectiveness. The findings underline the beneficial interaction with the stakeholders since diversity enriches the evidence base and provides valuable insight into the context-specific adaptation requirements of each solution.

4. Results of Co-creation Workshop with EU Stakeholders

The interactive session of the European stakeholders' workshop, was specifically designed for this action using the Mentimeter app, providing targeted linkages with the regional questionnaires that have been used as basis for the co-creation processes in the workshops of Greece and Spain. The session explored systemic and cross-contextual dimensions of solution uptake. Following a structural and scalable approach the following themes were explored:

***Solution relevance*:** Participants identified which RAINS solution was most relevant to their own context or region, providing a European-level mapping of solution applicability.

***Barrier analysis by solution*:** For each one of the 10 RAINS solutions, participants identified the main barriers to adoption in their context from a standardised list including cost, limited awareness, limited evidence of effectiveness, difficulty of integration, uncertain productivity impact, durability concerns, regulatory barriers, safety concerns, market acceptance, and lack of technical support. For the Water N-P Flow Modelling tool, the barriers list was adapted to reflect a policy and decision-making rather than farm-level adoption context, as this solution refers to strategic planning and assessment beyond fam level.

***Trusted information sources by solution*:** For each solution, participants identified whose opinion they would trust most before adopting or recommending it, by selecting from a list of actors that included farmer peers, agricultural advisors, researchers, technology providers, public authorities, farmer associations, independent consultants, buyers, and NGOs.

***Solution prioritisation matrix*:** Participants placed each RAINS solution on a two-dimensional matrix plotting ease of adoption against expected value or benefit, providing a visual representation of the European stakeholder consensus on solution positioning.

***Investor attractiveness*:** Participants identified which RAINS solutions they considered most likely to attract investor interest based on market potential and scalability.

***Open reflection*:** Participants were invited to identify the single change that would most increase the real-world uptake of RAINS solutions in their country or sector.

4.1 Relevance of RAINS Solutions Across European Contexts

Participants were invited to identify up to three RAINS solutions they considered most relevant to their own national or sectoral context. A total of 62 solution selections were recorded across the participant sample. The results demonstrate that every RAINS solution was identified as relevant by stakeholders from at least one national context, a finding of considerable strategic significance, confirming that the portfolio collectively addresses a broad and geographically distributed set of agricultural water and nutrient management challenges across the EU.

WaterIQ attracted the highest share of selections (19.4%), followed by Solid Water (17.7%), Nature-based Solutions for reclaimed wastewater reuse (16.1%), and Biofertilizers/biostimulants (16.1%). Biobased Nets received 9.7% of selections , while Compost Bricks, Moisture and Fog Harvesting Nets, and Water N-P Flow Modelling each accounted for 6.5%, and Optifangs-IA 1.6% . The concentration of selections around digital decision-support, water retention, circular water management, and bio-based inputs reflects the convergent priorities of European agricultural systems in addressing climate-induced water stress and the transition towards more resource-efficient and sustainable production models.

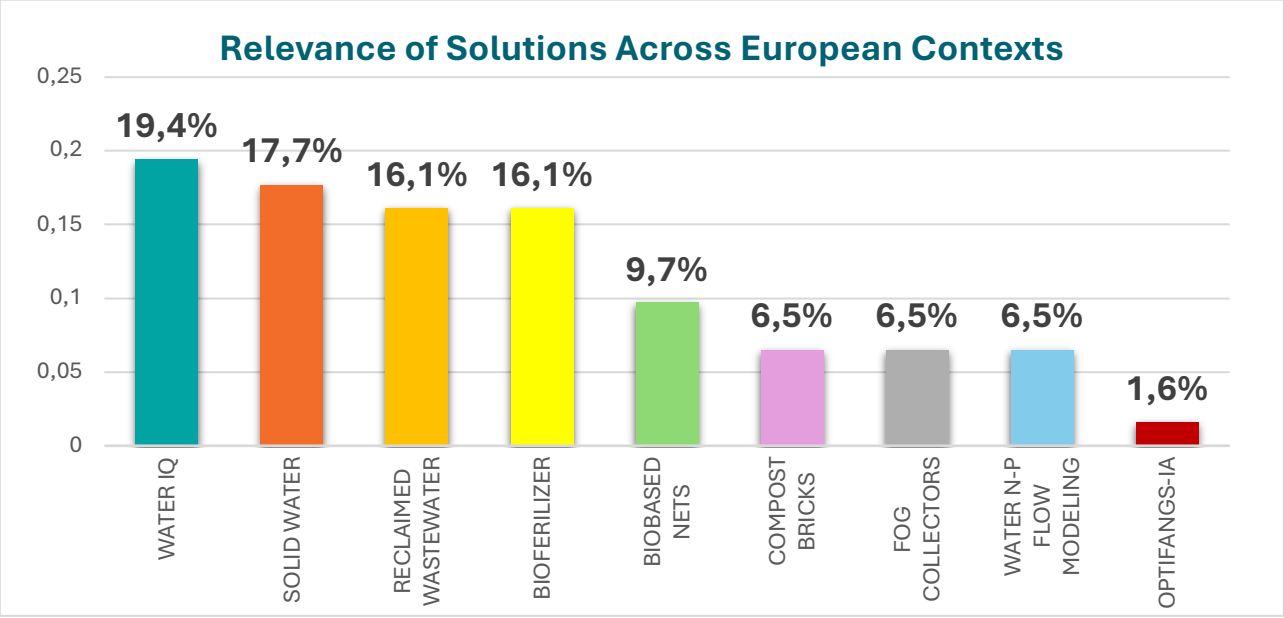


Figure 24: Stakeholder-perceived relevance of solutions at European level

4.2 Potential Barriers in the Adoption of RAINS Solutions

For each of the 10 RAINS solutions, participants selected the two most significant contextual barriers to adoption from a standardised list. These results should be interpreted as a mapping of the enabling environment required for each solution to realize its full adoption potential across European agricultural systems, not as a reflection of the solutions' intrinsic merit or technical performance, which are addressed through the RAINS demonstration activities. The findings provide a directly actionable evidence base for the design of targeted dissemination, policy engagement, and capacity-building strategies in the subsequent phases of the project.

A cross-cutting observation of strategic significance is that cost of adoption featured as a leading or co-leading barrier across the majority of solutions, consistent with the well-documented structural challenge of financing the transition to innovative agricultural practices in the absence of dedicated public support mechanisms.

Solid Water: Cost of adoption was the primary barrier (21.4%), followed by limited awareness or understanding (16.7%) and difficulty of integration into existing farming practices (11.9%). Limited evidence of effectiveness, uncertain impact on productivity, durability concerns, and lack of technical support were each cited by 9.5% of participants, while safety concerns and market acceptance each accounted for 4.8% and regulatory barriers for 2.4%. The broad distribution of responses across multiple categories reflects the early stage of market introduction of this innovative water-retaining technology and highlights the transformative role that locally validated demonstration data can play in advancing adoption readiness across diverse European crop systems.

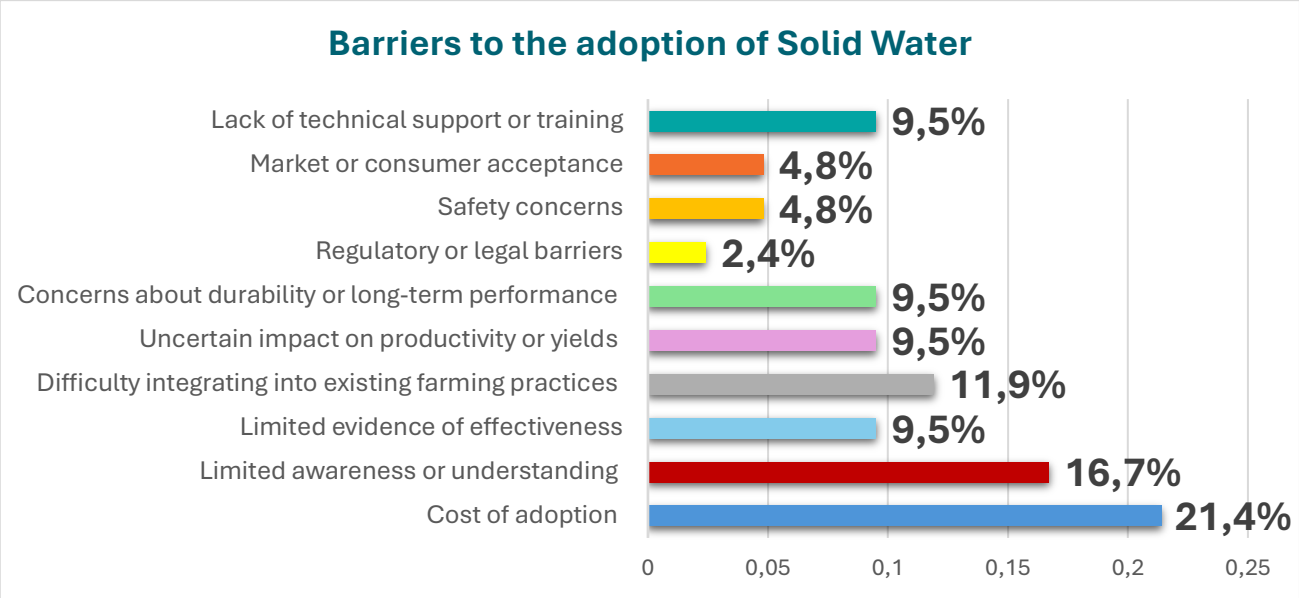


Figure 25: Barriers to the adoption of Solid Water

***Fog Harvesting Nets*:** Cost of adoption was the dominant barrier (33%), followed by difficulty of integration into existing farming practices (19%) and concerns about durability and long-term performance (14%). Uncertain impact on productivity was cited by 12% of participants. These findings confirm that economic accessibility and site-specific deployment guidance are the primary levers for unlocking the adoption potential of this solution across the European contexts where atmospheric water harvesting offers the greatest agronomic benefit, and that demonstration of long-term performance under real field conditions will be a key instrument for building stakeholder confidence.

