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CASE STUDY

REVISED Retrospective Analysis of Stakeholder Engagement Activities in a Horizon Europe Multi-Actor Project: Evidence from KijaniSpace

[version 2; peer review: 1 approved, 2 approved with reservations, 1 not approved]
Previously titled: "A multi-actor stakeholder engagement progression method for co-creating and sustaining space–IoT innovation ecosystems in Africa: Lessons from the KijaniSpace project"

Tuula-Maija Löytty

Smart & Lean Hub Oy, Lahti, 15320, Finland

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Abstract

Background

Stakeholder engagement is increasingly recognised as an important component of digital agriculture and climate-smart innovation projects. However, communication, consultation, co-design and collaboration activities are often implemented separately, without a common analytical structure for examining how they relate during project implementation.

Case study

This article presents a retrospective descriptive case study of stakeholder engagement in KijaniSpace, a Horizon Europe project using Copernicus Earth Observation and Internet of Things technologies to support climate-smart agriculture and aquaculture in the Lake Victoria Basin. Stakeholder engagement activities were planned as operational project tasks within the Horizon Europe multi-actor approach but were not originally conceptualised as components of a unified framework.

Methods

The study analysed stakeholder mapping datasets, project deliverables, workshop and ideation reports, and communication and

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1. **Franco Silveira**, Embrapa Digital Agriculture, Campinas, Brazil
2. **Vida Dabkienė**, Lithuanian Centre for Social Sciences, Vilnius, Lithuania
3. **Yiorgos Gadanakis**, Cyprus University of Technology, Limassol, Cyprus
4. **Matthew Ayamga**, Wageningen University, Wageningen, The Netherlands

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dissemination records. Activities were classified according to their primary objective, interaction format and intended stakeholder role. Drawing on the IAP2 Spectrum of Public Participation, Agricultural Innovation Systems, living lab research and multi-actor innovation literature, the activities were organised into four analytical categories: Inform, Consult, Involve and Collaborate.

Results

Activities corresponding to all four categories were identified. Inform activities supported awareness and access to project information. Consult activities generated contextual knowledge on stakeholder needs, barriers and regional priorities. Involve activities created opportunities for problem definition, ideation, co-design and participatory prioritisation. Collaborate activities addressed partnership development, governance dialogue, ecosystem coordination and continuity planning. The categories overlapped, and the evidence did not demonstrate sequential progression of individual stakeholders.

Conclusions

The KijaniSpace case shows how heterogeneous stakeholder engagement activities can be retrospectively organised through a common analytical framework. The framework is an interpretive classification structure rather than a validated methodology or measured progression model. It may support more transparent documentation and comparative analysis, while effects on trust, ownership, institutional embedding and long-term sustainability require longitudinal and participant-based research.

Keywords
stakeholder engagement, adaptive governance, participatory innovation, co-creation, Agricultural Innovation Systems, living labs, digital agriculture, climate-smart agriculture, innovation ecosystems, sustainability, multi-actor approach, Space–IoT integration



This article is included in the Horizon Europe gateway.

Corresponding author: Tuula-Maija Löytty (tuula.loytty@smartlean.fi)

Author roles: Löytty TM: Conceptualization, Data Curation, Writing – Original Draft Preparation

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REVISED **Amendments from Version 1**

We thank both reviewers for their careful and constructive assessments. Their comments led us to reconsider the central framing and evidentiary basis of the article.

The original manuscript presented the Multi-Actor Stakeholder Engagement Progression Model as a methodological contribution that had been developed and operationalised within KijaniSpace. It also made claims concerning stakeholder progression, trust, ownership, adaptive governance, exploitation readiness and sustainability that were not supported by direct measurements.

In response, the manuscript has been fundamentally reframed as a retrospective descriptive case study of documented stakeholder engagement activities in the KijaniSpace project.

The revised title, abstract, research question, analytical framework, methods, results, discussion and conclusions now consistently reflect this design. The framework is presented as an interpretive classification structure developed after implementation, rather than as a prospectively applied or validated methodology. The four categories—Inform, Consult, Involve and Collaborate—are used to classify activities rather than individual stakeholders, and no sequential participant progression is assumed.

Methodological transparency has been strengthened by identifying the documentary corpus, including the stakeholder mapping datasets and Deliverables D2.1, D2.2 and D6.2; defining documented engagement activities as the unit of analysis; describing the coding fields and classification criteria; and explaining how activities with overlapping characteristics were assigned according to their dominant purpose. Representative empirical examples and their documentary sources are now presented in Table 2.

The manuscript also distinguishes Digital Agriculture from Climate-Smart Agriculture, explains the role of Space–IoT technologies, relates the framework explicitly to IAP2 and other established literature, moderates unsupported causal claims, expands the limitations, and clarifies ethics and data availability. Identifiable stakeholder data are not publicly shared, while aggregated evidence and public deliverables are cited.

Any further responses from the reviewers can be found at the end of the article

1. Introduction

Climate-smart agriculture and digital innovation projects increasingly depend on collaboration among researchers, technology developers, public authorities, SMEs, innovation intermediaries and end-users. In such environments, stakeholder engagement extends beyond communication and dissemination to include consultation, co-creation, collaborative learning and the development of partnerships that support innovation uptake and long-term sustainability (Reed, 2008; World Bank, 2012). This is particularly important in projects that combine emerging digital technologies, environmental monitoring and local development objectives across diverse institutional, socio-economic and geographical contexts.

Within Horizon Europe, stakeholder engagement is embedded in the broader **multi-actor approach**, which promotes the active involvement of researchers, practitioners, businesses, public authorities, civil society organisations and other relevant actors throughout research and innovation processes. Rather than treating stakeholders as passive recipients of research outputs, the multi-actor approach encourages continuous interaction, knowledge exchange and co-creation from project design through implementation, demonstration and exploitation. Consequently, Horizon Europe projects commonly include communication, consultation, participatory workshops, stakeholder dialogues and collaborative activities as integral operational components of project implementation rather than as stand-alone dissemination tasks.

These considerations are particularly relevant in AU–EU innovation contexts, where digital solutions must operate across diverse governance systems, varying levels of digital readiness and highly context-specific agricultural and environmental conditions. In climate-smart agriculture and aquaculture, the uptake of Earth Observation, Internet of Things (IoT) and digital advisory solutions depends not only on technological performance but also on contextual adaptation, institutional coordination, stakeholder participation and collaborative learning (FAO & ITU, 2022; African Union, 2024). Agricultural Innovation Systems research similarly emphasises that innovation emerges through interaction, facilitation, knowledge exchange and institutional collaboration rather than through linear technology transfer alone (Klerkx et al., 2010; van Ewijk & Ros-Tonen, 2021).

Participatory innovation, living lab approaches and stakeholder participation frameworks provide valuable conceptual perspectives for understanding how different forms of engagement contribute to innovation processes (Reed et al., 2018; Gardezi et al., 2024; Toffolini et al., 2023). However, these approaches primarily describe principles of stakeholder participation rather than how stakeholder engagement is operationalised and evolves within the implementation of large

multi-partner research and innovation projects. There remains a need for case-based studies that examine how stakeholder engagement activities implemented within Horizon Europe projects can be interpreted, organised and analysed in relation to established participation theory.

This article addresses that need through a descriptive case study of the **KijaniSpace** project, a Horizon Europe innovation project supporting climate-smart agriculture and aquaculture in the Lake Victoria Basin through the integration of Copernicus Earth Observation, Internet of Things technologies and digital innovation. KijaniSpace was conceived from the outset as a multi-actor project. The Grant Agreement incorporated a broad range of stakeholder engagement activities, including communication and dissemination, stakeholder mapping, needs assessments, interviews, consultations, workshops, co-design activities, ecosystem-building initiatives and collaboration-oriented mechanisms. These activities were designed as operational project tasks supporting implementation and innovation uptake rather than as components of an explicit conceptual stakeholder engagement framework.

Although stakeholder engagement formed an integral part of project implementation, the relationships among the different engagement activities were not originally articulated through a common analytical structure. Communication, consultation, co-creation and collaboration activities were planned and implemented within different work packages to support project objectives, but they were not conceptualised as elements of a unified stakeholder engagement framework. This provided an opportunity for retrospective analysis of the implemented activities and their relationships.

Accordingly, this paper retrospectively analyses documented stakeholder engagement activities implemented within KijaniSpace and organises them using concepts derived from established stakeholder participation literature, including the IAP2 Spectrum of Public Participation, Agricultural Innovation Systems, living lab approaches and multi-actor innovation research. Based on this retrospective interpretation, the paper presents the **Multi-Actor Stakeholder Engagement Progression Framework** as an analytical framework for organising and interpreting documented engagement activities. The framework was developed after implementation to conceptualise project practice rather than to prescribe stakeholder engagement methods or validate a new methodology.

Using project documentation, including communication activities, stakeholder mapping, interviews, consultations, workshops, ideation sessions, co-design activities and emerging collaboration structures, the paper examines how stakeholder engagement was organised during project implementation and how different forms of participation contributed to contextual learning, co-creation and collaboration-oriented planning. The framework classifies documented activities into four analytical engagement categories—**Inform, Consult, Involve** and **Collaborate**—that represent conceptually different forms of stakeholder interaction. These categories are not treated as fixed or sequential stages through which all stakeholders progress. Rather, they provide an analytical structure for interpreting documented engagement activities that may overlap, recur or occur independently depending on stakeholder roles, project objectives and contextual circumstances.

The analysis does not seek to demonstrate causal relationships between stakeholder engagement and outcomes such as trust, ownership, institutional embedding, exploitation readiness or long-term sustainability. These outcomes were not directly measured within the project and are therefore discussed only as possible interpretations informed by the literature and the documented implementation experience.

The study addresses the following research question:

How can stakeholder engagement activities implemented within a Horizon Europe multi-actor project be retrospectively organised and interpreted using an analytical stakeholder engagement framework, and what insights does this provide into communication, consultation, co-creation and collaboration during project implementation?

The contribution of this article is not the development of a new stakeholder engagement methodology. Rather, it demonstrates how stakeholder engagement activities implemented within a Horizon Europe multi-actor project can be retrospectively conceptualised into a coherent analytical framework informed by established stakeholder participation theory. The framework provides a structured way to interpret relationships among communication, consultation, involvement and collaboration within the KijaniSpace case and offers an analytical approach that may support comparative analysis of stakeholder engagement in future multi-actor research and innovation projects.

2. Background and conceptual context

Stakeholder engagement has become an increasingly important component of research and innovation projects addressing complex societal challenges such as climate-smart agriculture, digital transformation and environmental

sustainability. Contemporary innovation policy recognises that technological advances alone are often insufficient to achieve lasting impact. Instead, successful innovation depends on continuous interaction among researchers, technology developers, businesses, public authorities, intermediaries and end-users throughout the innovation process (Reed, 2008; World Bank, 2012).

Within Horizon Europe, this perspective is reflected in the **multi-actor approach**, which promotes collaboration among diverse stakeholder groups from project conception through implementation, demonstration and exploitation. Rather than viewing communication and dissemination as isolated project activities, the multi-actor approach encourages continuous knowledge exchange, co-creation and shared learning so that innovations respond to practical needs and operating environments (European Commission, Multi-Actor Approach; EU CAP Network, 2017).

