Measurement Indicators for Social Appropriation of Knowledge in Colombia: Moving Beyond Product-Based Evaluation toward Relational Science–Society Engagement

Yaddy Paola Nino Sandoval[1]
[1]Universidad de La Sabana, Campus del Puente del Común, Km. 7, Autopista Norte de Bogotá, Chía, Cundinamarca, Colombia
Corresponding Author: pitanino2802@gmail.com/yaddynisa@unisabana.edu.co

Abstract

Social Appropriation of Knowledge (SAK) has become a central idea in Colombian science policy, which focuses on participatory, dialogical, and co-production processes between scientific and non-scientific actors. Although it is becoming increasingly important, the assessment of SAK is still largely based on traditional metrics of output, like publications, citations, and dissemination, which do not sufficiently reflect the relational and societal aspects of science–society engagement. The study proposes a conceptual framework and a set of measuring indicators for SAK in Colombia by integrating Science and Technology Studies (STS), Colombian science policy (Minciencias, 2021), the Theory of Planned Behaviour (TPB), and the Ambassador Program Engagement model. A qualitative documentary analysis of policy and theoretical literature was conducted to identify recurring constructs shaping SAK. The findings indicate that SAK is seen as a relational and process-oriented concept that involves behavioural intention, institutional enabling, and community engagement during the research cycle. These dimensions are operationalised using a staged approach that includes three main stages, namely pre-research, implementation, and post-research. The analysis informed the creation of a structured indicator framework evaluating behavioural, institutional, and relational aspects of SAK. The study contributes to the development of the Public Understanding of Science scholarship by providing an alternative to the traditional product-based research assessment systems and by advancing a process-oriented approach to assessing science–society relations.

Keywords: Social Appropriation of Knowledge; Public Understanding of Science; Science Communication; Theory of Planned Behaviour; Science Governance; Knowledge Co-production.

1. Introduction

Scientific activities have increasingly come to be understood as social practices embedded within cultural, political, and economic fields (Audretsch et al., 2025). Over time, perspectives on science have shifted from viewing it as an autonomous domain of expert knowledge to perceiving its continuous interaction with society (MATLOVIČ & MATLOVIČOVÁ, 2025). In this way, science is not just created in academic institutions but also shapes and influences people's and communities' daily lives. This changing view has strengthened the idea that science is neither the domain of scientists nor of a particular institution, but an integral part of human life and decision-making. The continued development and incorporation of digital technologies and artificial intelligence in science and social systems also highlights the shifting dynamics between the production of knowledge and society. Emerging computational approaches, such as the use of artificial intelligence analysis systems, show how scientific knowledge production, processing, and application takes place via technological settings, thus creating new challenges for accessibility, interpretation, and social appropriation (Mosleh et al., 2025).

Within this broader transformation, Science and Technology Studies (STS) has been central in redefining the relationship between science and society (MATLOVIČ & MATLOVIČOVÁ, 2025). The STS literature

emphasizes that scientific knowledge is constructively structured and culturally situated, emerging through interactions between scientists, institutions, and broader publics. Within this broader transformation, Science and Technology Studies (STS) has been particularly instrumental in reshaping the nature of the relationship between science and society. Biasiori (2023) argues that the understanding of science must be placed in the particular socio-cultural context in which scientific knowledge is generated and interpreted (Biasiori et al., 2023). Likewise, Perez-Alvaro & Boswell (2025) emphasize that science is not an isolated and separate entity from social life; it functions as one of many cultural activities within society (Perez-Alvaro & Boswell, 2025). In this view, scientific knowledge is not just conveyed from the experts to non-experts but is constantly negotiated and re-interpreted in social settings.

This reconceptualization has become more prevalent with the rise of public engagement and participatory approaches to science communication. In contrast to deficit-based models, where the lack of public engagement is attributed to a lack of knowledge, current approaches focus on dialogue, engagement, and co-production of knowledge. According to Iordanou et al. (2026), enhancing the relationship between science and society needs effective communication of the scientific research, the transparency of the whole research process, and an appreciation of the beliefs and values of the non-specialist receivers of scientific knowledge (Iordanou et al., 2026).

In Latin America, and particularly in Colombia, these global shifts have been translated into policy and institutional processes that advance a more democratic relationship between scientific and social actors. In this connection, Parthasarathy (2025) stresses the importance of taking into account the requirements of society at various stages of the research process (Parthasarathy, 2025). This view acknowledges that knowledge should not be limited to academic products but should contribute to addressing real-world problems and enhancing social well-being. In addition, Vallejo Sierra and Pirela Morillo (2025) stress the importance of promoting research in Colombia that would increase the involvement and cooperation between science and society (Vallejo Sierra & Pirela Morillo, 2025).

In this context, the concept of Social Appropriation of Knowledge (SAK) has emerged as a key framework for the Colombian science policy (Arias et al., 2025). SAK refers to processes that involve the dissemination of scientific knowledge, but also the active use, reinterpretation, and assimilation of scientific knowledge by society (Sohad & Mafrolla, 2025). It emphasizes dialogue, interaction, and co-construction, including community, research, institutional, and policy actors. According to Arias et al. (2025), SAK involves making scientific knowledge accessible in a way that enables its practical use, while Kuchtová (2024) argues that appropriation means "making something one's own," thereby giving a more active role to publics in knowledge production (Arias et al., 2025; Kuchtová, 2024). In this sense, SAK is more than just a dissemination model; it places society as an active producer of knowledge and transformation.

Despite its conceptual and policy relevance, current SAK evaluation systems have a limited measurement capacity. Most existing frameworks continue to be very materialistic and scientific, technological, and innovative (STI) based, with the majority of indicators about publications, citations, patents, and outreach or dissemination activities. While these metrics reflect academic production, they do not adequately measure the relational and interactive aspects of science–society interactions, the process of knowledge transformation and reinterpretation in communities, or the motivational and behavioral aspects of researchers' interactions with the public. Furthermore, the existing systems mostly fail to identify the inter-layered nature of analysis and mostly regard SAK as an institutional output, but not a process involving individual, institutional, and societal level analysis. This results in a clear disconnect between SAK's policy vision of co-production and its current evaluation practice, which is mostly output-based and separate. Contemperory cases in environmental studies demonstrate the importance of connecting scientific evidence with societal decision-making. Integrated strategies, which include environmental monitoring, technology assessment, and socio-economic studies, reveal how science needs to go beyond mere scientific production into societal applications (Anwar et al., 2026).

This gap between policy aspirations and evaluation practices underscores the need for the development of new frameworks that can encompass the relational, participatory, and transformative aspects of knowledge appropriation. In turn, this study suggests a set of Measurement Indicators of Social Appropriation of Knowledge in Colombia. They are built on the combination of four complementary approaches: (i) conceptual definition of interaction between science and society as SAK based on literature in the field of STS and science communication, (ii) policy frameworks established by the Colombian Ministry of Science, Technology and Innovation (Minciencias), (iii) the Theory of Planned Behavior as a tool to analyze researchers' intentions to public engagement, and (iv) the model of engagement of the Ambassador Program as a practical framework for relational science-society interaction.