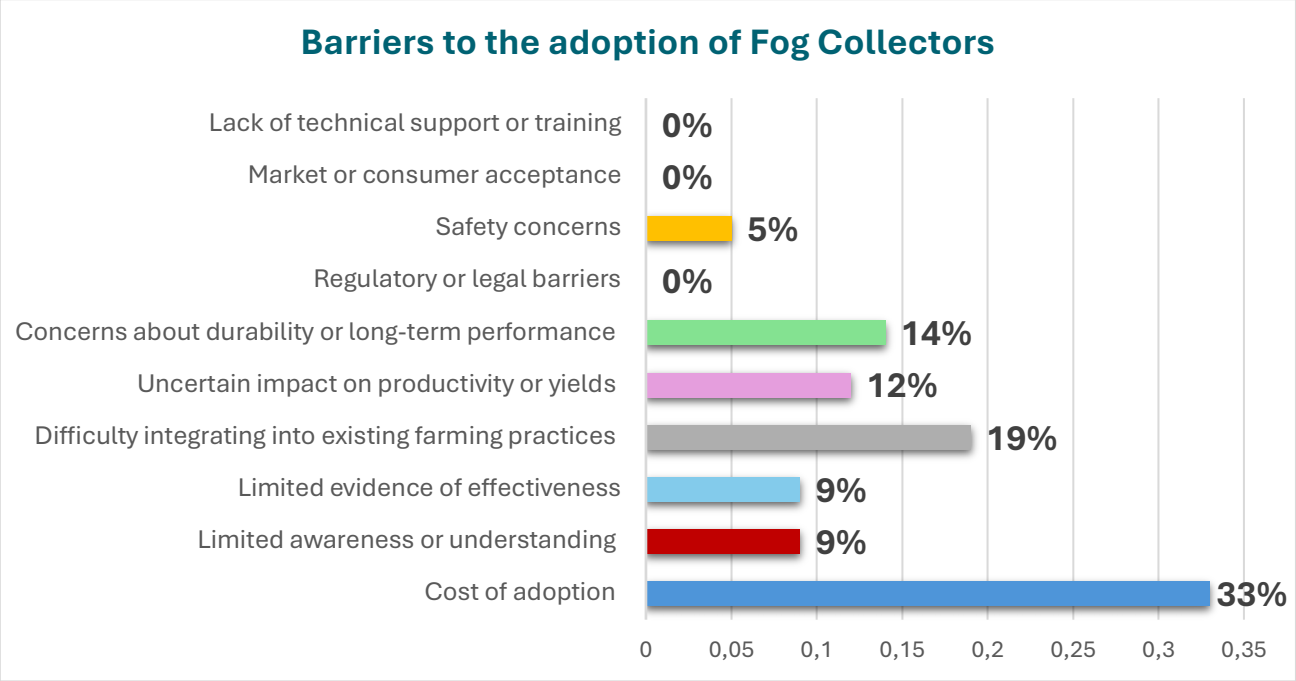


Figure 26: Barriers to the adoption of fog collectors

***Biobased Nets*:** Cost of adoption and difficulty of integration into existing farming practices were jointly the primary barriers (24% each), followed by limited awareness or understanding (13%) and limited evidence of effectiveness, uncertain impact on productivity, and durability concerns (11% each). These results highlight the importance of locally adapted implementation protocols and accessible cost-effectiveness evidence in translating the solution's well-recognised agronomic and environmental benefits, including soil erosion control, water retention, and full biodegradability into widespread farming practice.

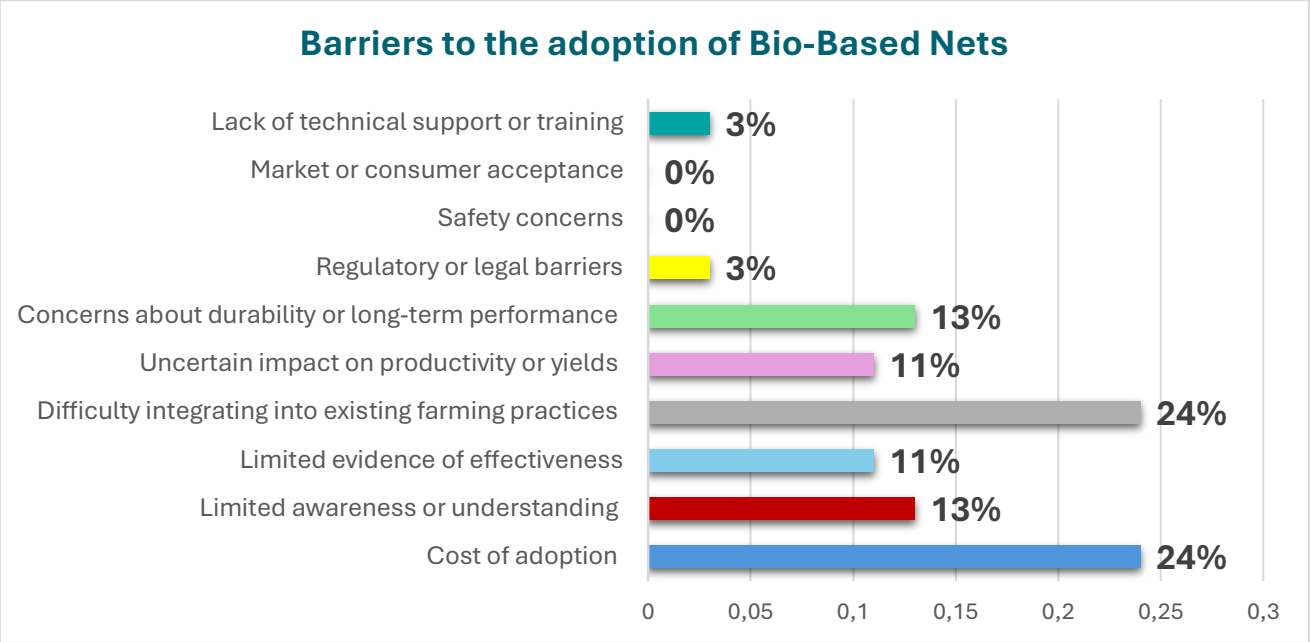


Figure 27: Barriers to the adoption of bio-based nets

***Optifangs-IA*:** Lack of technical support or training was the dominant barrier by a clear margin (29%), followed by limited awareness or understanding (19%), and cost of adoption and difficulty of integration (12% each). The prominence of training and awareness as the primary constraints, rather than fundamental reservations about the technology's capabilities is a strongly positive signal, indicating that the adoption gap for this AI-based sludge management tool is principally informational in nature and that structured capacity-building and knowledge transfer programmes can effectively and rapidly close it across European contexts.

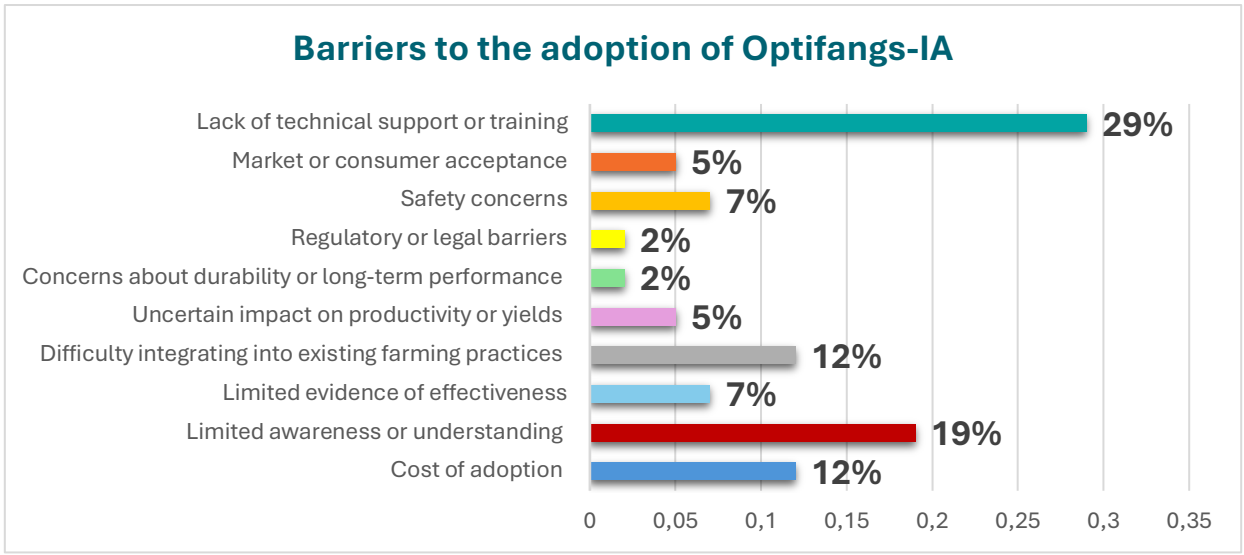


Figure 28: Barriers to the adoption of Optifangs-IA

Compost Bricks: Difficulty of integration into existing farming practices was the leading barrier (21%), followed by cost of adoption (17%) and limited evidence of effectiveness (14%). Uncertain impact on productivity and durability concerns were each cited by 12% of respondents. These findings directly inform the design of the RAINS demonstration phase, identifying the generation of site-specific implementation guidelines and crop-system-adapted performance data as the key knowledge outputs needed to consolidate the already strong stakeholder interest in this solution across Europe.