Within this article, **digital agriculture** refers to the application of digital technologies, including Earth Observation, Internet of Things (IoT), sensors, artificial intelligence and digital advisory services, to support agricultural decision-making and resource management. **Climate-smart agriculture** refers to approaches that seek simultaneously to improve productivity, strengthen resilience to climate change and, where appropriate, reduce environmental impacts. In KijaniSpace, Space–IoT technologies are considered enabling technologies that support climate-smart agriculture by providing information and digital services for more informed decision-making.

Several complementary bodies of literature informed the retrospective interpretation presented in this study.

Agricultural Innovation Systems (AIS) research emphasises that innovation emerges through interaction among multiple actors rather than through linear technology transfer. Innovation depends on knowledge exchange, institutional coordination, facilitation and collaborative learning involving research organisations, public authorities, businesses, intermediaries and end-users (World Bank, 2012; Klerkx et al., 2010). This perspective highlights the importance of stakeholder interaction throughout innovation processes rather than only during dissemination.

Participatory innovation and living lab research similarly emphasise the active involvement of stakeholders in identifying needs, defining problems, co-designing solutions and evaluating innovations under real-world conditions (Gardezi et al., 2024; Toffolini et al., 2023). These approaches recognise that stakeholders contribute valuable contextual, experiential and operational knowledge that complements scientific and technical expertise. Rather than treating participation as a single event, they describe engagement as an iterative process in which learning and adaptation occur throughout project implementation.

The literature on stakeholder participation provides additional conceptual perspectives for understanding different forms of engagement. The IAP2 Spectrum of Public Participation distinguishes among increasing forms of participation, ranging from informing and consulting to involving, collaborating and empowering stakeholders (IAP2 Federation, n.d.). Although originally developed for public participation, the spectrum provides a useful conceptual reference for distinguishing different forms of stakeholder interaction. Reed (2008) and Reed et al. (2018) further emphasise that effective stakeholder engagement depends on trust, legitimacy, contextual adaptation and the quality of interaction rather than on the application of standard participation procedures.

Research on digital agriculture in Sub-Saharan Africa further highlights the importance of contextual adaptation. FAO and ITU (2022) identify digital infrastructure, institutional capacity, governance arrangements and digital literacy as important factors influencing digital transformation. Similarly, the African Union Digital Agriculture Strategy (African Union, 2024) emphasises local ownership, entrepreneurship, ecosystem development and collaborative innovation as prerequisites for sustainable digital transformation. These studies suggest that stakeholder engagement should be adapted to local institutional, socio-economic and environmental conditions rather than implemented through uniform participation models.

Taken together, these complementary perspectives provide a conceptual lens for interpreting stakeholder engagement within the KijaniSpace project. Rather than serving as a blueprint for project implementation, they offer theoretical concepts that help explain how different stakeholder engagement activities contributed to communication, contextual understanding, co-creation and collaboration during the implementation of a complex multi-actor innovation project.

Accordingly, this study does not seek to compare or validate existing stakeholder participation frameworks. Instead, these established theoretical perspectives are used retrospectively to organise and interpret the stakeholder engagement activities documented during the implementation of KijaniSpace. The analytical framework presented in the following chapter synthesises these concepts into a coherent structure for examining how different forms of stakeholder

engagement were represented within the project and how they related to the broader objectives of collaborative innovation, contextual learning and ecosystem development.

3. KijaniSpace context

KijaniSpace is a Horizon Europe research and innovation project that examines how Copernicus Earth Observation services and Internet of Things (IoT) technologies can support climate-smart agriculture and aquaculture in the Lake Victoria Basin of East Africa. The project operates across Kenya, Tanzania and Uganda and brings together European and African partners representing research organisations, SMEs, innovation hubs, regional organisations and technical experts. Its overall objective is to develop, demonstrate and promote digital services that improve decision-making, environmental monitoring and sustainable management of agricultural and aquaculture systems (KijaniSpace project website, n.d.; KijaniSpace Grant Agreement, 2024).

The Lake Victoria Basin is a strategically important agricultural, fisheries and aquaculture region that supports the livelihoods of millions of people. At the same time, the region faces challenges associated with climate variability, environmental degradation, declining fish stocks, water quality and access to timely information for decision-making (Lake Victoria Basin Commission, n.d.; FAO, 2022; IPCC, 2022). KijaniSpace project documentation similarly identifies climate variability, water-quality management, soil and crop health, fish diseases, market access and fragmented information systems as important regional challenges.

To address these challenges, KijaniSpace combines Copernicus Earth Observation data, IoT technologies and digital innovation methods to develop applications supporting crop production, aquaculture, water management and environmental monitoring. A central technical concept is the KijaniBox, also referred to as the Space–IoT Box, which provides an integration environment for combining space-based data, sensor technologies and user-oriented digital services. The project's ideation activities explored applications including climate and early-warning advisory services, smart aquaculture, soil and water monitoring, disease detection, and market intelligence (KijaniSpace D2.2, 2026a).

Beyond technology development, KijaniSpace was conceived as a multi-actor innovation project. The Grant Agreement and project work packages incorporated stakeholder engagement as an operational component of project implementation. The planned activities included communication and dissemination, stakeholder identification and mapping, needs assessments, interviews, webinars, multi-actor workshops, ideation and co-design activities, and discussions concerning governance, partnerships and ecosystem development (KijaniSpace Grant Agreement, 2024; KijaniSpace D2.1, 2025; KijaniSpace D2.2, 2026a; KijaniSpace D6.2, 2026b).

These activities were implemented through different work packages and at different stages of the project according to their operational objectives. Although they represented different forms of stakeholder interaction, they were not originally designed as elements of a unified conceptual framework. Instead, they supported practical purposes related to communication, contextual understanding, requirements gathering, solution development and preparation for future collaboration and use of project results.

As implementation progressed, documentary evidence accumulated through project deliverables, stakeholder mapping datasets, workshop reports, consultation records, communication activities and project reporting. These materials provide the empirical basis for the retrospective analysis presented in this paper (KijaniSpace D2.1, 2025; KijaniSpace D2.2, 2026a; KijaniSpace D6.2, 2026b).

Accordingly, this study does not examine the implementation of a predefined stakeholder engagement framework. Instead, it examines how stakeholder engagement activities documented during KijaniSpace implementation can be retrospectively organised and interpreted using concepts derived from established stakeholder participation literature.

4. Analytical framework

4.1 Development of the analytical framework

The stakeholder engagement activities undertaken in KijaniSpace were planned as operational components of project implementation rather than as elements of a predefined conceptual model. The project included communication and dissemination, stakeholder mapping, interviews, needs assessments, webinars, workshops, ideation activities, co-design processes and collaboration-oriented discussions. These activities were implemented through different work packages and served practical purposes related to awareness-building, contextual understanding, technology development, stakeholder participation and preparation for the future use of project results.

The relationships among these activities were not originally expressed through a single stakeholder engagement framework. The analytical framework presented in this article was therefore developed retrospectively to organise and interpret the documented activities after their implementation. It should not be understood as a methodology that guided KijaniSpace from the beginning or as a model that was prospectively tested by the project.

The framework was informed by the conceptual perspectives reviewed in Chapter 2, particularly the Horizon Europe multi-actor approach, the IAP2 Spectrum of Public Participation, Agricultural Innovation Systems, participatory innovation and living lab research. These perspectives share an emphasis on interaction among different actors, the contribution of practical and contextual knowledge, and the value of participation beyond one-way communication (Klerkx et al., 2010; Reed, 2008; Reed et al., 2018; World Bank, 2012; IAP2 Federation, n.d.).

The IAP2 Spectrum provided a useful starting point because it distinguishes among different forms of participation, including informing, consulting, involving and collaborating. However, the framework developed for this study is not presented as a replacement for, or validation of, the IAP2 Spectrum. Instead, the four categories were adapted as an analytical structure suited to the types of activities documented within KijaniSpace. The category **Empower**, which appears in the IAP2 Spectrum, was not included because the available project documentation did not demonstrate a transfer of final decision-making authority to external stakeholders.

The resulting **Multi-Actor Stakeholder Engagement Progression Framework** contains four categories:

Inform → Consult → Involve → Collaborate.

The term *progression* refers to differences in the form and potential depth of stakeholder participation represented by these categories. It does not imply that all stakeholders followed a fixed sequence or moved systematically from one category to the next. The project documentation does not track individual stakeholder trajectories in sufficient detail to demonstrate such movement. The categories are therefore used to classify activities rather than participants.

The framework was developed through retrospective interpretation of documented project practice. Activities were considered in relation to their principal objective, interaction format and intended stakeholder role. Communication activities were associated mainly with informing; interviews and needs assessments with consulting; workshops and co-design processes with involving; and partnership, governance and ecosystem-oriented activities with collaborating. Some activities contained characteristics of more than one category. In such cases, they were assigned to the category that best represented their principal form of interaction.

This analytical approach makes it possible to examine a heterogeneous portfolio of stakeholder activities through a common structure. At the same time, it avoids assuming that deeper engagement necessarily produced trust, ownership, institutional embedding, exploitation readiness or long-term sustainability. These outcomes were not directly measured and are therefore treated as possible implications rather than demonstrated effects.

4.2 Structure and interpretation of the framework

The four categories represent distinct but potentially overlapping forms of stakeholder engagement.

Inform

The **Inform** category includes activities whose primary purpose was to provide information, increase awareness and make project objectives, activities and results visible to relevant audiences. Typical examples include the project website, social media, newsletters, videos, webinars with a predominantly presentational format and participation in dissemination events.

In these activities, stakeholders mainly acted as recipients of information. Informing created entry points through which broader audiences could learn about the project and its technologies. However, such activities generally provided limited opportunities for stakeholders to influence project decisions or contribute contextual knowledge.

Consult

The **Consult** category includes activities designed to obtain stakeholder views, experiences, needs and feedback. Typical examples include interviews, surveys, stakeholder dialogues, needs assessments and consultation-oriented webinars.

Stakeholders acted primarily as knowledge contributors. Their input could help the project identify local challenges, institutional constraints, user priorities and conditions affecting the relevance or usability of proposed solutions. Consultation therefore provided a basis for contextual understanding and possible adaptation. It did not necessarily imply shared decision-making, and the extent to which stakeholder feedback influenced later project choices must be assessed from the available documentation rather than assumed.

Involve

The **Involve** category includes activities in which stakeholders participated more actively in defining problems, discussing priorities, generating ideas or shaping solution concepts. Examples include multi-actor workshops, ideation sessions, prioritisation exercises, roadmap development and co-design activities.

In this category, stakeholders acted as active contributors or co-creators rather than only as information recipients or consultees. Their practical, institutional and local knowledge could be brought into discussions about technology design, implementation pathways and use-case development. Involvement created opportunities for contextual learning and participatory innovation, although the available evidence does not establish that all participants acquired ownership of the resulting solutions.