By combining these perspectives, the study aims to contribute to the current debates in science communication and the public understanding of science by changing the focus from output-based evaluation toward a process-oriented understanding of knowledge appropriation. In doing so, it seeks to provide a more comprehensive framework that assesses how scientific knowledge is transformed, shared, and co-produced within society.

2. Literature Review

2.1 Social Appropriation of Knowledge

The concept and policy framework of Social Appropriation of Knowledge (SAK) is important in Latin America for the comprehension of how scientific knowledge is reinterpreted, circulated, and incorporated into society (Boulton, 2022; Bucchi & Trench, 2016). Rather than viewing knowledge as being simply transferred from the academic environment to end users, it emphasizes the transformation of knowledge through social interaction, where scientific knowledge is gained through dialogue, co-production, and contextual adaptation. In this way, SAK reflects a shift away from the idea of science as a closed system of knowledge production towards a dynamic process in which knowledge is co-produced and co-shaped by society to solve social issues, supporting decision-making and creating public value (Yang, 2026).

Marín Agudelo (2012) emphasizes the importance of using clear and accessible language when communicating with society, so that it can be used by people and communities for their benefit. This emphasises functionality and accessibility as key aspects of appropriation (Marín Agudelo, 2012a). Similarly, the Colombian science policy (Minciencias, 2021) encourages SAK as a democratic approach that enables people to get involved in the discussion of scientific knowledge through various types of participation. This perspective is supported by Maldonado-Castañeda (2026), who supports the importance of empowering communities with the ability to make the right decisions about their rights and duties (Maldonado-Castañeda, 2026). Similarly, BENSAUDE VINCENT & BERGERON (2025) maintain that the involvement of people from the public in research improves their perception of their rights and their ability to participate actively in decision-making (BENSAUDE-VINCENT & BERGERON, 2025). However, Agyare (2025) also conceptualizes appropriation in a democratic framework where citizens engage in scientific debates and decision-making that impact their lives (Agyare, 2025).

In Colombia, SAK is institutionalized by the Policy frameworks created by the Ministry of Science, Technology, and Innovation (Minciencias) (Niño-Sandoval et al., 2023). According to the 2020 Policy, Science, Technology, and Innovation (STI) is a process that facilitates dialogue and exchange of knowledge, skills, and experiences for the production of social well-being (Olaopa, 2025). STI is different from the 2010 strategy that was oriented towards technoscience-society relations from an "interventionist" position. In the new version, participation, inclusion, and trust are key elements, and citizens are regarded as active knowledge agents.

Despite these conceptual developments, there is still insufficient evaluation of social impact. Previous systems have been strongly oriented towards bibliometric aspects, while relational and transformative

aspects of knowledge appropriation have remained underdeveloped (Silva-Flores et al., 2025). This tension between policy discourse and evaluation practice constitutes one of the main problems in the construction of SAK indicators, which necessitates the need for an integrated framework that encompasses both process and outcome aspects of appropriation.

2.2 Public Engagement and Science Communication

The linear models of the dissemination of public engagement and science communication are being replaced by dialogical and participatory ones, moving from deficit-based models toward participatory and co-productive approaches (Henke, 2025), although traditional deficit-based approaches continue to persist in practice (Simis et al., 2016). In contrast, STS and science communication literature reveal that science responses in the public domain are contextually and value-laden and affected by trust and lived experience. Mikami et al. (2026) highlight that Science, Technology, and Society (STS) research has tended to center on science/society relations, specifically the growing trend since the 1980s to view science as socially constructed (Mikami et al., 2026). In addition, Fernández et al. (2025) argue that science is a cultural activity that is influenced by political, social, and economic contexts (Fernández, 2025). Thus, science must encourage critical thinking amongst the common populace, enabling them to make their own decisions regarding topics relevant to their lives, such as health care, environmental and technological concerns, while recognizing that knowledge is an intricate product constructed through multiple ways of perspectives, expertise, and lived experiences. The increased application of AI in educational and social settings also emphasizes the need for making the communication of scientific information accessible and inclusive. AI-enabled tools used for identifying problems in learning processes reveal how new technologies can contribute to support social needs while also raising concerns about transparency, interpretation, and accessibility (Qusef et al., 2025).

In Colombia, these ideas have shaped science policy and education for more than 20 years, and their impact is still notable today through the promotion of democratic science models that prioritize the concepts of inclusion and diversity (Pinedo-López et al., 2025). Despite these advances, public engagement often remains limited to outreach activities rather than co-construction. This gap reveals the necessity for tools that can consider engagement as a relational and transformative activity, not one-way dissemination. According to Rubio-Vargas et al. (2026), further efforts still need to be made to increase the conceptual and practical understanding of Social Appropriation of Knowledge (SAK) to achieve the creation of a social context where science plays its role in improving the quality of human life (Rubio-Vargas et al., 2026) In addition, they highlight the importance of transcending the myth that the mere process of scientific dissemination is enough for knowledge appropriation, but rather that true knowledge appropriation involves dialogue and knowledge co-production by scientists and society together.

2.3 Theory of Planned Behavior

The intention-behaviour connection is explained using the Theory of Planned Behavior (TPB). TPB has been extensively applied in the study of scientists' willingness to communicate with non-specialist audiences in science communication. Recent application of behavioural theory frameworks in technology adoption shows that attitudes, perceived behavioural control, and organizational support significantly affect professionals' willingness to adopt innovation. Such findings reinforce the relevance of TPB for analysing researchers' engagement intentions within evolving knowledge settings (Abu-Farha et al., 2026). In addition, Rizki & Maulana (2026) argue that TPB uses three determinants to describe the behavioral intention: attitude toward the behavior, subjective norm, and perceived behavioral control (Rizki & Maulana, 2026). But Voicu (2025) found that positive attitudes towards public engagement and supportive institutional contexts are positively associated with scientists' likelihood of public engagement (Voicu, 2025). However, structural barriers continue to limit engagement. While institutions encourage outgoing activities, academic incentives still focus on getting published in top journals, which limits the incentive for engagement activities.