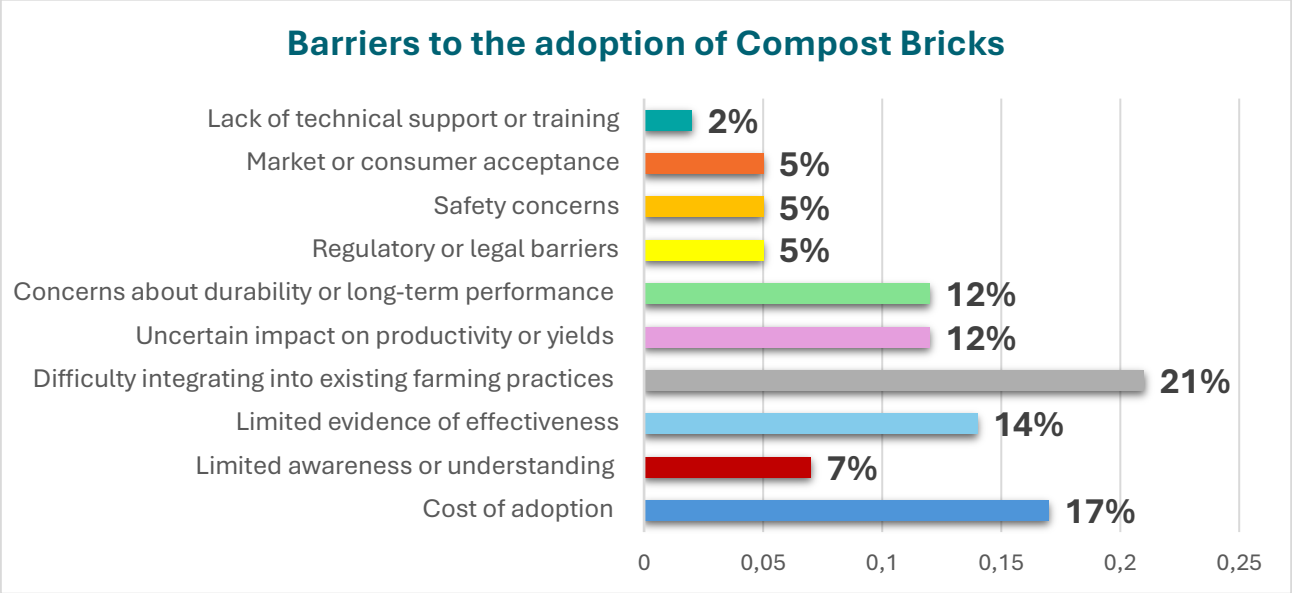


Figure 29: Barriers to the adoption of compost bricks

Nature-based Solutions for Reclaimed Wastewater Reuse: Cost of adoption was the dominant barrier (27%), followed by difficulty of integration into existing farming practices (17%) and concerns about durability and long-term performance (12%). Uncertain impact on productivity and market or consumer acceptance was each cited by 10% of participants. The market acceptance dimension reflects the variation in consumer and regulatory frameworks across EU member states and underscores the importance of science-based communication strategies that build on the robust EU regulatory standards governing reclaimed water quality and agricultural safety.

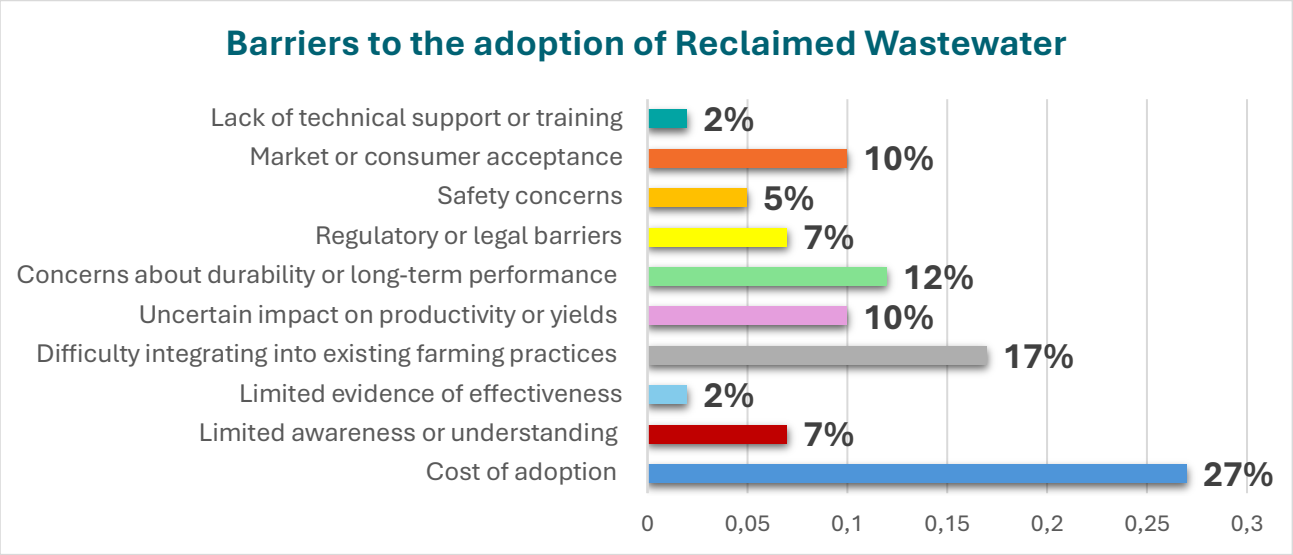


Figure 30: Barriers to the adoption of reclaimed wastewater solution

Biofertilizers/Biostimulants of biological origin: Cost of adoption and safety concerns were jointly the leading barriers (19% each), followed by uncertain impact on productivity or yields (17%) and difficulty of integration and regulatory barriers (12% each). The co-prominence of these dimensions reflects the position of biofertilizers at the frontier of the EU bioeconomy transition, where the pace of regulatory framework development and market certification is actively converging with a well-established scientific evidence base, a convergence that the RAINS project is directly contributing to through its demonstration and valorisation activities.