Collaborate

The **Collaborate** category includes activities oriented towards sustained interaction, partnership development, governance dialogue, ecosystem building and continuity planning. Examples include multi-stakeholder platforms, institutional partnerships, replication discussions, policy interaction and collaboration concerning the possible exploitation or continuation of project results.

Stakeholders in this category acted as prospective or active collaborative partners. These activities extended beyond individual consultations or workshops by addressing relationships, responsibilities and possible forms of longer-term cooperation. They may have created opportunities for institutional coordination and sustainability-oriented planning. However, collaboration-oriented activity should not be interpreted as evidence that long-term partnerships, shared ownership or project continuity were already secured.

Figure 1 illustrates the analytical framework developed through the retrospective interpretation of stakeholder engagement activities implemented within KijaniSpace. The framework organises documented activities into four conceptually distinct categories—Inform, Consult, Involve and Collaborate—according to their primary objectives and the nature of stakeholder interaction. The figure provides a visual summary of the analytical structure used throughout the remainder of this paper.

The framework should be interpreted as an analytical representation of different forms of stakeholder engagement rather than as a prescriptive implementation model. The arrows indicate that engagement activities may be related and that stakeholders may participate across multiple categories depending on project needs, stakeholder roles and contextual circumstances. They do not imply that all stakeholders move sequentially through the categories or that higher levels of interaction necessarily produce better outcomes. The horizontal axis represents conceptually increasing opportunities for interaction and contribution rather than a measured engagement scale.

Table 1 summarises the analytical framework developed through the retrospective interpretation of the KijaniSpace stakeholder engagement activities. The four categories represent analytically distinct forms of stakeholder engagement, characterised by their primary objectives, typical activities, stakeholder roles and their contribution to understanding how engagement was implemented within the project. The categories are intended as an interpretive classification rather than a prescriptive sequence of implementation.

The categories presented in Table 1 should not be interpreted as mutually exclusive or as mandatory stages through which all stakeholders progress. Individual engagement activities may exhibit characteristics of more than one category, and stakeholders may participate in different categories according to their roles and the objectives of specific project activities. The framework therefore provides an analytical structure for interpreting documented stakeholder engagement rather than a procedural model for implementing stakeholder participation.

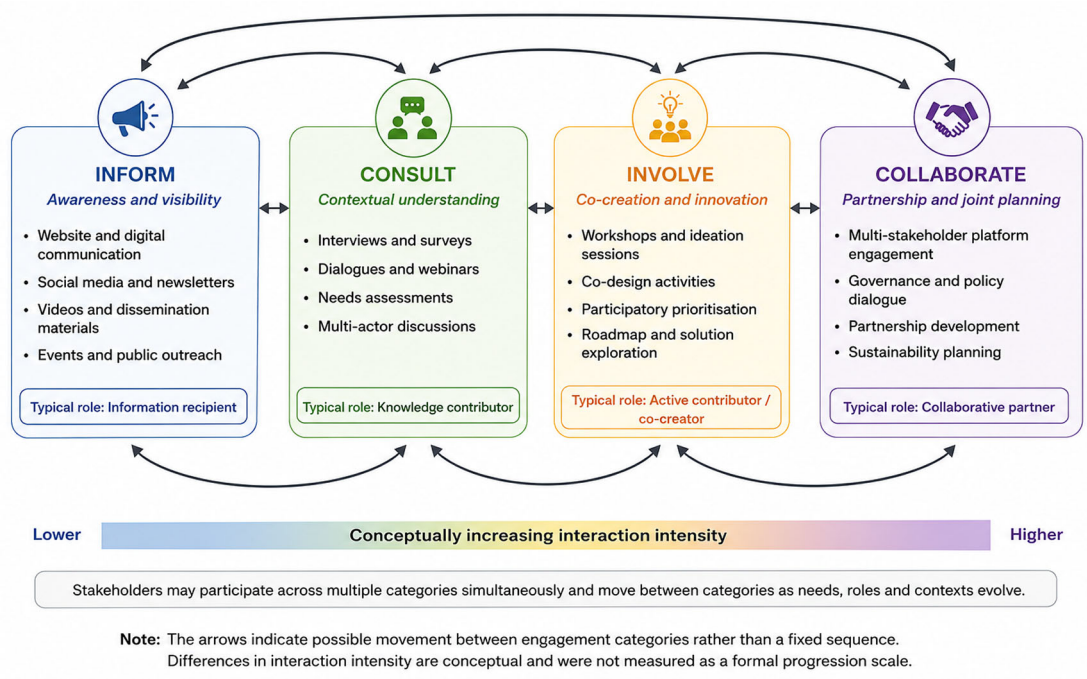


Figure 1. Multi-Actor Stakeholder Engagement Progression Framework used for the retrospective classification and interpretation of stakeholder engagement activities in the KijaniSpace project. The arrows indicate possible relationships between engagement categories and should not be interpreted as mandatory or sequential progression pathways.

Table 1. Analytical framework used to classify stakeholder engagement activities.

Category	Main objective	Typical activities	Principal stakeholder role	Analytical contribution
Inform	Awareness and visibility	Website, social media, newsletters, videos, dissemination events	Information receiver	Visibility, access to project information and initial awareness
Consult	Contextual understanding and needs identification	Interviews, surveys, dialogues, webinars, needs assessments	Knowledge contributor	Stakeholder insights, barriers, priorities
Involve	Co-creation and participatory innovation	Workshops, ideathons, co-design, prioritisation, roadmap development	Active contributor or co-creator	Shared concepts, pilot ideas, solution pathways
Collaborate	Sustainability and ecosystem continuity	Multi-stakeholder platforms, partnerships, governance interaction, replication planning	Collaborative partner	Partnership development, governance dialogue and continuity planning

5. Materials and methods

5.1 Study design

This study employs a retrospective descriptive case study design to examine stakeholder engagement activities implemented within the Horizon Europe KijaniSpace project. The objective is not to evaluate the effectiveness of stakeholder engagement or to validate a new stakeholder engagement methodology. Instead, the study retrospectively analyses documented stakeholder engagement activities and organises them using the Multi-Actor Stakeholder Engagement Progression Framework presented in Chapter 4.

Case studies are particularly appropriate for investigating complex social and organisational processes within their real-world context, especially when the boundaries between the phenomenon and its context are closely intertwined. In KijaniSpace, stakeholder engagement formed an integral part of project implementation through communication, consultation, co-creation and collaboration activities conducted across multiple work packages. These activities were designed to support project implementation and innovation uptake rather than to test a predefined conceptual framework.

The analytical framework presented in this paper was developed after the implementation of these activities through retrospective interpretation of project documentation using concepts derived from established stakeholder participation literature. Consequently, the framework serves as an analytical lens for organising and interpreting stakeholder engagement practices rather than as a prescriptive model against which project implementation is evaluated.

The study therefore adopts an interpretive rather than evaluative perspective. It seeks to answer the following research question:

How can stakeholder engagement activities implemented within a Horizon Europe multi-actor project be retrospectively organised and interpreted using an analytical stakeholder engagement framework, and what insights does this provide into communication, consultation, involvement and collaboration during project implementation?

The findings presented in the following sections describe how documented stakeholder engagement activities were represented within the project and how they can be interpreted using the proposed analytical framework. The study does not attempt to establish causal relationships between stakeholder engagement and outcomes such as trust, stakeholder ownership, technology adoption or long-term sustainability, as these outcomes were not systematically measured within the available project documentation.

5.2 Data sources

The analysis is based on documentary evidence produced during the implementation of the Horizon Europe KijaniSpace project. Documentary analysis was selected because the objective of the study is to retrospectively examine stakeholder engagement activities as they were planned, implemented and reported throughout the project. The available project documentation provides a comprehensive record of stakeholder engagement processes, their objectives, implementation and reported outcomes, making it an appropriate empirical basis for retrospective analysis.

The primary sources included the KijaniSpace Grant Agreement and Description of Action, project deliverables, periodic technical reports, communication and dissemination materials, stakeholder mapping documentation, workshop reports, needs assessments, interview summaries, co-design and ideation reports, and other project documents describing stakeholder engagement activities. Publicly available information from the project website and communication channels was also consulted where it complemented the official project documentation.

These documents collectively describe a broad range of stakeholder engagement activities, including communication and dissemination, stakeholder identification and mapping, interviews, consultations, workshops, webinars, ideation sessions, co-design activities, partnership discussions and ecosystem-building initiatives. The documentation therefore captures the diversity of stakeholder interactions implemented throughout the project and provides sufficient detail to classify activities according to the analytical framework developed in Chapter 4.

The documentary sources were not originally produced for research purposes. Instead, they were generated as part of routine project planning, implementation, reporting and communication. Consequently, the analysis presented in this paper should be understood as a retrospective interpretation of existing project documentation rather than an evaluation based on data collected specifically to test the proposed analytical framework.

5.3 Analytical procedure

The retrospective analysis focused on **documented stakeholder engagement activities** as the unit of analysis. Rather than analysing individual stakeholders or stakeholder groups, the study examined the engagement activities described in the project documentation and classified them according to the analytical framework presented in Chapter 4.

The documentary corpus comprised the detailed KijaniSpace multi-actor stakeholder mapping dataset and its aggregated summary tables, together with D2.1, D2.2 and D6.2. The stakeholder mapping datasets recorded stakeholder characteristics, organisational affiliation, geographic location, stakeholder group and participation across the multi-actor engagement activities implemented during 2025. The summary tables provided aggregated distributions by country, continent and stakeholder category. D2.1 documented the needs assessment, interviews, stakeholder mapping and proposed

Multi-Stakeholder Platform; D2.2 documented the ideation and co-design workshops; and D6.2 consolidated communication, dissemination and stakeholder-engagement activities during the first reporting period (KijaniSpace D2.1, 2025; KijaniSpace D2.2; 2026a, KijaniSpace D6.2, 2026b).

The author extracted each discrete stakeholder engagement activity into a coding table recording its primary objective, interaction format, intended stakeholder role, location and documentary source. Each activity was then classified according to the criteria presented in Table 1. Where an activity displayed characteristics of more than one category, the original documentary description was reviewed and the activity was assigned according to its dominant purpose. The resulting classification distinguished among Inform, Consult, Involve and Collaborate activities as defined below.

Each extracted activity was then reviewed to identify its primary objective, interaction format, intended stakeholder role and contribution to the project's stakeholder engagement process. Based on these characteristics, activities were assigned to one of the four analytical categories of the Multi-Actor Stakeholder Engagement Progression Framework:

- **Inform** – activities primarily intended to communicate information, raise awareness and disseminate project objectives, progress or results;
- **Consult** – activities designed to obtain stakeholder knowledge, opinions, needs or feedback relevant to project implementation;
- **Involve** – activities in which stakeholders actively participated in discussions, ideation, co-design or the development of solution concepts; and
- **Collaborate** – activities focused on partnership development, governance, ecosystem building or the exploration of longer-term cooperation beyond individual project events.

The framework was applied as an **analytical classification tool** rather than as an evaluation instrument. Its purpose was to organise and interpret the diversity of stakeholder engagement activities implemented within KijaniSpace using a consistent conceptual structure. The analysis therefore describes how different forms of stakeholder engagement were represented within the project but does not assess their relative effectiveness or assume a sequential progression of stakeholders through the four categories.