In the context of Public Engagement, communication is now recognised to be a process of co-construction, not dissemination, in which both scientists and publics contribute knowledge (Potochnik & Jacquart, 2025). From this point of view, TPB can be further expanded beyond explaining intention to inform the development of indicators for SAK evaluation. The primary construct in the Theory of Planned Behavior (TPB) is the behavioral intention, which is influenced by three basic constructs: attitude towards the behavior, subjective norms, and perceived behavioral control (Conner, 2020). According to the theory, the higher level of behavioral intention and perceived behavioral control a person has, the higher probability of performing the intended behavior they possess (Savari & Khaleghi, 2023) With regard to science communication, Yuan et al. (2019) emphasize that research organizations and scientists themselves become interested in understanding ways of overcoming the unidirectionality of communication and moving towards reciprocal communication (Yuan et al., 2019). One proposed option is improving the scientists' communication competencies since scientists believe themselves to be incompetent regarding communication with the public (Poliakoff & Webb, 2007). This perspective is consistent with the Public Engagement (PE) approach, which aims to explore scientists' attitudes to interaction with society while understanding that it is a joint process. Under this view, knowledge is co-produced in the interaction between the scientists and the public, with both groups contributing valuable knowledge, experience, and perspectives to address societal challenges (Garlick et al., 2025).

In addition, the Theory of Planned Behavior (TPB) is an important theoretical approach that can be used to analyze the factors that influence researchers' willingness to engage in communication with non-specialist audiences (Alkasasbeh et al., 2025). Moreover, it can help in realizing the need for extending science communication beyond academic communities to reach broader sectors of society. Notwithstanding that potential, the use of TPB in the indicator frameworks of the SAKs is not yet extensive, representing a key methodological gap in current evaluation approaches.

2.4 Ambassador Program Engagement

The Ambassador Program Engagement model offers a structured way of developing direct interaction between scientists and the non-specialist public (Figure 1). According to Nadkarni et al. (2019), this model was developed to foster meaningful interactions between scientists and people from the general population who have no connection to science at all, thereby promoting broader public participation in scientific activities. (Nadkarni et al., 2019).

The model consists of five steps: connection, immersion, design, engagement, and reflection. The stages help scientists create meaningful interactions based on context, values, and co-designed activities. Therefore, engagement is considered a two-way communication process instead of a one-way process.

Figure 1: Ambassador Program Engagement

The National Science Foundation (NSF) sponsored STEM Ambassador Program (STEMAP) puts this model into practice by training scientists as direct links between research institutions and the public (Johnson et al., 2022). The STEM ambassadors combine research with real-life experience to reach communities in non-traditional venues, expanding the reach of science beyond academic institutions.

The relevance of this model in the Colombian SAK context lies in its explicit focus on relational engagement, contextual adaptation, and iterative reflection aspects, all of which are emphasized in the Colombian SAK model as co-production and appropriation instead of dissemination. It offers a systematic process that captures the trajectory of engagement over time, is valuable for developing process-based indicators of SAK, and is different from conventional outreach models. In environmental and urban studies, technologies like geospatial analyses show how scientific information can be used for societal benefit by translating it into socially valuable knowledge products (Hussain, Hamidova, et al., 2026). Particularly, five dimensions can be measured: (i) connectivity with communities, (ii) depth of immersion in local contexts, (iii) degree of co-design in knowledge activities, (iv) intensity and inclusiveness of engagement practices, and (v) reflective learning outcomes for both scientists and the public. The Ambassador Program has proved the effectiveness of these activities for engaging various groups with science. The execution of the Ambassador Program entails dedication on the part of scientists towards understanding the needs of their communities, thereby fostering meaningful and sustained communication. Understanding the connection and immersion into the local context, combined with the design of participatory activities that will stimulate the participation of the community, is fundamental to facilitate an open dialogue between scientists and the community. However, while the model does offer a solid operational foundation for relational science communication, it does not provide common metrics to measure the quality of engagement within different contexts.

2.5 Conceptual Framework

The literature reviewed demonstrates converging views towards understanding science as socially embedded and participative, and a co-produced process. However, it also indicates a disintegration in the theoretical perspectives and evaluation instruments. Social Appropriation of Knowledge (SAK) offers an operational framework for the concept of knowledge appropriation as a social target oriented toward participation, access, and transformation (Arias et al., 2025). Both STS and public engagement

theories conceptualize science as a socially produced and culturally embedded entity. The Ambassador Framework provides a relational and procedural approach to engagement practice (Hatchimonji et al., 2026), whereas the Theory of Planned Behavior offers a theoretical foundation for explaining behavioral intention at the individual level. Although these theories share conceptual similarities, they are distinct from each other operationally.

To overcome this, this study is based on a conceptual framework that presents an integrated approach to systematically connect these four perspectives and establish a set of indicators. Each of the frameworks provides a unique analytical dimension of the measurement of Social Appropriation of Knowledge. Firstly, SAK outlines the institutional and normative framework that sets appropriation as a policy objective based on social participation, accessibility to knowledge, and societal impact (Figure 2). Second, STS offers the epistemological basis (theoretical underpinning) that takes the socially constructed and context-dependent nature of knowledge as given, thereby supporting the use of relational and contextual indicators. Third, TPB operationalizes the individual level of analysis by converting researchers' attitudes, subjective norms, and PBC into measurable constructs of engagement intention and capability. Fourth, the Ambassador model sets out a relational and procedural level, providing a structure of steps (connection, immersion, design, engagement, reflection).

The framework is based on the STS understanding of co-production and aligns these four dimensions to create a multi-level indicator system: (i) institutional level (SAK policy goals), (ii) individual level (behavioural indicators based on TPB), and (iii) relational/process level (Ambassador Engagement stages). This integration provides the possibility to create indicators that are more than output-centric and output-independent, moving towards an assessment of science–society interaction dynamically, not just on output but also on intentions, processes, and contextual transformation. Through this, the framework directly tackles some of the limitations of existing evaluation systems, which remain heavily focused on bibliometric indicators and unable to adequately measure relational and transformative aspects of science. These conventional evaluation approaches have been questioned, as they are insufficient for evaluating their broader impacts on society and assessing the diversity of research outputs (Hicks et al., 2015; Moed, 2017; González & Torres, 2025). The model proposed in this paper integrates behavioral, relational, epistemological, and institutional aspects, thus allowing for a comprehensive and structured approach, in which the Social Appropriation of Knowledge is defined as a multi-actor, multi-level, and co-productive process.