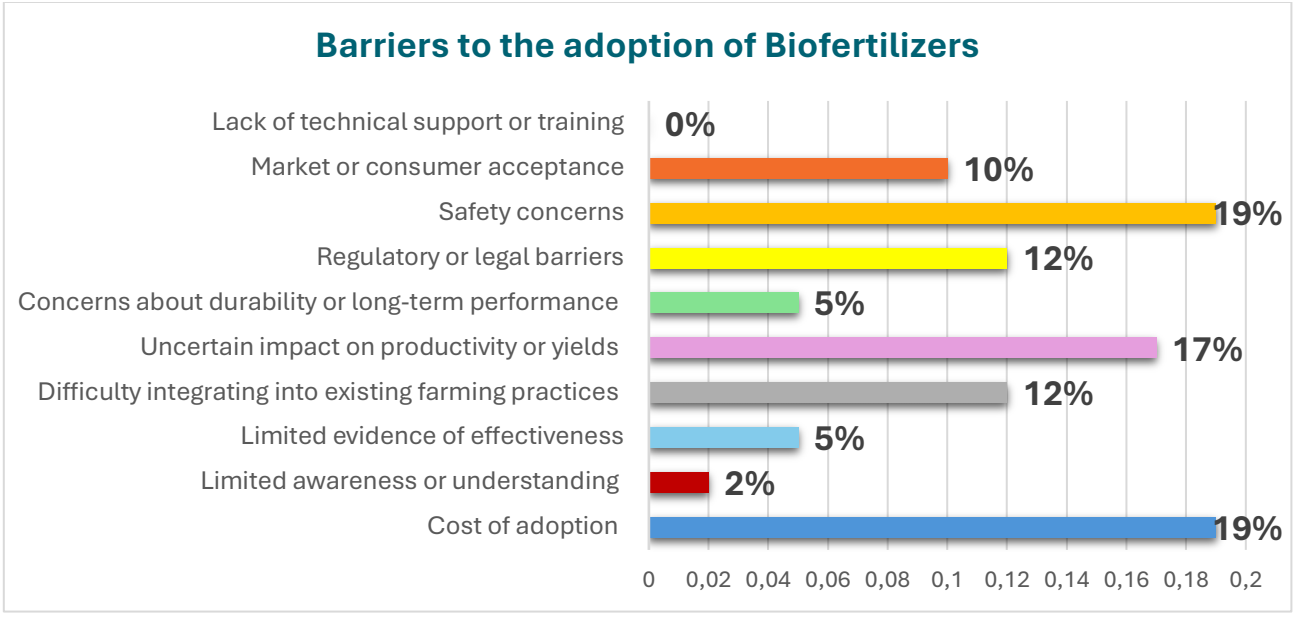


Figure 31: Barriers to the adoption of biofertilizers

***WaterIQ*:** Lack of technical support or training was the dominant barrier by a substantial margin (33%), followed by cost of adoption (18%) and uncertain impact on productivity or yields (15%). Limited awareness or understanding was cited by 13% of participants. This result is among the most significant findings of the European workshop: the primary constraint on WaterIQ adoption across Europe is not scepticism about the solution's value, which participants from 15 countries confirmed is high and broadly applicable but the availability of the training and advisory infrastructure needed to deploy it effectively at scale. This constitutes a clear and addressable knowledge transfer challenge that the RAINS project is uniquely positioned to address through its demonstration and dissemination activities.

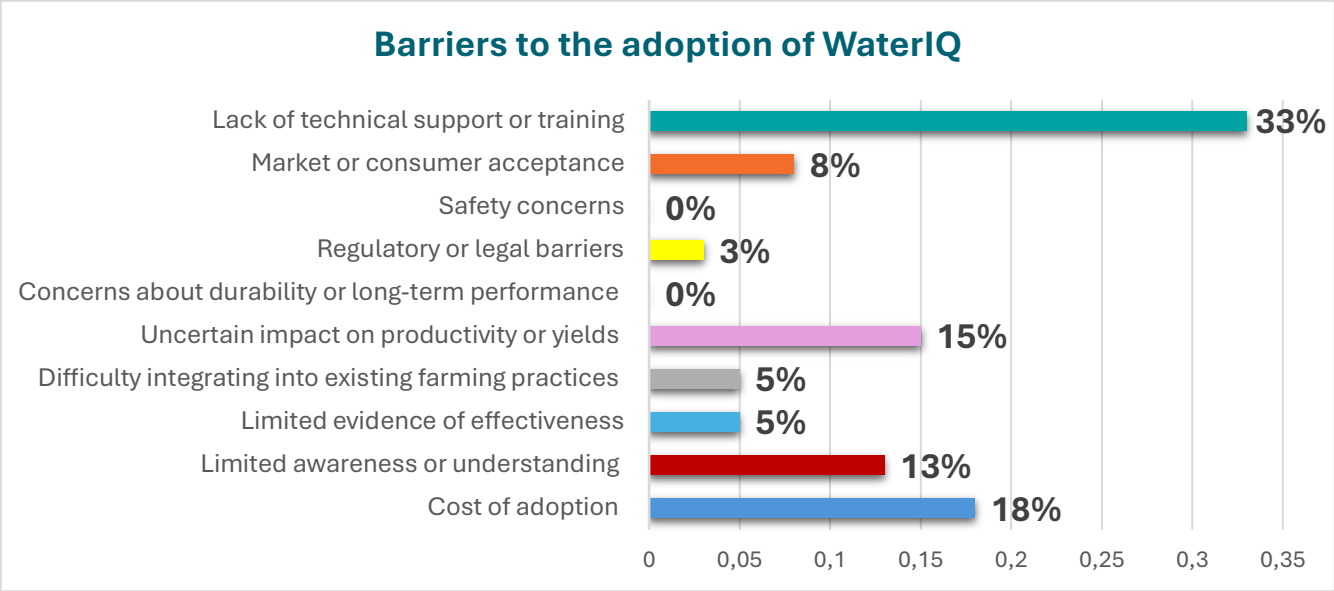


Figure 32:Barriers to the adoption of WaterIQ

***Water N-P Flow Modelling*:** Limited awareness or understanding and lack of staff capacity or expertise were jointly the leading barriers (26% each), followed by limited relevance to local decision needs (16%) and limited access to modelling outputs or results and priority given to short-term decisions (8% each). These findings reflect the institutional investment required to integrate advanced hydrological and nutrient flow modelling into evidence-based policy and water governance frameworks, an investment that RAINS is well positioned to support through the development of accessible, decision-maker-facing knowledge products in the project's later phases.

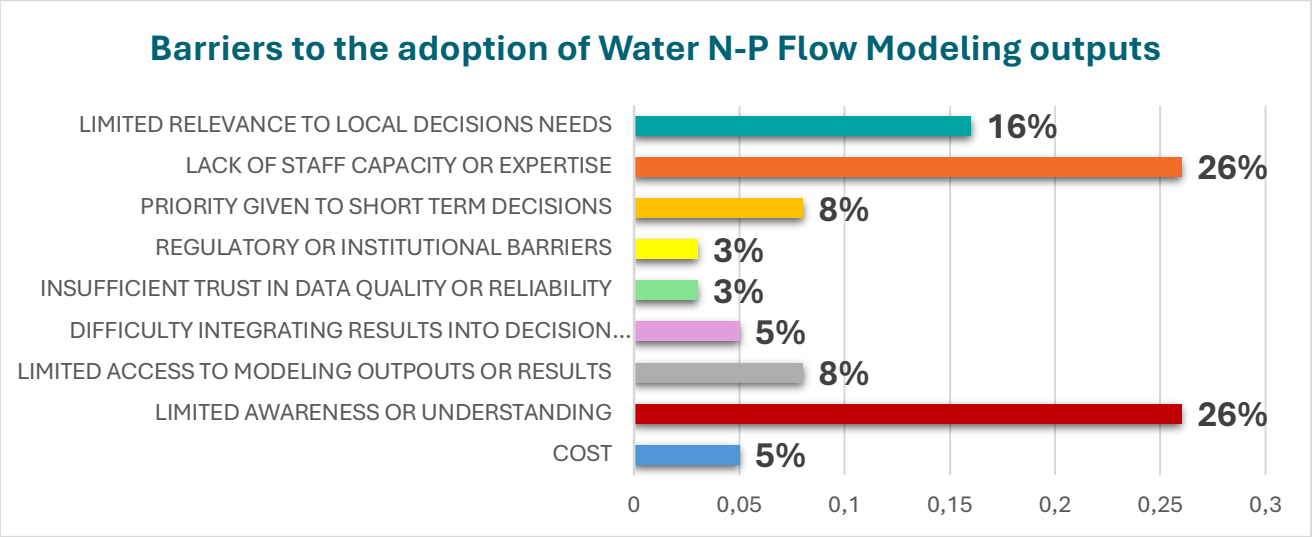


Figure 33: Potential barriers to the adoption of water and nutrient (N-P) flow modelling outputs by decision/policy makers

4.3 Trusted Information Sources by Solution

The trusted sources of information for stakeholders are the actors or organizations they turn to for support when seeking to understand the reliability, effectiveness, and practical aspects of a solution prior to its adoption. The trusted information source data reveals a nuanced and solution-specific pattern of trust across the RAINS portfolio, with important implications for the design of targeted communication and knowledge transfer strategies and pathways in the project's subsequent phases to maximize the project impact.

Researchers and Universities emerged as the most trusted source across the majority of solutions, including Solid Water (39%), Biofertilizers (47%), Nature-based Solutions for reclaimed wastewater reuse (37%), Biobased Nets (36%), Fog Collectors (33%), and Water N-P Flow Modelling (48%) reflecting the central role of scientific validation and academic credentialing in building stakeholder confidence in novel agricultural technologies at European scale. This finding has direct implications for the RAINS dissemination strategy, reinforcing the strategic value of peer-reviewed scientific output, academic partnership, and evidence-based communication as instruments for accelerating pan-European adoption readiness across the portfolio.

Notably, the trust landscape shifts significantly for solutions with a stronger operational or digital character. For WaterIQ, Technology providers were identified as the most trusted source by a clear majority (47%), followed by Farmer peers (32%), reflecting the expectation that commercially accountable digital solution providers, capable of demonstrating system reliability, data accuracy, and integration performance in real farm conditions will play a central role in validating this solution's value proposition at scale. This finding supports the development of strong

public-private partnership models and commercially validated demonstration frameworks as core components of the WaterIQ deployment strategy.

For Optifangs-IA, Farmer peers ranked as the most trusted source (41%), followed by Technology providers (23%) and Researchers/Universities (18%). This result underscores the critical importance of farmer-to-farmer knowledge exchange and peer demonstration networks as adoption pathways for AI-based agricultural management tools, a finding that provides strong justification for investment in participatory demonstration activities and farmer ambassador programmes as part of the Optifangs-IA communication strategy.

For Compost Bricks, Farmer peers were the most trusted source (40%), followed by Researchers/Universities (25%) and Agricultural advisors/Extension services and Farmer associations/Cooperatives (10% each). This dual validation pathway, combining peer experience with scientific evidence reflects the solution's positioning at the interface between traditional soil management practice and innovative bio-based materials, and suggests that demonstration activities combining farmer testimonials with robust agronomic data will be most effective in building adoption confidence.