The classified activities were subsequently synthesised to identify patterns of stakeholder engagement across the project and to examine how communication, consultation, involvement and collaboration contributed to the implementation of the KijaniSpace multi-actor approach. This synthesis forms the basis of the results presented in the following chapter.

5.4 Scope and limitations of the analysis

The analytical framework presented in this study provides a structured approach for organising and interpreting stakeholder engagement activities documented during the implementation of the KijaniSpace project. It is intended as a descriptive and interpretive tool rather than a method for evaluating stakeholder engagement performance or measuring the effectiveness of specific engagement strategies.

The analysis is based exclusively on project documentation and publicly available project outputs. Consequently, the findings reflect the information recorded during project implementation and are limited by the scope and level of detail of these documentary sources. While the documentation provides comprehensive evidence of the stakeholder engagement activities undertaken, it does not systematically capture individual stakeholder experiences, perceptions or behavioural changes over time.

Similarly, the available documentation does not provide sufficient evidence to establish causal relationships between stakeholder engagement activities and broader outcomes such as stakeholder trust, ownership, institutional embedding, technology adoption or the long-term sustainability of project results. Although these outcomes are frequently associated with effective stakeholder engagement in the literature, they were not directly measured within KijaniSpace and therefore cannot be empirically verified in this study.

The analysis also does not assume that stakeholders progressed sequentially through the four engagement categories. The categories—**Inform**, **Consult**, **Involve** and **Collaborate**—represent analytically distinct forms of stakeholder engagement rather than mandatory stages of participation. Individual activities may incorporate characteristics of more than one

category, and different stakeholder groups may participate in different forms of engagement according to their roles, interests and responsibilities within the project.

Finally, this study focuses on a single Horizon Europe project. Although the analytical framework may offer a useful approach for interpreting stakeholder engagement in other multi-actor research and innovation projects, its broader applicability has not been formally evaluated. Future research could apply the framework to additional projects, compare stakeholder engagement practices across different implementation contexts, and assess its usefulness as a tool for comparative analysis.

6. Results

This chapter presents the results of the retrospective analysis of stakeholder engagement activities implemented within the KijaniSpace project. Using the Multi-Actor Stakeholder Engagement Progression Framework described in Chapter 4 and the analytical procedure outlined in Chapter 5, documented activities were classified according to their primary objective, form of interaction and intended stakeholder role.

The analysis identified activities corresponding to all four analytical categories: **Inform, Consult, Involve** and **Collaborate**. Together, these categories capture a range of engagement practices, from communication and dissemination to consultation, participatory co-design and collaboration-oriented initiatives. The classification provides a structured basis for examining how different forms of stakeholder engagement were represented during project implementation.

Table 2. Representative examples of KijaniSpace stakeholder engagement activities classified using the analytical framework.

Gategory	Representative activity	Geographic scope	Evidence of engagement	Main stakeholder groups	Documentary source
Inform	Communication and dissemination activities (website, social media, newsletters, media, third-party events)	Regional and international	31,000+ website visitors; 145,000+ page views; 5,200 newsletter recipients; 55,000 LinkedIn impressions; 6,700 Facebook views; 500+ event audience	General public, researchers, SMEs, policymakers, farmers and innovation communities	D6.2
Consult	Needs consultations (farmer survey and key informant interviews)	Kenya, Tanzania and Uganda	**74** interview participants	Farmers, SMEs, public authorities, researchers and other local stakeholders	D2.1
Involve	Orientation webinar	Online/ regional	**60** webinar registrations	Researchers, SMEs, innovation actors, and public authorities	D2.1/D2.2
	Ideation and co-design workshops: one in Kenya and two in Tanzania	Kenya and Tanzania	**82** workshop registrations	Researchers, SMEs, farmer organisations, public authorities and innovation actors	D2.1/D2.2
Collaborate	Multi-Stakeholder Platform (MSP) discussions and ecosystem-building activities	Lake Victoria Basin region	Documented activities included Multi-Stakeholder Platform discussions, ecosystem-building meetings and partnership planning.	Public institutions, SMEs, researchers, innovation hubs, farmer organisations and regional bodies	D2.1/D2.2

Table 2 presents selected examples of documented KijaniSpace stakeholder engagement activities classified according to the analytical framework. The analysis drew on the broader documentary corpus, while the table illustrates how representative activities were assigned to each engagement category. The examples reflect variation in activity type, stakeholder groups, geographical scope and evidence of engagement. The individual categories are examined in greater detail in Sections 6.1–6.4.

The results should be interpreted as a retrospective description of documented stakeholder engagement activities rather than as an evaluation of their effectiveness. The framework is used to organise and interpret the available documentary evidence and does not imply that stakeholders progressed sequentially through the four engagement categories or that all documented activities produced comparable outcomes. Instead, the analysis shows how different forms of stakeholder engagement were represented in activities related to communication, contextual understanding, participatory innovation and collaboration during the implementation of the KijaniSpace project.

6.1 Inform: Communication and awareness-building

The **Inform** category comprised stakeholder engagement activities whose primary objective was to communicate project information, increase visibility and raise awareness of the KijaniSpace project and its Space–IoT solutions for climate-smart agriculture and aquaculture. These activities were designed to make project objectives, technologies, events and results accessible to a broad audience while providing opportunities for stakeholders to become familiar with the project and its objectives.

The documented Inform activities included the project website, newsletters, social media communication, videos, dissemination materials, webinars with a predominantly presentational purpose and participation in external conferences and stakeholder events. The project website functioned as the principal public communication platform, providing information on project objectives, partners, news, events and publicly available project outputs. Social media channels complemented the website by extending communication to professional networks and wider stakeholder communities, while newsletters and other dissemination materials supported regular communication with interested audiences.

Project documentation indicates that these communication activities reached substantial audiences during the reporting period. As summarised in Table 2, reported communication metrics included approximately 31,000 website visitors, more than 145,000 page views, over 5,200 newsletter recipients, around 55,000 LinkedIn impressions, approximately 6,700 Facebook views and audiences exceeding 500 participants through external dissemination events. These figures demonstrate the breadth of the project's communication activities but should be interpreted as indicators of communication reach rather than evidence of active stakeholder participation or engagement quality.

The Inform category involved a diverse range of stakeholder groups, including researchers, SMEs, policymakers, farmers, innovation communities and the general public. Communication activities created opportunities for stakeholders to access project information and become aware of ongoing developments irrespective of their geographical location or level of prior involvement in the project. As such, they contributed to the visibility of the project and provided accessible entry points for potential participation in subsequent stakeholder engagement activities.

Within the analytical framework, these activities are interpreted as representing the broadest form of stakeholder engagement. Their primary function was to disseminate information and support awareness-building rather than to obtain stakeholder knowledge or facilitate collaborative decision-making. While communication activities may encourage subsequent participation, the available documentation does not demonstrate whether stakeholders who accessed project information subsequently participated in consultation, co-design or collaboration-oriented activities. Consequently, the Inform category is interpreted as documenting communication reach and accessibility rather than progression to deeper forms of stakeholder engagement.

6.2 Consult: Understanding stakeholder needs and contextual conditions

The **Consult** category comprised stakeholder engagement activities designed to obtain knowledge, experiences and feedback from stakeholders to inform project implementation. Unlike the **Inform** category, which primarily focused on communication and awareness-building, consultation created opportunities for stakeholders to contribute contextual information on agricultural practices, operational challenges, institutional conditions and user requirements. The objective was to improve understanding of the regional context in which the project's Space–IoT solutions would be developed and demonstrated.

The principal consultation activities documented within KijaniSpace included stakeholder mapping, needs assessments, structured interviews, surveys and consultation-oriented meetings conducted across Kenya, Tanzania and Uganda. These activities involved farmers, aquaculture practitioners, SMEs, researchers, public authorities, innovation intermediaries

and other actors representing the regional innovation ecosystem. Together, they provided information on stakeholder priorities, existing practices, barriers to digital technology adoption and opportunities for climate-smart agriculture and aquaculture.

Stakeholder mapping formed an important component of the consultation process by identifying organisations and individuals relevant to the project's objectives. By the project's mid-term reporting stage, more than 200 stakeholders had been identified, representing technical users, farmer communities, policy actors, research organisations, SMEs and other innovation ecosystem participants. This mapping provided an overview of the stakeholder landscape and supported the planning of subsequent engagement activities. However, the number of mapped stakeholders should be interpreted as an indication of the breadth of the stakeholder environment rather than as evidence of active or sustained participation.

Needs assessments and interviews generated contextual information that helped characterise the operational environment for digital agriculture and aquaculture applications. The documented consultations explored issues such as farming and aquaculture practices, climate-related challenges, access to digital services, information needs and stakeholder expectations regarding Earth Observation and IoT-based solutions. These activities enabled the project consortium to gather practical knowledge from stakeholders with different institutional roles and operational experience.

Within the analytical framework, these activities are interpreted as representing consultation because their primary purpose was to obtain stakeholder knowledge rather than to develop solutions collaboratively. Stakeholders participated as **knowledge contributors**, providing information that could support contextual understanding and inform subsequent project activities. The available documentation indicates that consultation generated valuable insights into stakeholder needs, regional priorities and implementation challenges. However, it does not systematically document how individual consultation outcomes influenced specific project decisions or whether all stakeholder recommendations were subsequently incorporated into project activities.

The Consult category therefore illustrates how KijaniSpace moved beyond one-way communication by creating structured opportunities for stakeholders to contribute their knowledge and experience. Rather than representing an endpoint in the engagement process, consultation established a foundation for the more participatory activities examined in the following section, where stakeholders became active contributors to ideation, co-design and solution development through workshops and collaborative innovation activities.

6.3 Involve: Co-design and participatory innovation

The **Involve** category comprised stakeholder engagement activities in which participants moved beyond providing information or feedback to actively contributing to problem definition, idea generation and the development of potential solution concepts. Within KijaniSpace, these activities created opportunities for researchers, practitioners, public authorities, SMEs and other stakeholders to work together in participatory settings, where local knowledge and technical expertise could be combined to explore approaches for climate-smart agriculture and aquaculture.

The principal activities classified within this category included multi-actor workshops, ideation sessions, co-design exercises and participatory prioritisation processes conducted in Kenya and Tanzania. According to the project documentation, one workshop was organised in Kenya and two in Tanzania, with a total of 82 registered participants representing agriculture, aquaculture, research organisations, public authorities, innovation support organisations, SMEs and other regional stakeholders. These workshops were designed to encourage dialogue across stakeholder groups and to identify priorities for the development and application of Space–IoT solutions.

The workshop methodology was based on participatory and human-centred approaches. Participants discussed practical challenges affecting agriculture and aquaculture, identified priority areas for intervention and explored possible technological solutions that could address locally identified needs. The documented outputs included ideas related to climate and early-warning advisory services, smart aquaculture, soil and water monitoring, disease detection and market intelligence. These outputs illustrate how stakeholder knowledge was incorporated into the early conceptualisation and contextualisation of potential project solutions.