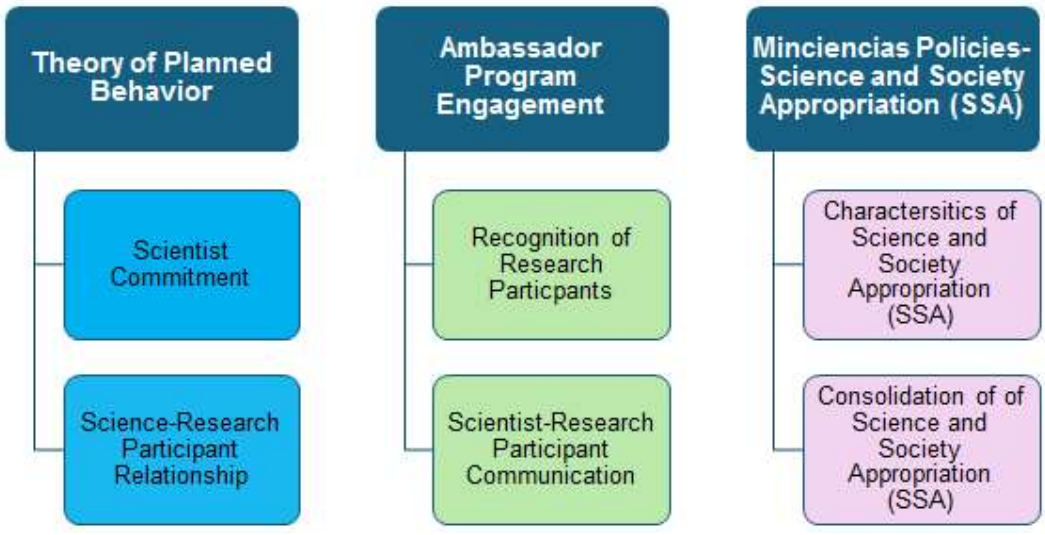

Figure 2: Conceptual Framework

3. Methodology

3.1 Research Design

The study uses a qualitative approach that is documentary analysis with explicit stages. Document identification was performed by systematic searches in peer-reviewed databases, institutional repositories, and Colombian policy sources, including the policy documents of the Ministry for Science, Technology, and Innovation (Minciencias), the STS literature, and the policy documents of the SAK. Second, document selection followed predefined inclusion criteria, which were defined as relevance to science–society relations, explicit reference to SAK or related constructs, appropriate publication period, and institutional credibility. Third, an initial set of 42 documents was screened for relevance. Out of this set, 36 documents were selected that fully satisfied the inclusion criteria and significantly contributed to the analysis. Finally, important concepts, theoretical assumptions, and policy mechanisms were distilled from these documents.

Thematic coding was used in a coding process to identify and categorize recurring ideas in analytical categories like engagement, co-production, participation, and policy instruments. Finally, synthesis involved integrating coded themes into higher-order constructs to create a measurable set of indicators and a coherent conceptual framework for Social Appropriation of Knowledge.

3.2 Data Sources and Analytical Materials

A total of 42 documents were considered as potentially relevant for this study, while 36 documents were finally selected due to their relevance towards social appropriation of knowledge, science-society interface, and knowledge co-production. They were retrieved from three primary sources: (i) peer-reviewed academic databases (Scopus, Web of Science and Google Scholar); (ii) official institutional repositories of science and innovation policy institutions in Colombia, such as the Ministry of Science and Technology (Minciencias); and (iii) important international organizations related to science–society and public engagement discourse (e.g., OECD and UNESCO reports). The inclusion and exclusion criteria used for document selection are summarized in Table 1.

Table 1: Inclusion and Exclusion Criteria for Document Selection

Inclusion Criteria	Exclusion Criteria
Documents addressing Social Appropriation of Knowledge (SAK), science–society relations, public engagement, or knowledge co-production.	Documents containing only descriptive or factual information without analytical or methodological content.
Policy documents, theoretical frameworks, conceptual studies, or analytical research.	Opinion pieces, editorials, or publications lacking methodological rigor.
Publications available in English or Spanish.	Duplicate records were identified across databases or repositories.
Peer-reviewed publications or documents produced by recognized institutions.	Documents without identifiable authorship or institutional validation.
Documents relevant to the study objectives and analytical framework.	Documents not directly relevant to the study themes or research objectives.

The study is based on four types of documentary sources that collectively inform the development of the analytical framework. These include policy documents from the Colombian Ministry of Science, Technology, and Innovation (Minciencias, 2021), which define the national approaches to Social Appropriation of Knowledge (Montoya-Alzate & Álvarez-Estrada, 2026). Second, conceptual and theoretical literature on Science and Technology Studies (STS) and Social Appropriation of Knowledge is included to provide broader epistemological bases for understanding knowledge as socially constructed, negotiated, and transformed through interaction, not transmitted linearly. Third, the Theory of Planned Behavior (TPB) is incorporated as a behavioural framework for understanding

researchers' intention and behavioural dispositions towards public engagement, which considers attitudes, subjective norms, and perceived behavioural control. Fourth, the Ambassador Program Engagement model serves as a practice-based framework to demonstrate structured interaction between scientists and communities in the phases of connection, immersion, co-design, engagement, and reflection.

3.3 Analytical Framework

A structured thematic coding and framework synthesis procedure was used for the analysis. All 42 documents were imported to a qualitative matrix and open-coded line by line to identify meaningful parts of the text and to allocate initial coding, including public engagement, researcher participation, institutional mediation, science communication, and co-production. Second, in order to resolve similarities and eliminate duplications and redundancies, the initial codes were refined through the constant comparative method, resulting in a more abstract set of axial codes representing higher-order concepts.

Third, through a cross-tabulation matrix, axial codes were systematically attributed to the four analytical lenses (SAK literature, Minciencias policy framework, Theory of Planned Behavior, and Ambassador Program Engagement model), which allowed for conceptual convergence and divergence to be identified. Fourth, selective coding was used to organize the axial codes into a set of superordinate thematic categories that represented dimensions of interaction between scientists and societies: engagement intensity, institutional facilitation, dialogue mechanisms, and pathways for co-creation of knowledge. These were then operationalised as constructs by assigning each theme to key indicators within the research cycle at the theoretical, policy, and engagement levels, providing consistency of concepts.

3.4 Development of Analytical Categories

Through the integration of the four analytical perspectives, a set of shared conceptual categories was identified to guide the construction of the indicators. These categories include science–society communication, co-construction of knowledge, involvement of non-specialist actors, institutional support for engagement, and transformation of social realities through research. These categories reflect the common understanding underlying all four frameworks, particularly the idea that knowledge production is a relational process involving continuous interaction between society and researchers. These categories act as the link between theory and practice.

3.5 Indicator Development Strategy

Thematic synthesis was used to develop indicators based on the four analytical frameworks. The eleven indicators have been generated using a systematic synthesis of cross-frameworks and a construct translation methodology.

The first step included creating a cross-framework concept matrix based on concepts drawn from four different sources: SAK literature (for instance, co-production, dialogue, participation, and knowledge circulation); Minciencias policy papers (institutional support, outreach tools, funding mechanisms, and evaluation standards); TPB (attitudes, subjective norms, and perceived behavioral control); and Ambassador Program Engagement Model (facilitation, intermediaries, and structured engagement activities).

The second step involved merging common concepts using axial coding to develop common constructs such as engagement-enabling conditions, which are based on dialogue, norms, and institutional facilitation.

Thirdly, these constructs were translated into measurable indicators through the identification of measurable expressions, which include interaction frequency, the existence of policies, and co-production activities.

Fourthly, the indicators were allocated to pre-research, during research, and post-research phases to achieve complete coverage of the process. This led to the elimination of unnecessary repetition and produced eleven indicators based on a tripartite approach to SAK.