For Water N-P Flow Modelling, Researchers/Universities (48%) and Public Authorities/Water Agencies (33%) together accounted for over 80% of trust attributions, the most institutionally concentrated trust profile across the entire portfolio. This finding is consistent with the policy-facing application context of this tool and underlines the importance of co-production between academic modelling expertise and water governance institutions as the primary pathway for integrating this solution into EU-level decision-making frameworks.

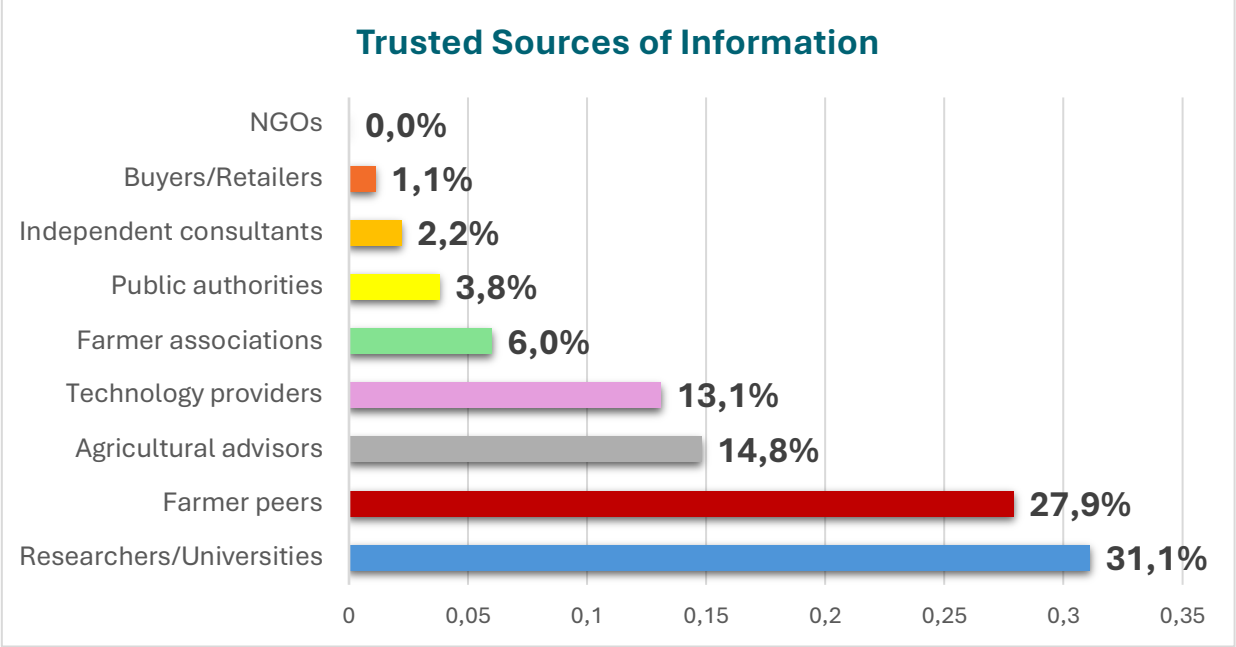


Figure 34: Trusted sources of information for the early adopters and end users of RAINS solutions

As illustrated in Figure 33, the aggregate distribution of trusted information sources across all RAINS solutions confirms the dominance of two complementary validation pathways at European level: scientific credibility, represented by Researchers and Universities (31.1%), and peer-based validation, represented by Farmer peers (27.9%). Agricultural advisors and Extension services (14.8%) and Technology providers (13.1%) follow as secondary but significant trust anchors, the latter driven primarily by the digital solutions in the portfolio. These findings directly inform the prioritization of communication and dissemination investment in the subsequent phases of the RAINS project.

4.4 Solutions Positioning Matrix

The solution positioning matrix, in which participants placed each RAINS solution on axes of ease of adoption and expected value or benefit yielded a distribution that attests to the strong overall perceived value of the RAINS portfolio. The majority of solutions were positioned in or around the upper half of the value axis, with Biofertilizers/biostimulants, WaterIQ, Solid Water, Compost Bricks, and NbS solutions for reclaimed wastewater reuse clustered in a central-to-upper-right position, indicating high expected benefit combined with moderate adoption accessibility, a positioning that is consistent with solutions ready for demonstration-phase deployment and capable of rapid scaling following successful proof of concept.

Optifangs-IA and Biobased Nets were positioned centrally on both axes, reflecting solid perceived value with adoption pathways that will benefit from targeted capacity-building and site-specific guidance. Fog Harvesting Nets and Water N-P Flow Modelling were positioned further along the adoption difficulty axis, consistent with their context-specific deployment requirements, findings that inform rather than constrain the demonstration strategy, identifying where focused support and targeted communication will have the greatest catalytic effect.

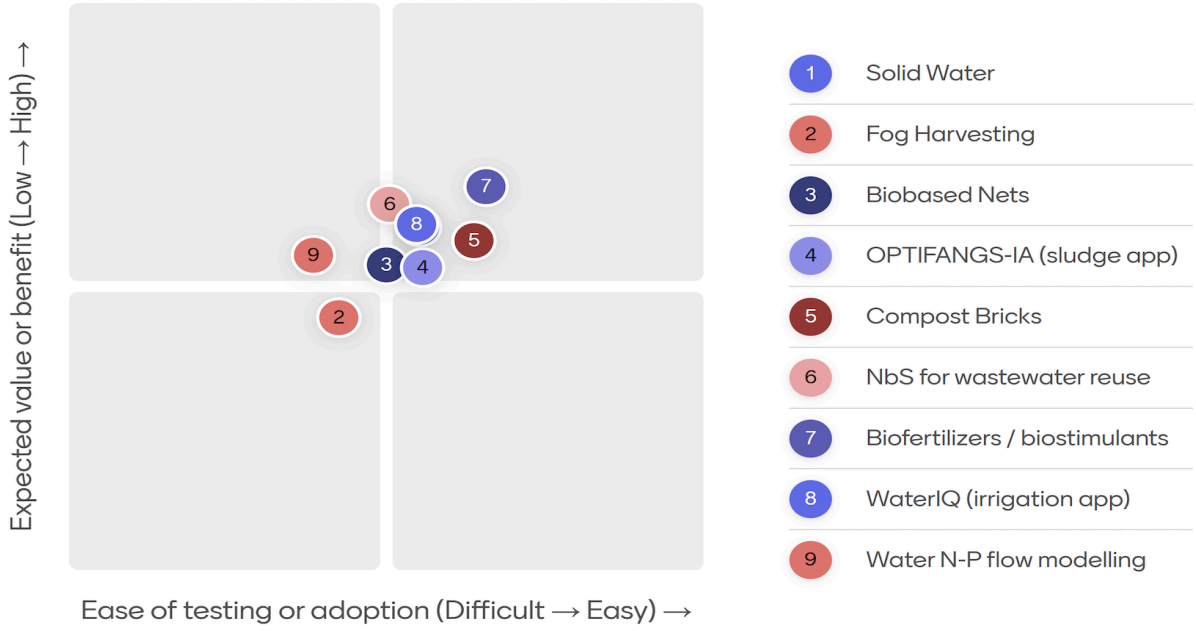


Figure 35: Solution positioning matrix across value and adoption dimensions

4.5 Investing Potential

Participants were invited to identify the RAINS solutions most likely to attract investors interest in terms of market potential and scalability. The results reveal a differentiated landscape of perceived commercial readiness across the portfolio, with Solid Water attracting the highest share of selections (25%), followed by WaterIQ (18%), Biofertilizers/biostimulants (13%), and Compost Bricks (12%). Nature-based Solutions for reclaimed wastewater reuse and Biobased Nets each received 8% of selections, Fog Collectors 7%, Optifangs-IA 5%, and Water N-P Flow Modelling 3%.