From the perspective of the analytical framework, these activities represent **active stakeholder involvement** because participants contributed directly to the exploration and refinement of solution concepts rather than acting solely as recipients of information or providers of feedback. The workshops created opportunities for interaction among technical experts, researchers, SMEs, public authorities and end-user representatives, enabling participants to exchange perspectives and jointly examine possible implementation pathways. In this sense, the **Involve** category reflects participatory innovation processes in which stakeholder knowledge contributes to shaping ideas and identifying contextually relevant opportunities.

The available documentation demonstrates that these participatory activities generated documented ideas, priorities and concept proposals. However, it does not systematically record whether the same stakeholders continued to participate in subsequent project activities, whether all proposed concepts were implemented, or whether participation resulted in stronger stakeholder ownership, sustained collaboration or measurable innovation outcomes. Consequently, the evidence supports the interpretation that stakeholders actively contributed to co-design and concept development, but it does not support conclusions regarding the longer-term effects of this involvement.

The **Involve** category therefore represents an important transition from consultation towards active participation in innovation processes. It demonstrates how KijaniSpace created structured opportunities for stakeholders to contribute their knowledge, experience and ideas to the development of potential Space–IoT applications. At the same time, the documentary evidence indicates that these activities should be interpreted as participatory contributions to project implementation rather than as evidence of sustained co-ownership or long-term collaborative engagement. The latter is examined in the following section through activities classified within the **Collaborate** category.

6.4 Collaborate: Partnership and ecosystem development

The **Collaborate** category comprised activities and emerging structures oriented towards partnership-building, governance dialogue, ecosystem coordination and possible longer-term continuity. In contrast to the **Involve** category, which focused primarily on participation in problem definition and concept development, collaboration-oriented activities addressed how stakeholder relationships, institutional roles and support structures might be maintained beyond individual workshops or consultation events. At the stage covered by the available documentation, these mechanisms had been initiated but were still under development. They should therefore be interpreted as ongoing collaboration-oriented arrangements rather than as evidence of established long-term collaboration.

The principal mechanism associated with this category was the proposed **Multi-Stakeholder Platform**. The platform was designed to support knowledge exchange, access to data and knowledge resources, collaboration among start-ups, SMEs, researchers and institutions, and the integration of traditional and indigenous knowledge with modern innovations. Project documentation described it as a flexible and context-sensitive mechanism intended to support broad stakeholder representation, farmer participation, feedback and peer learning.

The collaboration-oriented structure also included planned **Technical Working Groups** covering policy, research and innovation, and application. These groups were intended to create opportunities for interaction among policymakers, researchers, farmers, NGOs and other ecosystem actors. Their anticipated functions included supporting transparent discussion, capacity-building and coordination around future implementation. However, their development remained ongoing during the period examined, and the available documentation does not provide evidence that they had yet become fully established governance structures.

Further collaboration-oriented activities were linked to institutional integration, regional and government partnerships, monitoring and evaluation, knowledge repositories, replication planning and longer-term ecosystem support. These elements indicate that KijaniSpace was seeking to connect stakeholder engagement with governance arrangements, future implementation pathways and sustainability planning. Public authorities, innovation hubs, researchers and SMEs also participated in discussions concerning partnerships, ecosystem continuity, pilot implementation and possible replication opportunities.

Within the analytical framework, these activities are classified as **Collaborate** because their main purpose extended beyond communication, consultation and co-design towards the development of relationships and structures for future cooperation. Stakeholders were positioned not only as recipients of information or contributors of knowledge, but as prospective institutional and ecosystem partners involved in discussions about governance, coordination and continuity.

Nevertheless, the documentary evidence supports only a cautious interpretation of this category. The available materials demonstrate that collaboration-oriented discussions, structures and partnership activities were planned or ongoing, but they do not establish their effectiveness or long-term continuity. In particular, the evidence does not demonstrate institutional embedding, sustained partnership performance, collaborative ownership, exploitation readiness or ecosystem sustainability. These outcomes would require longitudinal monitoring and evidence collected beyond the period analysed in this study.

The **Collaborate** category therefore captures the project's efforts to create opportunities for continued institutional interaction and ecosystem development. It shows that stakeholder engagement within KijaniSpace extended beyond individual communication, consultation and co-design activities to include planning for partnership, governance and

future coordination. At the same time, it remains important to distinguish the presence of collaboration-oriented mechanisms from demonstrated long-term collaborative outcomes.

7. Discussion

7.1 Interpretation of stakeholder engagement within KijaniSpace

The retrospective analysis demonstrates that stakeholder engagement within KijaniSpace encompassed a diverse set of communication, consultation, participatory and collaboration-oriented activities that can be meaningfully organised using the Multi-Actor Stakeholder Engagement Progression Framework. Rather than representing isolated engagement events, the documented activities illustrate how different forms of stakeholder interaction supported complementary objectives throughout project implementation.

The analysis indicates that communication and dissemination activities created broad awareness of the project and its objectives, while consultation activities generated contextual knowledge concerning stakeholder needs, local conditions and implementation challenges. Participatory workshops and co-design activities provided opportunities for stakeholders to contribute ideas, discuss priorities and explore potential applications of Space–IoT technologies. Collaboration-oriented initiatives extended stakeholder engagement towards partnership development, ecosystem building and governance discussions.

These findings suggest that stakeholder engagement within a Horizon Europe multi-actor project is better understood as a portfolio of complementary engagement approaches than as a single participation process. Different activities served different implementation needs, involved different stakeholder groups and required different forms of interaction. Consequently, the four categories should be interpreted as complementary analytical perspectives rather than successive implementation stages.

The retrospective analysis also indicates that stakeholder engagement was iterative and context-dependent. Activities frequently overlapped, and stakeholders could participate in different forms of engagement according to their expertise, institutional responsibilities and opportunities for participation. The available documentation does not support the interpretation that stakeholders progressed sequentially through the four engagement categories. Instead, the concept of progression reflects increasing opportunities for stakeholder interaction and contribution rather than measured participant trajectories.

7.2 Relationship to existing stakeholder engagement literature

The findings are consistent with previous research emphasising that innovation in agriculture emerges through interaction among multiple actors rather than through linear technology transfer (Klerkx et al., 2010; World Bank, 2012). The consultation and co-design activities documented within KijaniSpace illustrate how contextual knowledge from farmers, researchers, SMEs, public authorities and other stakeholders contributed to discussions concerning the design and implementation of digital agriculture solutions.

Similarly, the results align with participatory innovation and living lab research, which emphasises iterative learning, stakeholder participation and the integration of practical knowledge into innovation processes (Reed et al., 2018; Toffolini et al., 2023; Gardezi et al., 2024). However, the KijaniSpace case also demonstrates that participation within large international research projects is distributed across multiple activity types rather than confined to formal co-design workshops. Communication, consultation, involvement and collaboration each fulfilled different functions within the broader implementation process.

The analytical framework also draws inspiration from the IAP2 Spectrum of Public Participation, particularly the distinction between informing, consulting, involving and collaborating stakeholders. Unlike the IAP2 Spectrum, however, the framework presented in this study was not designed as a normative participation model. Instead, it was developed retrospectively as an interpretive structure for classifying and analysing documented stakeholder engagement activities within a Horizon Europe multi-actor project. In this respect, the framework complements rather than replaces existing stakeholder participation models by demonstrating one possible approach to organising project documentation for analytical purposes.

7.3 Implications for Horizon Europe multi-actor projects

The study has practical implications for the planning, documentation and evaluation of stakeholder engagement within Horizon Europe projects. Many multi-actor projects implement a broad range of engagement activities but document them primarily as individual project tasks or deliverables. Retrospective analysis using a common analytical framework can help reveal relationships among these activities and provide a more coherent understanding of how different forms of stakeholder engagement contribute to project implementation.

The framework may also support project monitoring and comparative analysis by providing a consistent vocabulary for describing stakeholder engagement activities. Rather than focusing exclusively on communication outputs or participation numbers, projects may benefit from documenting the objectives, interaction formats and intended stakeholder roles associated with different engagement activities. Such documentation could facilitate cross-project learning and contribute to a more systematic understanding of stakeholder engagement practices within Horizon Europe.

At the same time, the framework should not be interpreted as a prescriptive implementation model. Different projects operate in different institutional, technological and socio-economic contexts, and stakeholder engagement strategies should remain adaptable to project objectives, stakeholder capacities and regional circumstances. The framework therefore offers an analytical structure that may support reflection and comparison rather than a standardised methodology for stakeholder engagement.

7.4 Limitations and future research

Several limitations should be considered when interpreting the findings. First, the study is based on documentary evidence from a single Horizon Europe project. Although the documentation provides a comprehensive record of stakeholder engagement activities, it was produced primarily for project management and reporting rather than for research purposes.

Second, the retrospective analysis classifies documented activities rather than evaluating stakeholder experiences or engagement outcomes. The available evidence does not allow conclusions to be drawn regarding changes in stakeholder attitudes, trust, ownership, technology adoption or the long-term sustainability of project results. Nor does it permit the reconstruction of individual stakeholder participation across successive engagement activities.

Third, the analytical framework has been applied only to the KijaniSpace project. Its broader usefulness for analysing stakeholder engagement in other research and innovation projects remains to be examined.

Future research could apply the framework to additional Horizon Europe and other multi-actor projects, compare stakeholder engagement patterns across different thematic domains and implementation contexts, and combine documentary analysis with interviews, surveys or longitudinal participant tracking. Such studies would help assess the framework's wider applicability and provide stronger evidence concerning the relationships between stakeholder engagement processes and project outcomes.

8. Conclusions

This study retrospectively examined stakeholder engagement activities implemented within the Horizon Europe KijaniSpace project and organised them using the **Multi-Actor Stakeholder Engagement Progression Framework** developed through the retrospective interpretation of project documentation. Rather than proposing a new stakeholder engagement methodology, the study demonstrates how documented stakeholder engagement activities can be systematically classified and interpreted using concepts derived from established stakeholder participation literature.

The analysis showed that stakeholder engagement within KijaniSpace extended beyond communication and dissemination to include consultation, participatory involvement and collaboration-oriented activities. These activities served different but complementary purposes during project implementation, including raising awareness, gathering contextual knowledge, supporting co-design and exploring partnership and ecosystem development. The retrospective application of the analytical framework provided a coherent structure for describing these different forms of engagement while recognising that stakeholder participation was context-dependent, overlapping and not necessarily sequential.

The principal contribution of this study is the development of an analytical approach for interpreting stakeholder engagement activities within a Horizon Europe multi-actor project. By organising documented activities into the categories **Inform**, **Consult**, **Involve** and **Collaborate**, the framework provides a consistent vocabulary for describing and comparing stakeholder engagement practices. As an interpretive framework, it may support project reflection, documentation and comparative analysis across research and innovation projects, while complementing established stakeholder participation concepts such as the Horizon Europe multi-actor approach, the IAP2 Spectrum of Public Participation and Agricultural Innovation Systems.

The study also highlights the importance of documenting stakeholder engagement in a manner that captures not only communication outputs but also the objectives, forms of interaction and stakeholder roles associated with different engagement activities. Such documentation can improve the transparency of stakeholder engagement processes and facilitate learning across projects implementing multi-actor approaches.