3.6 Social Appropriation of Knowledge (SAK) Indicators

3.6.1 Pre-Research Stage

The pre-research phase focuses on initial factors influencing engagement. It encompasses awareness activities like workshops and training that impact researchers' attitudes towards public engagement, in line with TPB. Further, support mechanisms at the institutional level in the universities and research centres are also key to facilitating engagement. Additionally, emphasis is placed on early consideration of two-way communication strategies in the research planning as a way to start the interaction before data collection. In parallel, the Ambassador model informs the design of activities aimed at establishing initial connections with research subjects, and participatory models stimulate the participation of non-specialist actors in defining research problems from the outset.

3.6.2 Research Implementation Stage

The research implementation stage focuses on the co-production of knowledge between researchers and communities. It involves engaging in community dialogues to get a sense of issues that are relevant to the community and to incorporate them as part of the research design, in accordance with the principles of Minciencias, which are based on context recognition. Open dialogue spaces enable the co-creation of knowledge and alignment between research and social needs. Furthermore, it entails the identification of the communication styles and channels preferred by the community members to develop appropriate materials that facilitate effective knowledge appropriation. The entire process ensures that not only is research done for the community, but it is done with the community.

3.6.3 Post-Research Stage

The post-research stage addresses the long-term sustainability and impact of Social Appropriation of Knowledge beyond the completion of formal research activities. In relation to this idea, Marin Agudelo (2012) and Ministerio de Ciencia (2026) argued that it is important to create spaces for dialogue, where people share different points of view on special issues related to communities and create new knowledge, and generate SKA processes (Marín Agudelo, 2012b; Ministerio de Ciencia, 2026). Lastly, researchers are required to prepare reflective documents that are critical in assessing their engagement processes with communities using the Ambassador Program Engagement approach. These reflections help evaluate the depth of co-construction and the quality of relationships being developed during the research process.

3.7 Methodological Rationale

The methodological approach applied within this work was developed from the understanding that social appropriation of knowledge cannot be effectively analyzed using conventional methods, such as the number of publications or dissemination activities. Instead, it includes participation, interaction, and knowledge co-construction between researchers and society. By integrating the Minciencias policy framework, practice-based engagement models such as the Ambassador Program, STS theory, and TPB, this study develops a comprehensive and multidimensional indicator system. This system considers SAK as a continuous and dynamic process that starts before research formulation and extends beyond the research outputs completion, emphasizing the transformation of relationships between society and science.

4. Results

4.1 Emergent Analytical Dimensions

The three dimensions were obtained by a systematic and iterative inductive coding procedure, which involved analysing documents related to the SAK literature, TPB studies, Ambassador Program documents, and Minciencias policy documents. Recurring behavioral codes that included researcher openness, communication willingness, collaborative disposition, and engagement attitude were consistently found in the TPB constructs and literature on SAK engagement in the first coding cycle. These codes were then grouped together by the axial coding process into a higher-order grouping of researcher behavioural intention and commitment to engagement, which was evident in both theory and policy statements emphasizing engagement as an internalised practice rather than only an institutional requirement.

During the second cycle, codes like institutional support mechanisms, organizational incentives, policy frameworks, and governance structures were found within Minciencias documents and related policy literature. These codes consistently co-occurred across the documents, suggesting that engagement occurs structurally, as a set of codes, rather than being individually driven. In the third cycle, concepts and themes that appeared frequently in both the SAK literature and the model of the Ambassador Program were identified: dialogue, mutual learning, co-production, community interaction, and knowledge exchange. These were clustered under the rubrics of sustained community interaction and knowledge co-production, having to do with a process that is relational and ongoing. These dimensions imply that SAK can be considered a relational, multi-level process from a behavioural, institutional, and participatory perspective (Montoya-Alzate & Álvarez-Estrada, 2026).

4.2 Integration of Theoretical and Policy Perspectives

Comparison of the four analytical domains revealed significant convergence despite the various origins and goals. The Theory of Planned Behavior puts the emphasis on the attitude, intentions, and perceived responsibilities of the researchers towards public involvement. The Ambassador Program Engagement model focuses on connection, immersion, engagement, and reflection as methods for establishing meaningful relationships with communities. Participation, dialogue, social transformation, and recognition of multiple forms of knowledge are emphasised in Minciencias policy frameworks.

Likewise, conceptual understandings of SAK always emphasize a process of interaction and co-construction, not one of dissemination. This convergence suggests that the processes of knowledge production, sharing, negotiation, and social application are not only to be considered in the evaluation of SAK but also in its outputs.

4.3 Development of the Indicator Framework

Each of the four analytical domains has been used to develop eleven indicators across the three phases of the research lifecycle. The pre-research conditions are the initial stages and consist of indicators for researcher awareness, institutional support, communication planning, and initial connections with research participants. The contribution from these models is the main driver of these indicators: TPB and Ambassador Program Engagement. The second stage focuses on the implementation of participatory research. Indicators for this phase include context recognition, dialogue, co-creation processes, and communication strategies aimed at enabling interaction between researchers and communities. The indicators are strongly based on Minciencias policy principles and conceptualisations of SAK.

The third phase is post-research appropriation and ongoing involvement. In this stage, indicators highlight the continuation of activities, ongoing communication, reflection, and evaluation of the maintenance of knowledge appropriation processes after the formal closure of research projects. The resulting framework calls for a change from an output-centred evaluation to an assessment of the relational processes that enable co-production of knowledge, participation, and ongoing science–society

engagement.

The selection rationale for the eleven indicators was made transparent by using an explicit cross-framework mapping process in which each indicator is mapped back to its conceptual source(s). Each indicator did not emerge from a single source, but rather converged in the SAK literature, in policy documents from the Ministry of Science, Technology, and Innovation (Minciencias), in the TPB constructs, and in the Ambassador Program Engagement model. This linkage and its informativeness in indicator construction by the theoretical, behavioural, and policy dimensions are summarized in Table 2.