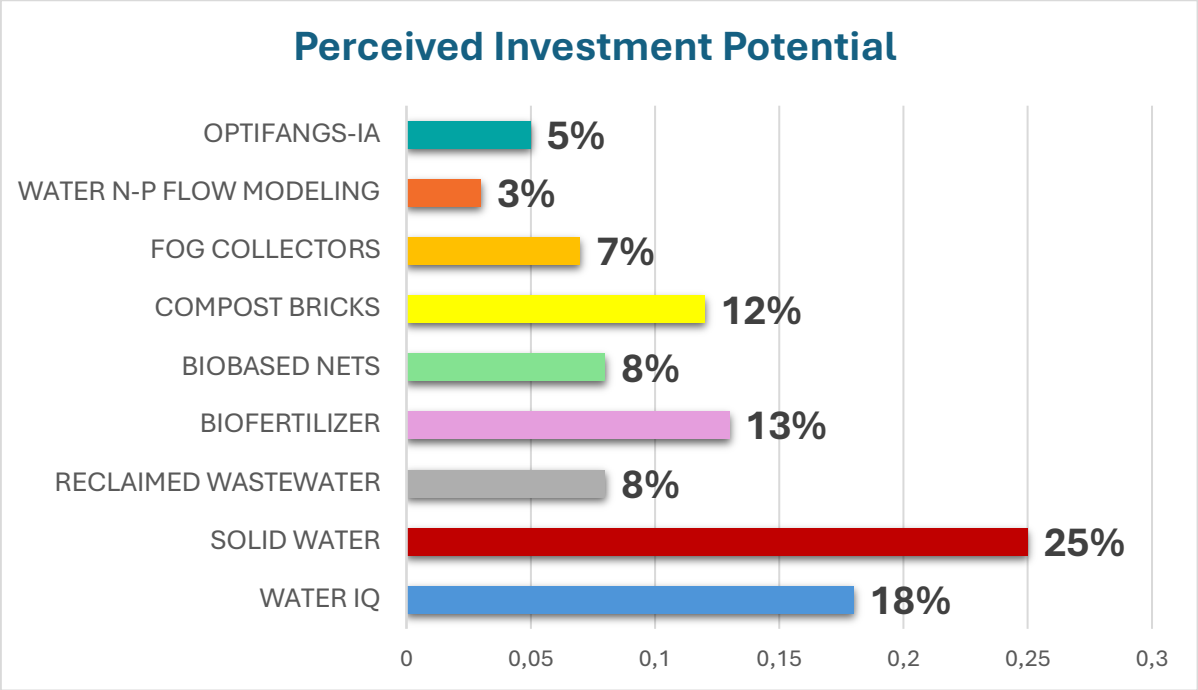


Figure 36: Perceived investment potential of RAINS solutions

The distribution of investor attractiveness across the portfolio reflects a nuanced stakeholder assessment of commercial viability that extends well beyond the two pilot areas. Solid Water's leading position is consistent with the increasing global prioritisation of water retention and drought resilience as strategic agricultural challenges, and with the inherent scalability of product-based innovations that can be deployed across diverse crop systems and climatic zones without requiring significant infrastructure investment. WaterIQ's strong second-place ranking underscores the perceived market potential of digital decision-support platforms in the agricultural sector, where data-driven irrigation and resource management tools are increasingly recognised as essential components of climate-adaptive farming systems. The prominent positioning of Biofertilizers/biostimulants reflects the accelerating EU policy and market transition towards circular bioeconomy models, with bio-based fertilization products derived from recovered biological resources occupying a growing share of the sustainable agriculture input market. Compost Bricks' fourth-place ranking similarly signals strong perceived commercial potential for bio-based soil management solutions that address the dual challenge of erosion control and soil fertility enhancement. Taken together, these results confirm that the RAINS portfolio encompasses solutions at varying stages of market readiness, collectively offering a compelling investment landscape that spans physical agricultural inputs, digital platforms, and bio-based products, a breadth that positions the project as a significant contributor to the EU's agricultural innovation and sustainability transition agenda.

4.6 Open Reflection: Enabling Conditions for Real-World Uptake

In response to the open question inviting participants to identify the single change that would most increase the real-world uptake of RAINS solutions in their country or sector, responses converged around a coherent set of systemic enabling conditions. The most frequently recurring themes were:

- *The establishment of innovation-aligned regulatory frameworks and clear certification pathways.*
- *Financial incentives, subsidies, and accessible cost-benefit evidence at farm level.*
- *Investment in technical training and professional education for advisory and extension services.*
- *Greater awareness and engagement among policymakers and*
- *The early and systematic integration of farmers into co-development processes.*

Particularly noteworthy was the emphasis placed by multiple participants on the importance of bridging the gap between research institutions, policymakers, and farming communities, with one participant explicitly advocating for structured exchanges in which researchers and policymakers engage directly with farm-level realities as a prerequisite for effective solution design and communication. This perspective resonates strongly with the RAINS co-creation methodology and reinforces the project's participatory approach as a model that European stakeholders recognize as essential to achieving lasting agricultural innovation uptake.

Taken together, these responses articulate a systemic enabling framework for the deployment of innovative agricultural solutions at European scale: one in which regulatory alignment, financial accessibility, scientific credibility, advisory capacity, and participatory co-development are mutually reinforcing conditions. The findings provide a rich and actionable evidence base for RAINS policy engagement, knowledge transfer, and dissemination strategy in the subsequent phases of the project and constitute a compelling demonstration of the project's capacity to generate pan-European stakeholder intelligence in support of the EU's agricultural sustainability transition.

5. Key Outcomes and Conclusions

The co-creation activities implemented within WP1 generated a robust and decision-relevant evidence base for the adaptation of the RAINS solutions, while also confirming the strategic value of participatory design within an Innovation Action of this type. Across the six in-person workshops in Greece and Spain, 113 stakeholders engaged directly in the assessment of the solutions, and the European online workshop added the perspective of 43 stakeholders from 15 countries. Taken together, the process combined local agronomic knowledge, institutional insight, and broader European reflections on transferability, thereby responding directly to the project's objective of ensuring that RAINS solutions are shaped by end-user realities rather than developed through a purely top-down logic.

5.1 Greek vs Spanish Regional Outcomes

A critical comparison between the Greek and Spanish outcomes shows both strong convergence and important contextual divergence. In all pilot areas, stakeholders gave clear priority to economic and practical adoption criteria, with cost, productivity gains, ease of implementation, and durability consistently outweighing environmental arguments as primary decision drivers affecting the adoption of solutions. Reclaimed wastewater reuse, biofertilizers, and WaterIQ, solid water and compost bricks generated strong interest in both countries confirming their broad relevance to the shared challenge of water scarcity and input efficiency that characterizes Mediterranean agriculture.

At the same time, the two national contexts differed in the type of scrutiny applied to the solutions. Greek participants, particularly in Thessaloniki, approached the portfolio through a stronger regulatory and institutional lens, with notable openness to reclaimed wastewater, sludge application, and biofertilizers when accompanied by clear safety, governance, and implementation conditions. In Lesvos, practical suitability under severe seasonal water stress was the dominant filter. Spanish participants, by contrast, assessed the solutions more rigorously through the lens of operational reliability, market implications, and compatibility with high-value horticultural and citrus production systems. This helps explain why Spain expressed stronger caution than Greece with respect to sludge-related solutions, especially sludge application and Optifangs-IA, while also showing strong interest in solutions that can generate tangible efficiency gains under intensive irrigation conditions. These differences should not be interpreted as a stronger or weaker innovation culture in either pilot, but rather as evidence that solutions' acceptability is strongly mediated by crop system, market exposure, scale of production, and the perceived risk of implementation.

5.2 EU vs Regional Perspective

The workshops in Greece and Spain produced highly grounded, practice-oriented intelligence: they revealed how stakeholders respond to concrete deployment questions such as installation cost, technical support needs, compatibility with existing irrigation systems, regulatory compliance, and trust in the evidence base for specific solutions. The European workshop, by contrast, did not replace this local knowledge; it complemented it by testing the broader relevance, perceived barriers, trusted information channels, and transferability of the full RAINS portfolio across multiple national and sectoral contexts. The regional workshops therefore generated depth, while the European workshop generated breadth. Importantly, the two levels were largely consistent: cost, technical support, and integration into existing practice emerged as recurring barriers across scales, while WaterIQ, reclaimed wastewater-related solutions, Solid Water, biofertilizers, and compost bricks appeared as solutions with particularly strong wider relevance. At the same time, the EU-level exercise introduced dimensions that were less visible in the local workshops, especially the importance of solution-specific trust pathways, the role of researchers, advisors, farmer peers, and technology providers in future uptake, and the need to consider transferability beyond the immediate pilot environments. This makes the EU workshop particularly valuable as a strategic filter for replication and dissemination, even though it is necessarily less detailed than the pilot-level consultations in terms of local agronomic constraints.

5.3 Concluding Remarks

The co-creation outcomes are highly useful because they do not function merely as stakeholder consultation records; they provide operational guidance for the project's subsequent demonstration, knowledge transfer, and policy-oriented activities. The engagement of end-users in the development of RAINS solutions and the fact that knowledge is made available for their uptake in practice are the key benefits of WP1 activities. In this regard, the present co-creation findings provide precisely the intelligence needed to prioritise the framing, testing, and communication of each solution: which concerns must be addressed during deployment and demonstrations, which benefits must be evidenced more convincingly, which user segments require targeted support, and which institutional or advisory actors should be mobilised to strengthen trust and adoption pathways.

Overall, the co-creation process has been useful for RAINS in three interlinked ways.

- *First, it has reduced the risk of mismatch between technological ambition and user reality by identifying where adaptation, clarification, or stronger evidence is needed before and during demonstration.*
- *Second, it has improved the project's capacity to differentiate between solutions that require primarily technical validation and those that require stronger communication, training, regulatory clarification, or market-confidence building.*

- *Third, it has created a credible foundation for the project's later exploitation, dissemination, and policy work, since the findings show not only whether stakeholders are interested, but under what conditions they are willing to trust, test, adopt, and recommend the solutions.*

For these reasons, the co-creation activities should be regarded not as a preliminary consultation exercise, but as a core implementation mechanism within RAINS: one that strengthens the scientific relevance, practical viability, and future uptake potential of the project's solutions across both the pilot territories and the wider European context.