Several limitations should be recognised. The framework was developed through retrospective analysis of a single Horizon Europe project and was applied using documentary evidence generated during project implementation. Consequently, the study does not evaluate the effectiveness of stakeholder engagement or establish causal relationships between engagement activities and outcomes such as stakeholder trust, ownership, technology adoption or long-term sustainability. These outcomes require dedicated empirical investigation using participant-based and longitudinal research approaches.

Future research should apply the framework to additional multi-actor projects in different thematic and geographical contexts to examine its broader applicability and support comparative analyses of stakeholder engagement practices. Combining documentary analysis with interviews, surveys and longitudinal stakeholder monitoring would also provide a stronger basis for evaluating how different forms of stakeholder engagement contribute to innovation processes and project outcomes.

Ethics and consent

This study is based on the retrospective analysis of project documentation generated during the implementation of the Horizon Europe KijaniSpace project. The analysis used project reports, public deliverables, communication materials and other documentary sources describing stakeholder engagement activities. No new data were collected directly from human participants for the purposes of this study.

Where stakeholder engagement activities involved interviews, workshops or surveys conducted as part of the KijaniSpace project, these activities were implemented within the project's established ethical procedures and applicable institutional and Horizon Europe requirements. The present study analyses the documented outputs of these activities and does not report personally identifiable information.

Use of generative AI tools

Generative artificial intelligence (AI) tools were used to support language editing, improve clarity and assist in the organisation of the manuscript. The authors reviewed, revised and verified all generated text and remain fully responsible for the content, interpretation and conclusions presented in this article. Generative AI tools were also used to support the preparation of illustrative figures. All figures were subsequently reviewed and finalised by the authors.

Data availability

The analysis is based on documentation produced during the Horizon Europe KijaniSpace project. Publicly available sources include the KijaniSpace project website, public project deliverables and communication and dissemination materials.

The identifiable stakeholder mapping dataset is not publicly available because it contains personal data and potentially identifiable organisational information. Aggregated stakeholder distributions and the project-level evidence used in the analysis are reported in the article and cited public deliverables. Access to any non-public material is subject to applicable data-protection requirements, participant consent and consortium approval.

Publicly available project materials can be accessed through the KijaniSpace project website and the project's Zenodo community.

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✓ **Matthew Ayamga**
Wageningen University, Wageningen, The Netherlands

I found the paper interesting because of my experience in EU projects focused on stakeholder engagement and collaboration in co-identifying and co-creating/designing solutions.

Also, most of my comments were already addressed in the earlier round of revisions.

However, my main comment concerns how the gap is framed. EU projects I know usually set out in the grant agreement how stakeholder engagement activities will be carried out, so why should this require an explicit conceptual stakeholder framework when existing research already offers a range of stakeholder engagement approaches?

I would expect the gap framing to point to whether the project's stakeholder engagement activities follow any known approaches, or to a new way to reconceptualize them. The current framing is close to this and can be easily addressed.

Is the background of the case's history and progression described in sufficient detail?
Yes

Is the work clearly and accurately presented and does it cite the current literature?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Is the case presented with sufficient detail to be useful for teaching or other practitioners?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Innovation management, interdisciplinary collaboration, agricultural innovation ecosystems, entrepreneurship and innovation, business management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 26 Sep 2026

Tuula-Maija Löytty

Dear Dr Matthew Ayamga Thank you very much for your thoughtful comment. I found your point about the framing of the research gap particularly useful, because it helped me clarify an important distinction. I agree that the gap is not that Horizon Europe projects lack stakeholder engagement activities or established approaches for conducting them. In KijaniSpace, stakeholder engagement was already embedded in the Grant Agreement and planned through different activities and work packages. However, **living with a multi-actor approach in practice is not necessarily easy**. I consider it very positive that the EU requires and encourages meaningful multi-actor engagement, but having stakeholder engagement written into a Grant Agreement is different from understanding how to make it work throughout the life of a project. There is still much to learn about how different forms of engagement interact, how relationships develop, and how engagement can create **mutual benefit for stakeholders, the project, and the project partners**, rather than becoming merely a set of activities to be completed. This is where I see the value of the retrospective perspective. The contribution is not another stakeholder engagement methodology, but an attempt to look back at what actually happened and to interpret heterogeneous engagement activities through established participation approaches. Your comment helped me see the research gap more precisely as the relationship between **what was planned, what was implemented, and what we can learn from the dynamics of implementation**. Thank you again for this observation and for contributing to my learning through the review process. With the article now accepted, I feel that the input–output balance has reached an appropriate equilibrium. There will always be room for further refinement, but I will leave the article here and carry these lessons into future work.

Best regards

Tuula

Competing Interests: No competing interests were disclosed.

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Yiorgos Gadanakis
Cyprus University of Technology, Limassol, Cyprus

It was really interesting reading this manuscript and its approach. Based on previous comments and reviews, the author has successfully repositioned it from an over-ambitious "new methodology" paper to a retrospective case study, which is much better aligned with the available evidence. The paper is coherent, transparent about its limitations, and generally well written although, there are sections that are repeated across the manuscript - especially statements about the objective of the paper and the treatment of methodology. I believe that this repetition can be limited.

Examples:
The manuscript repeatedly states:

- "Retrospective descriptive case study"
- "Activities rather than stakeholders"
- "Not a validated methodology"
- "No causal relationships are claimed"

These phrases appear many times across Introduction, Methods, Results, Discussion and Conclusions
Overall, the main strengths of the paper can be summarized around the structure of a clear research question, an appropriate case study design, and a transparent description of data sources. Moreover, it demonstrates a good integration with the IAP2, AIS and living lab literature and is also demonstrating practical relevance for Horizon Europe multi actor approach projects. However, a major concern remains as it is also described from another reviewer and that is of the use of the term "progression" since this creates a conceptual inconsistency. Throughout the manuscript, it is repeated that activities are classified and not people, no stakeholder trajectories were tracked and that no sequential movement was demonstrated. Yet the framework is still mentioned as a Multi-Actor Stakeholder Engagement Progression Framework. Therefore, the author might need to consider revisiting the title of the framework and avoid the use of the word progression.
The Results section could briefly summarize the main patterns emerging from the analysis, rather than focusing primarily on describing activities within each category.
In the discussion section, I would encourage for a stronger critical reflection of the findings, for example, in the discussion, the author could focus the effort in answering the questions below:

- Why was Collaborate the least evidenced category?
- What barriers prevented deeper engagement?
- What are the risks of relying on project-generated documentation?
- How do Horizon Europe reporting requirements shape stakeholder engagement evidence?

Based on the response of the authors to comments from reviewers and also the extensive revision of the manuscript from its original format I could suggest that the paper is now indexable, but it would be stronger if it shifted from describing activities to analyzing patterns emerging from

those activities and resolved the remaining conceptual inconsistency around "progression."

Is the background of the case's history and progression described in sufficient detail?
Yes

Is the work clearly and accurately presented and does it cite the current literature?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
No source data required

Are the conclusions drawn adequately supported by the results?
Yes

Is the case presented with sufficient detail to be useful for teaching or other practitioners?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: I have worked in a number of Horizon funded projects as the leader of co-production activities, stakeholder engangement and multi actor approach designing frameworks.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 26 Sep 2026

Tuula-Maija Löytty

Dear Dr Yiorgos Gadanakis Thank you very much for your thoughtful and constructive review. I particularly appreciate your observation concerning the term **"Progression,"** and I fully agree that it can create a conceptual inconsistency when stakeholder trajectories have not been tracked and sequential movement has not been demonstrated. A more accurate designation would therefore be **"Multi-Actor Stakeholder Engagement Dynamics Framework."** The four engagement modes should be understood as analytical categories rather than sequential stages. Engagement activities may occur independently, overlap, recur, or shift between modes depending on context and purpose. Deeper collaboration may represent a strategic orientation where appropriate, but the framework does not assume a predetermined stakeholder trajectory. In practice, the dynamics are perhaps closer to a *"spaghetti tango"* than a staircase: there is interaction and potentially direction, but not a prescribed linear route. Thank you also for your observations on repetition and on strengthening the synthesis of the Results. With the article now accepted, I feel that the input–output balance has reached an appropriate equilibrium. Although further

improvements would certainly remain possible, I will leave the article here and take these lessons forward into future research.

Best regards

Tuula

Competing Interests: No competing interests were disclosed.

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Franco Silveira
Embrapa Digital Agriculture, Campinas, State of São Paulo, Brazil

Thank you for the careful and substantial revision of the manuscript, as well as for the detailed responses to the reviewers' comments.

The revised version is considerably clearer in its methodological positioning and presents the study much more coherently as a retrospective descriptive case study. I would also like to acknowledge the effort made to clarify the relationship with existing participation frameworks, strengthen methodological transparency, and moderate claims that were not directly supported by the available evidence.

I believe the manuscript has improved substantially. However, there is one remaining point that I suggest considering before finalising the article.

The designation "Multi-Actor Stakeholder Engagement Progression Framework", together with the graphical representation "Inform → Consult → Involve → Collaborate", may still convey the idea of a sequential progression or movement across different levels of engagement. At the same time, the revised version explicitly clarifies that individual stakeholder trajectories were not tracked, that sequential progression was not demonstrated, and that the categories may overlap or occur independently.

Given this revised conceptual positioning, I suggest reconsidering whether the term "Progression" and the use of directional arrows are fully consistent with the empirical evidence and with the analytical purpose of the framework.

A more neutral designation, such as "Multi-Actor Stakeholder Engagement Analytical Framework" or "Multi-Actor Stakeholder Engagement Classification Framework", could more accurately reflect

the retrospective, analytical, and non-sequential nature of the study. Alternatively, the authors could provide a stronger conceptual justification for retaining the term “Progression”.

Overall, I appreciate and acknowledge the substantial improvements made in this revised version of the manuscript.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Digital Agriculture; Agriculture 4.0; Innovation Ecosystems; Agricultural Innovation Systems; Technology Adoption; Agri-food Systems.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 26 Sep 2026

Tuula-Maija Löytty

Dear Dr Franco Sileveira,
Thank you very much for your careful and constructive review, and especially for the way your comments challenged me to think more precisely about what the empirical evidence actually allows us to claim. For me, this review process has also been a genuine learning experience. Looking back at Version 1, one particularly valuable lesson was understanding why calling the original concept a **“MODEL”** was simply too ambitious for the evidence available. Your criticism helped me recognise much more clearly the distinction between a model, a methodology or an analytical framework. In fact, this lesson has stayed with me beyond this manuscript. **Nowadays, whenever I hear someone use the word “model”, I listen very carefully and find myself asking: is it really a model, or is it actually a framework—or perhaps something else?** That is a very concrete piece of learning that I take from this peer-review process. I also fully agree with your final observation concerning the word **“Progression.”** It still suggests a sequential journey from Inform → Consult → Involve → Collaborate, while this is not what the evidence demonstrates. If I were naming the framework now, I would use **“Multi-Actor Stakeholder Engagement Dynamics Framework.”** The four engagement modes are analytical categories rather than sequential stages. Activities may occur independently, overlap, recur, or shift between modes depending on context and purpose. Deeper collaboration may represent a strategic orientation where appropriate, but there is no predetermined stakeholder trajectory. Perhaps in less academic language, what happens in a real multi-actor project is closer to a **“spaghetti tango” than a staircase**: actors and activities meet, separate, reconnect and change direction, while there may nevertheless be some overall direction to the dance. I think *dynamics* captures this reality much better than *progression*. Thank you again, Franco. Your review did more than help improve this manuscript; it also changed the way I think about some of the terminology we use in research. With the article now accepted, I feel that the **input–output balance has reached an appropriate equilibrium**. There will always be something that could still be improved, but at this point I will leave the article here—and take the learning with me.