Table 2: Mapping of the Eleven SAK Indicators to Source Frameworks and Constructs

Phase	Indicator (Operationalized)	Construct Definition	Source Framework(s)
Pre-research	Researcher awareness and orientation toward SAK	The degree to which researchers demonstrate understanding and value of societal knowledge engagement in research planning	TPB (attitudes, behavioural intention) + SAK literature
Pre-research	Institutional enabling environment for engagement	Presence of institutional policies, incentives, and governance structures supporting public engagement	Minciencias policy + SAK literature
Pre-research	Structured communication and engagement planning	Inclusion of formal strategies for stakeholder communication and participation before project initiation	TPB (intent formation) + Ambassador Model
Pre-research	Early stakeholder identification and mapping	Identification and inclusion of relevant community actors and non-academic participants at the project design stage	Ambassador Model + SAK literature
Implementation	Context-sensitive research adaptation	The degree to which the research design integrates local/community knowledge and contextual conditions	SAK literature + Minciencias policy
Implementation	Dialogic interaction between researchers and communities	Frequency and quality of two-way communication and knowledge exchange during research	SAK literature (dialogue)
Implementation	Co-production of knowledge outputs	Joint generation of research outputs involving researchers and community stakeholders	SAK literature + Ambassador Model
Implementation	Participatory communication strategies in practice	Use of structured methods (workshops, forums, participatory tools) to enable engagement	Minciencias policy + Ambassador Model

Post-research	Continuity of engagement beyond project completion	Sustained interaction and collaboration after formal research closure	TPB (behavioural continuation) + SAK literature
Post-research	Knowledge dissemination and circulation practices	Translation of research outputs into accessible formats for non-specialist audiences	Minciencias policy + SAK literature
Post-research	Reflexive evaluation of engagement processes	Systematic assessment of engagement effectiveness and institutional learning feedback loops	TPB (behavioural feedback) + Minciencias policy

4.4 Proposed Indicators for Social Appropriation of Knowledge

The indicator framework proposed in this study was based on the integration of the three dimensions of behaviour, institutional, and relational aspects identified via the documentary analysis, presented in Table 2. The indicators are designed to support evaluation of engagement processes across the research lifecycle, rather than just publications, citations, or dissemination outputs.

Table 3: Proposed Indicators for Social Appropriation of Knowledge (SAK).

Stage	Dimension	Indicator	Operational Definition	Data Sources	Measurement Criteria	Scoring Logic	Example Evidence
Pre-Research	Researcher Engagement	Participation in awareness and training activities on public engagement	The extent to which researchers participate in formal SAK/public engagement training before project initiation	Training records, institutional HR logs, workshop attendance sheets	0 = none, 1 = informal exposure, 2 = attended ≥1 training, 3 = multiple trainings completed	Frequency-based cumulative score (0–3)	Attendance certificate; workshop registration list
Pre-Research	Institutional Support	Availability of institutional support for SAK activities	Presence of institutional mechanisms (policies, funding, units) enabling engagement	Institutional policy documents, funding schemes, and university SAK offices	0 = none, 1 = partial/unclear, 2 = defined policy, 3 = structured institutional unit + funding	Policy strength index (0–3)	SAK policy document; grant call guidelines

Pre-Research	Communication Planning	Inclusion of two-way communication strategies in research plans	The degree to which research proposals include structured participatory communication	Project proposals, ethics application	0 = absent, 1 = one-way dissemination only, 2 = partial two-way strategy, 3 = fully structured participatory communication plan	Proposal content coding score (0–3)	Proposal section on stakeholder engagement
Pre-Research	Stakeholder Connection	Early engagement with communities	Level of engagement with stakeholders during the project design phase	Meeting records, MoUs, stakeholder logs	0 = none, 1 = informal contact, 2 = consultation meetings, 3 = co-design involvement	Engagement intensity scale (0–3)	Workshop minutes; signed collaboration agreements
Pre-Research	Participatory Design	Stakeholder involvement in project design	Extent of community input in defining research questions and methods	Design workshops, co-authorship records	0 = none, 1 = feedback only, 2 = consultative input, 3 = shared decision-making	Participation depth index (0–3)	Co-design workshop outputs
Implementation	Context Recognition	Community dialogues for local needs identification	Degree of structured dialogue used to understand the community context	Field notes, interview transcripts, and focus group reports	0 = absent, 1 = minimal consultation, 2 = periodic dialogue, 3 = sustained participatory dialogue	Frequency + depth coding (0–3)	Focus group reports
Implementation	Knowledge Co-Creation	Collaborative knowledge production	Extent of joint researcher-community knowledge generation	Co-authored outputs, workshop outputs	0 = none, 1 = consultation only, 2 = partial co-production, 3 = full co-production	Co-production index (0–3)	Joint reports, co-authored outputs

Implementation	Inclusive Communication	Use of accessible communication channels	The extent to which communication is adapted for non-specialist audiences	Outreach materials, media content, translations	0 = technical only, 1 = partially adapted, 2 = multiple formats, 3 = fully accessible multilingual/community formats	Accessibility score (0–3)	Infographics, translated summaries
Post-Research	Sustained Engagement	Follow-up interactions post-project	Continuity of engagement after project completion	Follow-up reports, communication logs	0 = none, 1 = single follow-up, 2 = periodic follow-up, 3 = structured long-term engagement	Continuity index (0–3)	Post-project meetings
Post-Research	AAccessible Dissemination	Community-oriented dissemination of findings	Extent of dissemination tailored to non-academic audiences	Public events, policy briefs, community reports	0 = academic only, 1 = partial outreach, 2 = structured dissemination, 3 = participatory dissemination	Dissemination diversity score (0–3)	Public seminars, brochures
Post-Research	Reflexive Practice	Evaluation of engagement processes	Degree of systematic reflection on engagement outcomes	Evaluation reports, reflective journals	0 = none, 1 = informal reflection, 2 = structured review, 3 = institutionalized evaluation mechanism	Reflexivity index (0–3)	Final project evaluation report

5. Discussion

The study aimed to analyze the configuration of the Science and Technology Studies (STS) approach to the Science and Technology (ST) of Social Appropriation of Knowledge (SAK) in the current science governance in Colombia, based on the Science Policy (Minciencias, 2021), the Theory of Planned Behavior (TPB), and the Ambassador Program Engagement model. The analysis shows that in policy and theory, SAK is becoming more and more a relational and process-oriented concept, but in governance systems, its operationalization is still not fully in line with this conceptual shift. Rather, the current evaluation practices still favour traditional output-based metrics, creating a persistent gap between participatory science principles and assessment systems.

One of the important analytical findings of this research is that SAK can be considered as a governance configuration of structural duality. On one hand, science policy in Colombia has a vision that is based on inclusion, dialogue, and co-production. Whereas institutional research evaluation systems rely on bibliometric indicators like citations, publications, and indexed outputs. This can be thought of as a governance mismatch, in which the policy expectations are largely misaligned with policy incentives. In other international science systems, such as the European system of science assessment, "responsible research and innovation" agendas face similar difficulties in changing established performance measures. Within this context, the SAK model emerges not as a stable implementation, but as a

contested policy field defined by different logics of knowledge valuation.

From a PUS point of view, the findings suggest an extension of the existing criticisms of deficit and linear communication models by demonstrating that the challenge is no longer primarily epistemological but institutional. Even in such contexts where participatory discourse is already well embedded, the study demonstrates that structural conditions can be a barrier to the implementation of participatory discourse in science communication. From this perspective, output-centred evaluation systems function as a form of structural inertia that limits the translation and implementation of participatory science policy. The implication is that science–society relations could not be achieved without better communication strategies and reconfiguration of institutional governance mechanisms.