ANNEX I: Questionnaire Used in Regional Workshops

RAINS Solutions Implementation Questionnaire

Section A: Farmer Information

- Age: ____
- Gender: ☐ Male ☐ Female
- Area/Location: _____
- Crop Type: _____
- Farm Size (in hectares): _____

Section B: Awareness and Use of RAINS Solutions

Which of the following RAINS solutions would you be most interested in applying on your farm?

☐ Reclaimed Wastewater-reuse (constructed wetlands with biochar)
☐ Sludge Application from Wastewater Treatment Plants
☐ Optifangs-IA (App for Optimized Sludge Use)
☐ Biofertilizer (biostimulants from microalgae and hydrolyzed blood)
☐ WaterIQ (Digital irrigation management tool)
☐ Solid Water (Water-retaining gel)
☐ Moisture & Fog Harvesting Nets
☐ Biobased Nets (Biodegradable soil nets)
☐ Compost Brick Ladders (Erosion-control compost structures)

Explain why:

Have you already implemented any of the above solutions on your farm?

☐ Yes ☐ No
If yes, which ones? _____

Section C: Individual RAINS Solutions Evaluation

1.Reclaimed Wastewater (constructed wetlands with biochar)

How do you evaluate this solution?
☐ Positive ☐ Negative ☐ Neutral
Adoption / implementation challenges to be consired:
☐ Water quality
☐ Installation cost
☐ Lack of information
☐ Difficulty in application
☐ Other: _____

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2. Sludge Application from Wastewater Treatment Plants

How do you evaluate this solution?
☐ Positive ☐ Negative ☐ Neutral
Adoption / implementation challenges to be consired:
☐ Social acceptance
☐ Possible pollutants/pathogens
☐ Lack of information or training
☐ Difficulty integrating into my crop system
☐ Other: _____

3. Optifangs-IA (AI app for sludge application)

How do you evaluate this solution?
☐ Positive ☐ Negative ☐ Neutral
Adoption / implementation challenges to be consired:
☐ Complexity of technology
☐ Maintenance requirements
☐ Trust in AI
☐ Other: _____

4. Biofertilizer (microalgae and blood biostimulants)

How do you evaluate this solution?
☐ Positive ☐ Negative ☐ Neutral
Adoption / implementation challenges to be consired:
☐ Raw material source
☐ Possible pollutants/pathogens
☐ Lack of information or training
☐ Difficulty integrating into my crop system
☐ Other: _____

5. Solid Water (Water-retaining gel)

Would this solution be useful for your farm?
☐ Yes ☐ No ☐ Maybe
Justify: _____

6. Moisture & Fog Harvesting Nets

Would this solution be useful for your farm?
☐ Yes ☐ No ☐ Maybe
Justify: _____

7. Biobased Nets (Biodegradable soil nets)

Would this solution be useful for your farm?
☐ Yes ☐ No ☐ Maybe
Justify: _____

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8. Compost Brick Ladders (Erosion-control compost structures)

Would this solution be useful for your farm?
☐ Yes ☐ No ☐ Maybe
Justify: _____

9. WaterIQ Digital System

Do you currently use any Farm Management Information System (FMIS)?

☐ Yes – which one? _____
☐ No

Which features of WaterIQ interest you most?

☐ High-resolution weather forecasts
☐ User-friendly interface
☐ Current and seasonal irrigation needs assessment
☐ Irrigation planning support
☐ Fertilization management – advisory services
☐ Water use advice based on quality and quantity
☐ Forecasting water availability from alternative sources
☐ Soil health monitoring

Overall, how do you rate this solution?

☐ Positive ☐ Negative ☐ Neutral

Section E: Adoption Factors

Rank the following factors (1 = most important):

- Cost: [__]
- Environmental protection: [__]
- Ease of implementation: [__]
- Productivity/yield increase: [__]
- Durability/longevity: [__]

What challenges do you face when adopting new technologies?

☐ High initial cost
☐ Lack of proper education or information
☐ Limited access to technology
☐ Low reliability or uncertainty of results
☐ Limited time for experimentation or changes
☐ Difficulty integrating into daily work
☐ Lack of support from advisors or experts
☐ Other: _____

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ANNEX II: Documentation of the EU stakeholders workshop (invitation, agenda, screenshots)





RAINS

Scope & Challenges

CHALLENGE 1: REDUCED IRRIGATION FREQUENCY
SUSTAINED WATER AVAILABILITY IN SOIL 30-50%

CHALLENGE 2: LONGER SOIL MOISTURE RETENTION SEASON-LONG WATER SUPPORT POTENTIAL

COMPOSTABLE RIGID CAPSULES

SOLID WATER

Core technology: Biodegradable hydrocollid "solid water" system acting as a water reservoir with controlled water release in soil.



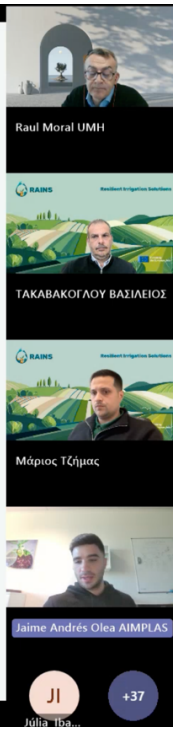


Goals:

- Improve water use efficiency by reducing irrigation frequency through sustained water release in soil.
- Enhance crop resilience to water stress by maintaining soil moisture over extended periods.

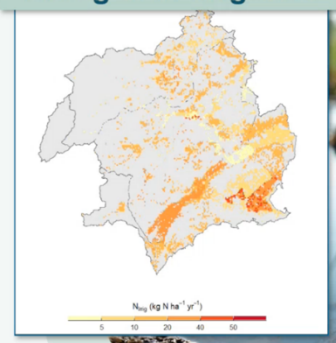
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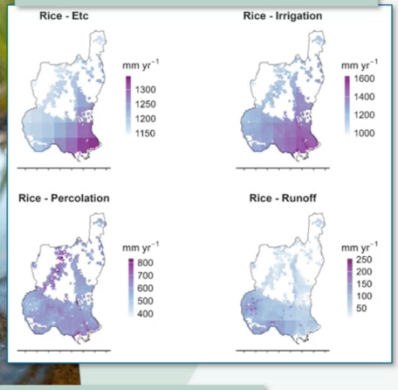