Best regards

Tuula

Competing Interests: No competing interests were disclosed.

Version 1

Reviewer Report 30 June 2026

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Vida Dabkienė
Lithuanian Centre for Social Sciences, Vilnius, Lithuania

The manuscript addresses a highly relevant topic and presents an interesting attempt to conceptualize stakeholder engagement within a Horizon Europe innovation project. The practical experience gained from the KijaniSpace project clearly represents a valuable foundation for developing such a framework, and the manuscript successfully demonstrates the complexity of stakeholder engagement in AU–EU innovation ecosystems.
At the same time, as this is presented as a methodological paper, I expected a more detailed description of how the proposed method was actually developed and operationalized. The manuscript provides an extensive conceptual discussion and numerous examples of project activities; however, the methodological development itself remains insufficiently transparent. In particular, it would considerably strengthen the paper if the authors described the development process in greater detail. For example, it would be helpful to know how many experts or project partners contributed to the framework, whether the model evolved through several iterations, how the engagement stages were defined and refined, and what criteria were used to classify activities into the proposed categories. Likewise, more information about the workshops, stakeholder consultations, participant profiles, and analytical procedures would allow readers to better understand the methodological logic behind the framework.

Is the rationale for developing the new method (or application) clearly explained
Yes

Is the description of the method technically sound?
Yes

Are sufficient details provided to allow replication of the method development and its use

by others?
Partly

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Application of the Living Lab Methodology for Agricultural Innovation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 10 Jul 2026

Tuula-Maija Löytty

Dear Vida Dabkienė,

First of all, I would like to sincerely thank You for the highly knowledgeable, thoughtful and constructive review. I greatly appreciate the time and expertise devoted to reading the manuscript and providing such clear and valuable comments. I am particularly grateful for the positive assessment of the practical relevance of the work and for recognising the value of the experiences gained during the KijaniSpace Horizon Europe project.
My original intention was to document these practical experiences and to organise them into a structured stakeholder engagement approach that could be useful for similar innovation ecosystems. After carefully considering your comments, I realised that **I positioned the manuscript incorrectly by presenting it as a methodological paper**. This was largely due to my own misunderstanding of the scientific expectations associated with the term *model*. My professional background is primarily in leading and implementing European innovation projects rather than in developing formal scientific methods, and I underestimated the methodological requirements implied by presenting the work as a new model. My intention was never to claim the development of a universally applicable or fully validated stakeholder engagement model. Rather, I sought to describe and synthesise a practical approach that emerged during the implementation of the KijaniSpace project. Looking back, terms such as *approach*, *framework*, or *practice pattern* would have been more appropriate than *model*. Your comments regarding the need for a much more transparent description of the development process, the iterative refinement of the framework, stakeholder participation, analytical procedures and operationalisation are entirely justified. They have helped me recognise that the manuscript, in its current form, does not meet the expectations of a methodological paper.

After reflecting on the reviews, I believe that the manuscript would benefit from a fundamentally different positioning. Rather than attempting to revise it as a Method Article, I believe it would be more appropriate to redevelop it in the future as an exploratory case study describing stakeholder engagement practices and lessons learned from the KijaniSpace project, with the proposed framework presented as an empirical synthesis rather than as a new methodological model. I would like to thank you once again for your constructive and insightful review. Your comments have significantly improved my understanding of how practical innovation outcomes developed within European research and innovation projects should be positioned and communicated in scientific publications, and they will undoubtedly influence my future research writing.

Tuula

Competing Interests: No competing interests were disclosed.

Author Response 22 Jul 2026

Tuula-Maija Löytty

We thank Reviewer 2 for the constructive assessment and for recognising the value of the practical experience generated within KijaniSpace. The reviewer's main concern was that the article was presented as a methodological paper without sufficient transparency concerning how the method was developed and operationalised. We agree that the original framing and evidence were not adequately aligned.

1. Status and development of the framework Comment: The manuscript should provide a clearer description of how the proposed method was developed.

Response: The revised manuscript clarifies that KijaniSpace did not prospectively develop and implement the framework as a project methodology. Communication, mapping, consultations, workshops, co-design and collaboration-oriented activities had been planned in the Grant Agreement as operational tasks. The framework was developed afterwards through retrospective interpretation of the documented activities using concepts from IAP2, Agricultural Innovation Systems, living labs and multi-actor research. This chronology is now stated explicitly in the Introduction, KijaniSpace context, analytical framework and methods. The manuscript therefore no longer claims that the framework guided implementation or was tested as a predefined method.

2. Expert involvement and iterative refinement Comment: The manuscript should state how many experts or partners developed the model and whether it evolved through several iterations.

Response: Because the framework was not created through a formal expert-consensus or iterative method-development process, the revised article does not imply that such a process occurred. It identifies the author's retrospective documentary analysis and explains the theoretical sources and classification logic used. We considered it more transparent to state the actual analytical process than to reconstruct a methodological development history that was not documented. The absence of formal multi-expert development and independent validation is reflected in the limitations and in the decision to present the framework as interpretive rather than validated.

3. Definition and classification of engagement categories Comment: The criteria used to

define, refine and assign activities to the categories should be explained.
Response: Section 5.3 now gives the classification procedure in detail. Each discrete activity was extracted into a coding table recording its primary objective, interaction format, intended stakeholder role, location and documentary source. Activities were classified according to the definitions in Table 1. Where an activity displayed characteristics of more than one category, the original documentary description was reviewed and the activity was assigned according to its dominant purpose. The revised framework also clarifies that categories classify activities rather than participants and are not mutually exclusive or mandatory sequential stages.
4. Documentary sources and analytical corpus Comment: More detail was needed about the material used to derive the analysis.
Response: The revised methods identify the principal corpus as:

- the detailed KijaniSpace multi-actor stakeholder mapping dataset;
- aggregated stakeholder mapping summaries;
- D2.1, covering needs assessment, interviews, mapping and the proposed Multi-Stakeholder Platform;
- D2.2, covering ideation and co-design workshops;
- D6.2, covering communication, dissemination and stakeholder-engagement activities during the first reporting period.

The broader project documentation, Grant Agreement, periodic reports and public communication materials are described in Section 5.2 as contextual and supporting sources. **5. Workshops, consultations and participant profiles Comment:** Additional information was requested concerning workshops, stakeholder consultations and participant profiles. **Response:** The revised Results provide representative activities, geographical scope, documented participation or reach, stakeholder groups and source documents. Examples include interview participants, webinar registrations, workshop registrations, communication reach and collaboration-oriented activities. The manuscript distinguishes between mapped stakeholders, event registrations, actual consultation participants and public communication reach. It also states that these figures are not directly comparable and do not measure engagement quality or individual progression.
6. Reproducibility Comment: Greater methodological transparency was required to allow replication.
Response: The revised manuscript provides a reproducible logic for applying the analytical framework to another documentary corpus: identify discrete engagement activities, record their objectives, interaction formats and stakeholder roles, and classify them according to Table 1 using dominant purpose where categories overlap. At the same time, the manuscript now accurately limits the reproducibility claim. The source documentation was produced for project management and reporting rather than as a predesigned research dataset, and some identifiable stakeholder information cannot be released. The study is therefore reproducible at the level of analytical procedure and public documentary evidence, but not as a fully open participant-level dataset.
7. Support for conclusions Comment: The conclusions concerning the performance of the method were only partly supported.
Response: The conclusions have been rewritten so that they no longer make performance claims. The revised article concludes only that the four-category framework provides a coherent way to organise heterogeneous documented activities. It does not conclude that

the framework improved engagement or produced trust, ownership, sustainability or exploitation readiness. The manuscript now explicitly identifies longitudinal tracking, interviews, surveys, independent stakeholder feedback and comparative application across projects as necessary for evaluating such outcomes.

Competing Interests: No competing interests were disclosed.

Reviewer Report 29 June 2026

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Franco Silveira
Embrapa Digital Agriculture, Campinas, State of São Paulo, Brazil

The manuscript addresses a highly relevant topic, particularly in the context of digital agriculture, innovation ecosystems, climate-smart agriculture, and AU/EU collaboration initiatives. The article is well written, logically structured, and provides valuable practical insights from the KijaniSpace project.

However, while the practical relevance of the work is evident, several aspects require further clarification and strengthening before the proposed framework can be considered a robust methodological contribution.

Major Comments:

Originality of the framework - The manuscript presents the multi-actor stakeholder engagement progression model as a novel methodological contribution. However, the proposed framework closely resembles existing stakeholder participation models, particularly the IAP2 spectrum of public participation and related participatory governance frameworks. The authors should more clearly articulate: what is genuinely novel in the proposed model, how it differs conceptually and operationally from existing participation frameworks, and why a new framework is needed instead of adapting existing approaches. At present, the distinction from prior models remains insufficiently demonstrated.

Concepts - The manuscript frequently combines the concepts of Digital Agriculture and Climate-Smart Agriculture, often treating them as complementary or closely intertwined approaches. However, these concepts have distinct theoretical origins, objectives, and scopes. Although there is an important overlap between them, the manuscript does not clearly explain how these approaches are related within the proposed framework. In some sections, digital agriculture appears to be presented as a tool supporting climate-smart agriculture, while in others the concepts appear to be used almost interchangeably.

I recommend that the authors provide a clearer conceptual discussion, preferably in the Introduction or Background section, addressing:

- What is meant by Digital Agriculture;
- What is meant by Climate-Smart Agriculture;
- How these concepts interact within the KijaniSpace project;
- The specific role of Space–IoT technologies in connecting these two approaches.

A stronger conceptual foundation would improve the theoretical coherence of the manuscript and reduce potential ambiguity for readers.

Limited empirical validation - The manuscript primarily relies on descriptive evidence derived from project activities, stakeholder interactions, workshops, consultations, and communication efforts. Although these examples illustrate framework implementation, they do not constitute strong validation of the framework itself. The manuscript would benefit from: explicit evaluation criteria, indicators measuring stakeholder progression, and evidence demonstrating improved outcomes compared to alternative engagement approaches. Currently, many conclusions remain largely inferential.

Reproducibility and transparency - The article references project deliverables (e.g., D2.1, D2.2, D6.2) as major sources of evidence. However, sufficient methodological details are not always provided within the manuscript itself. The authors should provide additional information regarding stakeholder sampling procedures, number and profiles of participants, workshop methodologies, data collection procedures, and analytical methods used to derive conclusions. This would improve reproducibility and methodological transparency.