The Theory of Planned Behavior (TPB) adds to this structural tension by revealing a decision-behaviour disconnect that is pervasive in researcher engagement. The results indicated that researchers have positive attitudes towards public engagement and recognize its relevance to society. However, the subjective norms in academic settings still favor conventional research products, while perceived behavioural control is limited by factors such as inadequate institutional backing, time demands, and a lack of communication skills training. This combination creates a systematic separation between intention and action. Rather than being a behavioural issue alone, public engagement is structurally conditioned, indicating that individual motivation is insufficient without an enabling institutional environment.

This study's second major contribution is the conceptualization of SAK as a multi-level governance system that functions on the policy, institutional, individual, and community levels. SAK is also part of the national science strategies at the policy level that emphasise participation and knowledge exchanges. At the institutional level, it is mediated by organizational structures, funding mechanisms, and management of research. At the individual level, it is manifested through researchers' practices, communication skills, and willingness to cooperate. At the community level, it is enacted through participation in dialogue and co-production processes. However, the current challenges faced worldwide, such as the disruption of food systems by the COVID-19 crisis, further highlight the need for integrating science and its knowledge with the community, policymakers, and other stakeholders (Hussain, Mubeen, et al., 2026).

The Ambassador Program Engagement model provides an important operational lens to help understand how engagement takes place in practice. The staged structure (connection, immersion, co-design, engagement, and reflection) fosters an understanding of science–society interaction as a cyclical and iterative process. This is consistent with the contemporary PUS literature advocating for upstream and continuous engagement models. However, the analysis also highlights a limitation in its institutional scalability. While it is effective at the micro level of the researcher-community interaction, it remains weakly integrated into formal research governance systems. As a result, its implementation is often dependent on individual initiative rather than systematic institutionalisation, reducing its sustainability and impact.

Another conceptual contribution of this study is the reconceptualisation of SAK as not a communication strategy, but rather as a relational epistemology. The role of knowledge in the analysed frameworks is not defined as a unidirectional flow from experts to the public, but as the result of a co-produced, negotiated process of interaction. This moves the epistemic basis of science–society relations from hierarchy to reciprocity and introduces multiple versions of knowledge, such as experiential and local knowledge, as part of research processes. This finding underscores the general STS discussion on epistemic pluralism and offers a critique of paradigms of scientific authority as the legitimate knowledge system.

Though this relational change poses a methodological and evaluative challenge. If knowledge is co-produced through interaction, then traditional output-based indicators are insufficient to capture its quality, depth, and social relevance. This study, therefore, contributes to current PUS discussion on

research activities by proposing that indicators must move beyond counting activities to measuring relational processes like trust-building, continuity of the engagement over time, and participation quality. Meanwhile, indicators are proliferating, raising the danger of over-institutionalisation, where engagement becomes performative and proceduralised. This contradiction between meaningful participation and bureaucratic measurement has been much discussed in the science policy literature and continues as an unresolved tension in the operationalisation of participatory science.

Finally, the literature and policy review analysis reveals a conceptual change from a communication-centred to a governance-oriented approach to science–society relations in SAK. Across the examined STS literature, Minciencias policy (2021), TPB-informed studies, and the Ambassador Program Engagement model, there is a great emphasis on the need for greater alignment between the actions of the policy, institutional incentives, and scientists' practices to facilitate effective SAK implementation. The synthesis implies that, in the absence of such alignment, participatory science might be rhetorically represented but only partially integrated into institutional practice. Thus, the study views SAK improvement as a need to focus not just on engagement practices, but also on institutional settings, which can hinder or facilitate the practices. Similar principles can be observed in sustainability transitions, which involve technological innovation that must include environmental governance, social acceptability, and institutional collaboration, not just technological progress (Maharana, 2026).

This contributes to PUS scholarship by conceptualising science communication as a part of larger systems of governance, assessment, and epistemic valuation, rather than an individual outreach project. Such governance issues are now evident in the application of artificial intelligence-based approaches, where technological progress necessitates compatibility between policy regulations and societal values. This further emphasizes the need for incorporating the consideration of knowledge practices in larger governance arrangements (Al-Billeh et al., 2025).

6. Strengths and Limitations

A key strength of this study lies in its conceptual integration between Social Appropriation of Knowledge (SAK), Theory of Planned Behavior (TPB), Science and Technology Studies (STS), and Ambassador Program Engagement within an integrated and evaluative framework, based on the science policy of Colombia (Minciencias, 2021). The study does not consider governance structures, behavioural intention, and science–society interaction as distinct analytical areas, but sees them as interdependent dimensions of knowledge co-production. This integrative approach supports Public Understanding of Science (PUS) scholarship in providing a clear conceptual framework to explain the interaction between institutional, behavioural, and relational factors in shaping SAK processes and providing a foundation for the future operationalization and empirical testing of the indicators.

However, the framework remains conceptual and has never been empirically tested in institutional or community settings. Therefore, its measurement reliability, practicality, and predictive validity have yet to be determined. The study is also subject to document-selection bias inherent in qualitative documentary analysis, as results may vary based on what policies and theories were selected and how well they are interpreted. Moreover, the lack of stakeholder input and field-based validation prevents the real-world relevance of proposed indicators from being measured. Last, the framework is primarily based on the science governance framework in Colombia, so its transferability to other national/ institutional contexts that have varying research cultures, funding mechanisms, and science communication systems could be constrained.

7. Future Research Direction

Further studies should prioritise empirical validation of the proposed framework of indicators of the SAK in various institutional and community settings. This covers testing indicators in research institutes, universities, and community-based innovation contexts to evaluate their potential to document actual knowledge co-production processes rather than just documenting formal engagement activities. The methodological approach would be appropriate for all mixed-method designs

(longitudinal survey, semi-structured interviews, and participative observation), thus supporting the evaluation of both the behavioural intention (TPB) and relational engagement (Ambassador Model). These studies would also lead to further development of the sensitivity and scalability of the indicators across various disciplinary and institutional contexts. Comparative international research is also needed to evaluate the framework's ability to be adapted beyond Colombia. This would enable future research to compare the impact of various science governance regimes on the operationalisation of Social Appropriation of Knowledge, particularly in the context of evaluation cultures of performance metrics.

8. Conclusion

This study proposed an integrated conceptual framework for the assessment of Social Appropriation of Knowledge (SAK) from a Public Understanding of Science (PUS) perspective by combining the Theory of Planned Behavior, STS, Colombian science policy (Minciencias, 2021), and the Ambassador Program Engagement model. This contribution consists mainly of the development of a process-oriented indicator framework that re-conceptualizes SAK as a multi-level and relational process, where behavioral intention, institutional enablement, and persistent community involvement are among the indicators that shape the process, rather than as an output-driven activity measured by publications or dissemination counts. Practically, the framework provides a structured approach to reframing how science is assessed and evaluated in governance and enables policymakers and institutions to recognize engagement processes throughout the research lifecycle. It also provides an initial conceptual framework for aligning policy goals with institutional incentives and researcher practices. However, the study is only a conceptual and documentary analysis, and the proposed indicators have not been empirically validated in institutions or communities. Therefore, their reliability in measuring and operational applicability are yet to be tested. Future studies are recommended to focus on stakeholder testing, empirical validation, and contextual adaptation of this framework across different governance systems to evaluate its transferability and robustness beyond Colombia.