Potential Applications

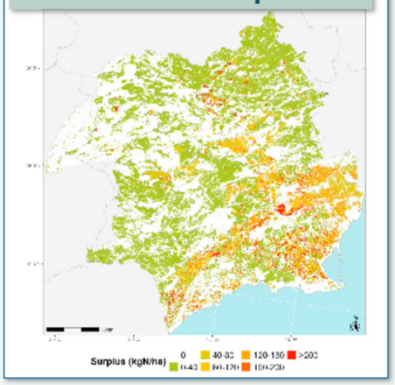
Nitrogen in irrigation



Water balance



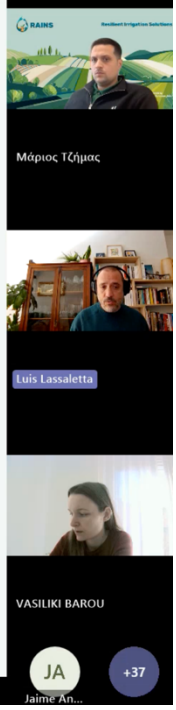
Nutrients surplus

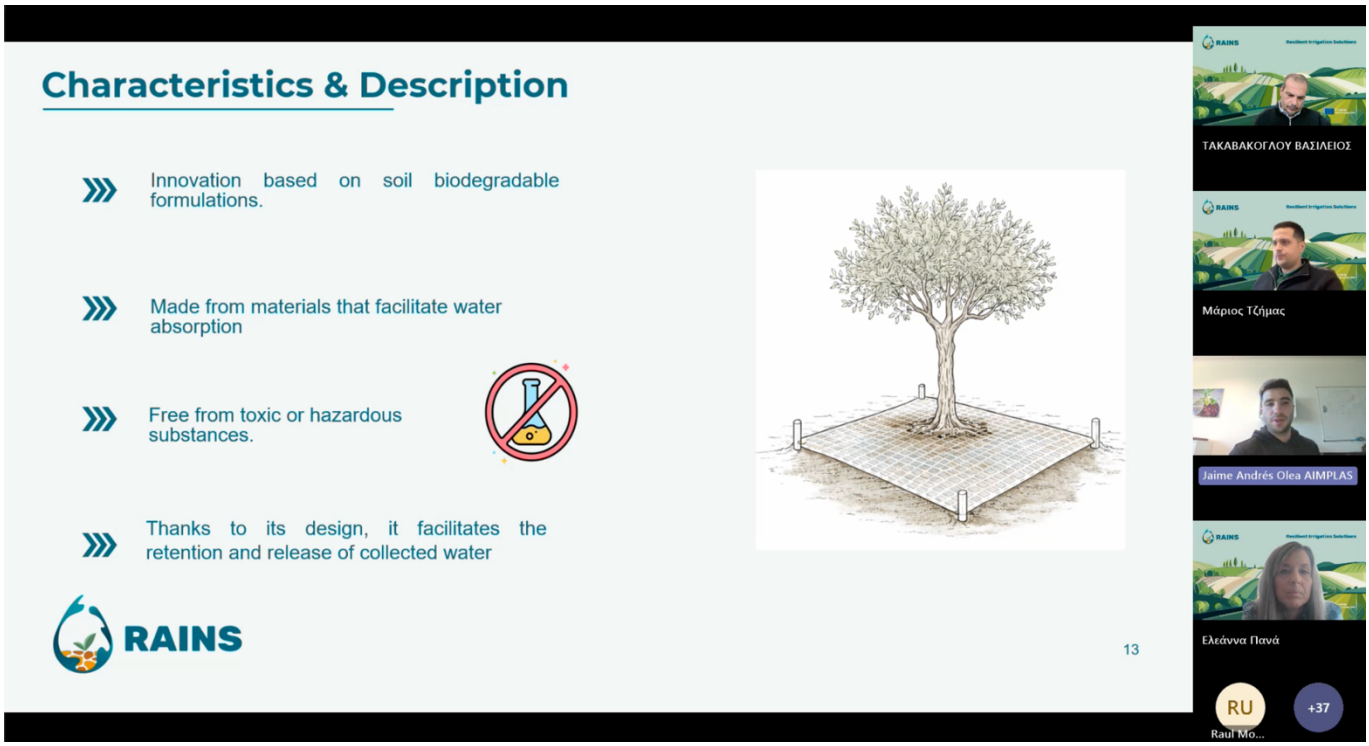


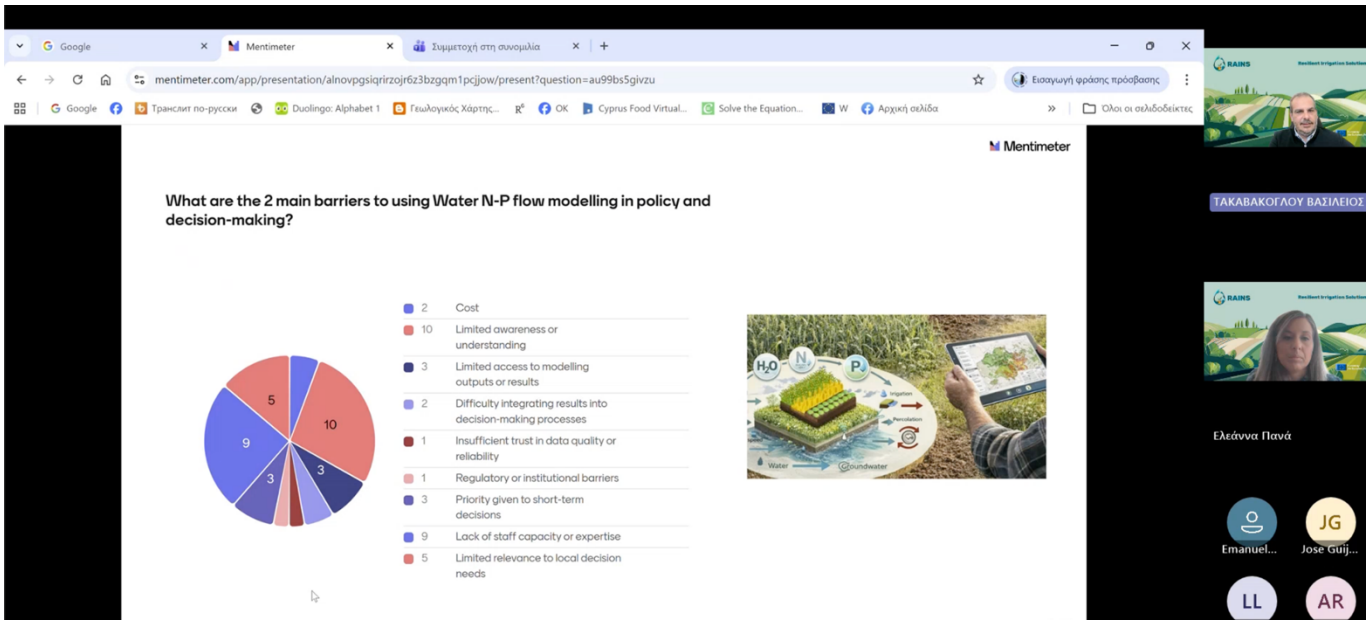
Spatial understanding of agricultural systems
Territorial evaluation of new technologies
Circularity assessment
Agro-food system interactions

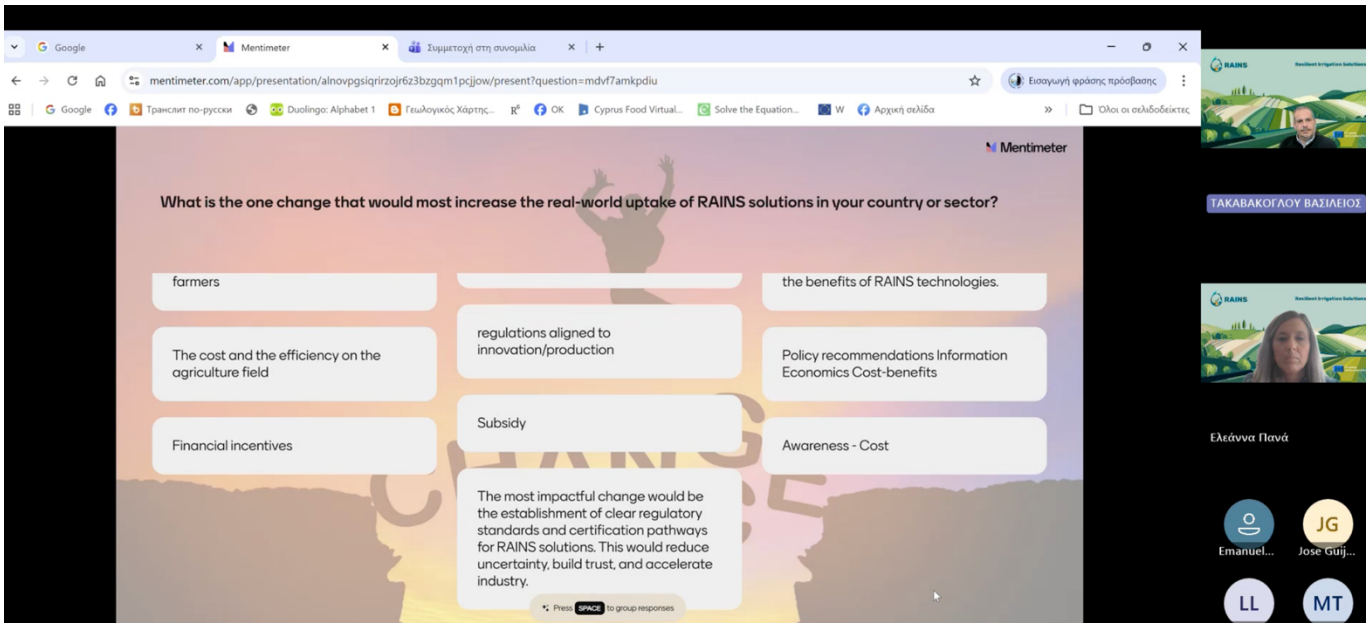
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Characteristics & Description
Innovation based on soil biodegradable formulations.
Made from materials that facilitate water absorption
Free from toxic or hazardous substances.
Thanks to its design, it facilitates the retention and release of collected water
RAINS
13
ΤΑΚΑΒΑΚΟΓΛΟΥ ΒΑΣΙΛΕΙΟΣ
Μάριος Τζήμας
Jaime Andrés Olea AIMPLAS
Ελεάννα Πανά
RU
+37


mentimeter.com/app/presentation/alnovpgsiqrirzojr6z3bzgqm1pcjjow/present?question=au99bs5givzu
Mentimeter
What are the 2 main barriers to using Water N-P flow modelling in policy and decision-making?
2 Cost
10 Limited awareness or understanding
3 Limited access to modelling outputs or results
2 Difficulty integrating results into decision-making processes
1 Insufficient trust in data quality or reliability
1 Regulatory or institutional barriers
3 Priority given to short-term decisions
9 Lack of staff capacity or expertise
5 Limited relevance to local decision needs
ΤΑΚΑΒΑΚΟΓΛΟΥ ΒΑΣΙΛΕΙΟΣ
Ελεάννα Πανά
Emanuel...
Jose Guij...
LL
AR


Mentimeter
What is the one change that would most increase the real-world uptake of RAINS solutions in your country or sector?
farmers
the benefits of RAINS technologies.
regulations aligned to innovation/production
The cost and the efficiency on the agriculture field
Policy recommendations Information Economics Cost-benefits
Subsidy
Financial incentives
Awareness - Cost
The most impactful change would be the establishment of clear regulatory standards and certification pathways for RAINS solutions. This would reduce uncertainty, build trust, and accelerate industry.
Press SPACE to group responses
ΤΑΚΑΒΑΚΟΓΛΟΥ ΒΑΣΙΛΕΙΟΣ
Ελεάννα Πανά
Emanuel...
Jose Güij...
LL
MT