Observations on clarity, precision, and conceptual consistency - Several statements throughout the manuscript are overly broad and generic, reducing the scientific rigor of the arguments presented.

For example, the Introduction states: *"This is particularly important in innovation ecosystems that combine emerging digital technologies, environmental monitoring and local development objectives across diverse institutional and socio-economic contexts".* However, it remains unclear which institutional and socio-economic contexts are being discussed. Does this refer specifically to East Africa, the Lake Victoria Basin, low-income countries, or agricultural systems more broadly? Greater contextualization is needed.

Similar issues can be observed in several other statements, including:

"Stakeholder engagement is increasingly recognised as a critical component of innovation governance..." — Recognized by whom?

"Recent research and innovation programmes increasingly recognise..." — Which programmes? European, African, or international?

"The findings suggest that progressively deepening stakeholder engagement can strengthen collaborative ownership..." — What empirical evidence supports this claim?

"The framework may have broader applicability beyond the specific Lake Victoria Basin context" — Which contexts specifically?

Additionally, concepts such as *trust-building*, *ownership*, *ecosystem continuity*, *adaptive governance*, and *sustainability* are frequently used without clear operational definitions or measurable indicators. The manuscript would benefit from more precise, contextualized, and evidence-based language throughout.

Conclusions - Several conclusions suggest that the framework strengthened trust, ownership, sustainability, adaptive governance, and exploitation readiness. While these claims are plausible, the manuscript currently provides limited empirical evidence demonstrating these outcomes. The authors should either provide stronger supporting evidence or moderate the language used in the results and conclusions sections to better reflect the descriptive nature of the study.

Minor Comments:

Figure 1 provides a useful visual summary of the framework but remains relatively simplistic for a methodological paper. The inclusion of additional theoretical constructs, causal mechanisms, or relationships between framework components would strengthen the contribution.

A comparative table contrasting the proposed framework with existing stakeholder engagement frameworks would help clarify its unique contribution.

The limitations section could more explicitly discuss potential biases associated with self-assessment within an ongoing Horizon Europe project.

The manuscript would benefit from a dedicated discussion of the indicators used to assess stakeholder progression across engagement levels.

- The manuscript addresses an important and timely topic and presents valuable practical experiences from a large international innovation project. However, its scientific contribution would be significantly strengthened through a clearer demonstration of originality, stronger empirical validation, greater methodological transparency, and a more cautious interpretation of the results. Therefore, I recommend publication only after substantial revisions addressing the concerns outlined above.

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Is the rationale for developing the new method (or application) clearly explained
Partly

Is the description of the method technically sound?
Yes

Are sufficient details provided to allow replication of the method development and its use by others?
Partly

If any results are presented, are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions about the method and its performance adequately supported by the findings presented in the article?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Digital Agriculture; Agriculture 4.0; Innovation Ecosystems; Agricultural Innovation Systems; Technology Adoption; Agri-food Systems.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 10 Jul 2026

Tuula-Maija Löytty

Dear Franco Silveira

First of all, I would like to sincerely thank You for the exceptionally knowledgeable, thoughtful and constructive review. I greatly appreciate the time and expertise invested in reading the manuscript and providing such detailed comments and relevant literature recommendations. After carefully reading the review, I realised that the main weakness of my manuscript is not the practical work itself, but the way I positioned its scientific contribution. **This was largely due to my own misunderstanding of the scientific implications of presenting the work as a model.**

My professional background is primarily in leading and implementing European innovation projects rather than in developing formal scientific methods. Consequently, I underestimated the methodological expectations associated with the term *model* in the scientific literature.
My original intention was not to propose a universally valid stakeholder engagement model. Rather, I wanted to document and structure a stakeholder engagement approach that proved useful during the implementation of the KijaniSpace project. In retrospect, terms such as *approach*, *framework*, or even *practice pattern* would probably describe the contribution more accurately than *model*. The review has been extremely valuable because it has helped me better understand the distinction between practical innovation solutions developed within Horizon Europe projects and scientifically validated methodological models. I fully acknowledge the reviewer's comments regarding originality, validation, methodological transparency and the need for stronger theoretical positioning. After reflecting on the review, I have concluded that the manuscript would benefit from a fundamentally different positioning. Rather than attempting to revise it as a methodological paper, I believe it would be more appropriate to redevelop it in the future as an exploratory case study describing the stakeholder engagement practices and lessons learned from the KijaniSpace project, with the proposed framework presented as an empirical synthesis rather than as a new methodological model. I would once again like to express my sincere gratitude for the reviewer's exceptionally constructive comments. Regardless of the future of this particular manuscript, the review has provided me with valuable insights that will significantly improve both my future scientific writing and the way I position practical innovation outcomes arising from European research and innovation projects.

Tuula

Competing Interests: No competing interests were disclosed.

Author Response 22 Jul 2026

Tuula-Maija Löytty

We thank Reviewer 1 for the detailed assessment and for recognising the relevance of the topic and the practical value of the KijaniSpace case. The comments identified important weaknesses in the original manuscript, particularly its claims of methodological novelty and validation. We have addressed these concerns through a substantial reframing and restructuring of the article.
1. Originality of the framework Comment: The proposed framework closely resembles existing participation frameworks, particularly the IAP2 Spectrum, and its originality and need were insufficiently demonstrated.
Response: We agree that the original manuscript overstated the novelty of the framework. The revised article no longer presents it as a new or validated stakeholder engagement methodology. It is now described as a retrospective analytical framework that organises documented KijaniSpace activities using concepts derived from IAP2, Agricultural Innovation Systems, living lab research and multi-actor innovation literature. The revised Chapter 4 explicitly identifies IAP2 as an important conceptual starting point and explains that the categories Inform, Consult, Involve and Collaborate were adapted for retrospective

classification. It also explains why Empower was not included: the documentation did not demonstrate transfer of final decision-making authority to external stakeholders. The contribution is therefore no longer claimed to be the invention of new participation stages. It is the retrospective organisation of heterogeneous activities implemented across a Horizon Europe multi-actor project into a coherent analytical structure.

2. Digital Agriculture and Climate-Smart Agriculture Comment: Digital Agriculture and Climate-Smart Agriculture were used ambiguously or interchangeably, and the role of Space–IoT technologies was unclear.

Response: We have added separate definitions in the Background section. Digital Agriculture is defined as the use of technologies such as Earth Observation, IoT, sensors, artificial intelligence and digital advisory services to support agricultural decision-making and resource management. Climate-Smart Agriculture is described as an approach seeking to improve productivity, strengthen climate resilience and, where appropriate, reduce environmental impacts. The revised manuscript explains that Space–IoT technologies are enabling technologies within KijaniSpace: they provide data and digital services that may support climate-smart agricultural and aquaculture decision-making. The concepts are therefore related but not treated as synonymous.

3. Limited empirical validation Comment: Project activities and examples do not constitute validation of the framework, and no comparison with alternative approaches or outcome indicators was provided.

Response: We agree. The revised article no longer claims to validate the framework or demonstrate its effectiveness. It is explicitly presented as a retrospective descriptive case study and an interpretive classification exercise. The abstract, methods, results, discussion and conclusions now state that the study does not establish causal relationships between engagement activities and trust, ownership, adoption, institutional embedding, exploitation readiness or long-term sustainability. These outcomes were not measured and are identified as subjects for future longitudinal and participant-based research.

4. Reproducibility and methodological transparency Comment: More information was needed on sampling, participants, workshops, data collection and analytical procedures.

Response: The Materials and methods section has been substantially expanded. It now identifies:

- the retrospective descriptive case-study design;
- documented stakeholder engagement activities as the unit of analysis;
- the documentary corpus, including the detailed stakeholder mapping dataset, aggregated summaries, D2.1, D2.2 and D6.2;
- the types of information extracted into the coding table: activity, primary objective, interaction format, intended stakeholder role, location and documentary source;
- the criteria used to classify activities;
- the use of dominant purpose when an activity displayed characteristics of more than one category.

The Results also provide participant or reach information where it is documented and distinguish website reach, registrations, interview participants and mapped stakeholders rather than treating them as comparable measures of engagement quality. Because identifiable stakeholder data contain names, affiliations and contact information, they cannot be publicly released. The Data availability statement now explains that aggregated distributions and public project evidence are available, while access to non-public materials

is subject to data-protection requirements, consent and consortium approval.
5. Clarity, precision and contextualisation Comment: Several statements were overly broad, insufficiently sourced or unclear about their geographical and institutional context.
Response: The manuscript has been revised throughout to specify the Horizon Europe, AU–EU and Lake Victoria Basin contexts. Chapter 3 now identifies the participating countries, project objectives, regional context, KijaniBox concept and planned stakeholder activities, supported by project, FAO, IPCC and Lake Victoria Basin sources. Generic statements have been removed, qualified or supported with references. The revised paper also avoids implying that findings from one project automatically apply to all digital agriculture or multi-actor projects.
6. Trust, ownership, adaptive governance and sustainability Comment: These concepts were not operationally defined or measured, but the manuscript presented them as outcomes. **Response:** We agree. Claims that KijaniSpace "strengthened," "generated" or "demonstrated" trust, ownership, exploitation readiness or sustainability have been removed. The revised manuscript states that the documentation records communication, consultation, co-design and collaboration-oriented activities, but does not establish their longer-term relational or institutional effects. Where these concepts remain in the Discussion, they are presented as possible implications from the literature or as future research questions, not as empirical findings.
7. Figure 1 Comment: Figure 1 was too simplistic for a methodological contribution.
Response: Following the reframing of the article, Figure 1 is no longer presented as a validated methodological or causal model. It now serves as a visual summary of the four analytical categories and their possible relationships. The caption and surrounding text explicitly state that the arrows do not represent mandatory progression and that the horizontal dimension is conceptual rather than measured.
8. Comparison with existing frameworks Comment: A comparative table with existing stakeholder engagement frameworks would clarify the contribution.
Response: We have strengthened the direct comparison with IAP2 in the text, including the origin of the four categories, their analytical adaptation and the exclusion of Empower. Because the revised paper no longer claims superiority or replacement of existing frameworks, we did not add a comparative performance table. Instead, the manuscript positions the framework as an application-oriented synthesis for interpreting KijaniSpace documentation.
9. Indicators of stakeholder progression Comment: The manuscript should specify indicators used to assess progression.
Response: The revised manuscript does not claim to assess individual stakeholder progression. It explicitly states that the documentation did not track participant trajectories sufficiently to demonstrate movement between categories. The term progression refers only to conceptually different opportunities for interaction and contribution. Communication reach, interview participation, workshop registrations and collaboration-oriented activities are reported as descriptive evidence, not as a formal progression scale. Developing and validating participant-level indicators is proposed as future research.
10. Self-assessment bias Comment: The limitations should address bias arising from project self-assessment.
Response: The limitations now acknowledge that the analysis is based on documents generated through project planning, implementation and reporting rather than independent research data. The paper recognises the possible influence of selective

documentation, researcher involvement and the absence of independently collected stakeholder evaluations. These limitations are also reflected in the cautious interpretation of the findings.

Competing Interests: No competing interests were disclosed.