9. Conflict of Interests

The authors declare that they have no competing interests.

10. Funding Statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

11. Data Availability

No new datasets were generated or analyzed during the preparation of this study. Therefore, data availability is not applicable.

12. References

Abu-Farha, R. K., Alzoubi, K. H., Al Safadi, A. a., Alsous, M. M., Nawasreh, A., El-zubi, M. K., & Al-Ashwal, F. Y. (2026). Exploring Physicians' Willingness to Integrate Artificial Intelligence in Clinical Practice: Ethical and Practical Insights From a Jordanian Cross-Sectional Survey. *Health Science Reports*, *9*(3), e71994.

Agyare, P. (2025). Scientific Expertise In Democratic Contexts: Towards Reflexive And Inclusive Governance. *Social Sciences and Education Research Review*, *12*(2), 32-45.

Al-Billeh, T., Al-Hammouri, A., & Al-Khalaileh, L. (2025). Methods of teaching electronic administration legislation by using artificial intelligence techniques. *International Journal of Electronic Security and Digital Forensics*, *17*(3), 351-362.

Alkasasbeh, A. M., Jarrah, S. S., Alhusamiah, B. K., & Tarawneh, F. S. (2025). Factors influencing the utilization and adoption of electronic health records among nurses in Jordanian hospitals. *Jordan Journal of Nursing Research*, *4*(1), 68-80.

Anwar, A., Younes, I., Afzal, M. Z., Arshad, M. Z., Alshouha, B., Qaisrani, S. A., Wakeel, M., Khan, J. H., Hussain, S., & Karuppannan, S. (2026). Integrated remote sensing and socio-economic evaluation of winter smog and its impacts in Lahore district, Pakistan. *Environmental Systems Research*.

Arias, A. M., Gutiérrez, L. N. S., MARTÍNEZ ARIAS, A., & SIERRA GUTIÉRREZ, L. (2025). Social appropriation of knowledge as a key driver in shaping life pathways for rural youth in Colombia. *Revista Ibero-Americana de Estudos Em Educação*, *20*, e19954.

Audretsch, D. B., Belitski, M., Fiedler, A., & Meurer, M. M. (2025). Values and entrepreneurship in the sustainable society: Toward a multilevel understanding of entrepreneurial value practices: Audretsch et al. *Small Business Economics*, 1-25.

BENSAUDE-VINCENT, B., & BERGERON, A. (2025). Science for the People? STS Perspectives on the Question of Science and the Public. *Science and Technology in Society*, 77-95.

Biasiori, L., Mazzini, F., & Rabbiosi, C. (2023). *Reimagining Mobilities Across the Humanities: Volume 2: Objects, People and Texts*. Taylor & Francis.

Boulton, G. (2022). Science as a global public good: the roles of the representative bodies of science—a perspective. *Proceedings of the Indian National Science Academy*, *88*(4), 832-841.

Bucchi, M., & Trench, B. (2016). Science communication and science in society: A conceptual review in ten keywords. *Tecnoscienza*, *7*, 151-168.

Conner, M. (2020). Theory of planned behavior. *Handbook of sport psychology*, 1-18.

Fernández, R. (2025). *Understanding cultural change*.

Garlick, S., Besley, J. C., Peterman, K., Black-Maier, A., Downs, M. R., Ortiz Franco, E., Groffman, P. M., Lavallee, A., O'Connell, K., & Storksdieck, M. (2025). Six elements of effective public engagement with science. *Frontiers in Ecology and the Environment*, *23*(10), e70014.

Hatchimonji, D. R., McNeela, L., Noor, Z., Stoffers, M., Barnes, T. N., Branch, K., Perry, D., Parks, A., & Berthe, M. (2026). The role of Research-Practice Ambassadors in strengthening socially just and equitable partnership processes. *American Journal of Community Psychology*.

Henke, J. (2025). Strategic Interactions in Science Communication: A Complex Adaptive Systems Framework. *Science Communication*, 10755470251363825.

Hussain, S., Hamidova, E., Qaisrani, S. A., Yusifova, M. M., Alawadi, R., Wakeel, M., Tariq, A., Arshad, M. Z., & Ullah, S. (2026). Geospatial analysis of urban expansion, land use transitions and thermal environment interactions using Google earth engine. *Environmental Systems Research*.

Hussain, S., Mubeen, M., Qaisrani, S. A., Fahad, S., Suffian, M., Tahir, M., Javeed, H. M. R., & Nasim, W. (2026). COVID-19 and Global Agriculture: Impacts on Food Security, Supply Chains and Agricultural Resilience. *COVID*, *6*(6), 104.

Iordanou, K., Antoniou, A., & De Vos, M. (2026). Public Trust in Science: a systematic literature review. *Journal of Academic Ethics*, *24*(1), 56.

Johnson, A. R., Nadkarni, N. M., & Weber, C. Q. (2022). Providing public engagement training to build connections between the community and research ethics professionals: a pilot project. *Journal of Empirical Research on Human Research Ethics*, *17*(5), 545-553.

Kuchtová, A. (2024). *The Ungraspable as a Philosophical Problem: The Stubborn Persistence of Humanism in Contemporary Phenomenology* (Vol. 5). Brill.

Maharana, I. P. P. P. P. M. P. P. M. M. (2026). Renewable Energy and Sustainability: A Critical Review of Technologies, Environmental Benefits, and Future Development Pathways. https://doi.org/10.55041/ijcope.v2i6.332

Maldonado-Castañeda, P. H. (2026). "Our Voice Matters… If They Allow It": Ecochildism–Sentipensante as a Praxis for Capability Expansion and Epistemic Justice in Colombian Sustainable Education. *Journal of Human Development and Capabilities*, *27*(1), 56-80.

Marín Agudelo, S. A. (2012a). Apropiación social del conocimiento: una nueva dimensión de los archivos. *Revista Interamericana de Bibliotecología*, *35*(1), 55-62.

Marín Agudelo, S. A. (2012b). Social appropiation of knowledge: A new dimension of archives. *Revista Interamericana de Bibliotecología*, *35*(1), 55-62.

MATLOVIČ, R., & MATLOVIČOVÁ, K. (2025). The metamodern shift in geographical thought: Oscillatory ontology and epistemology, post-disciplinary and post-paradigmatic perspectives. *Folia Geographica*, *67*(1), 22.

Mikami, K., Szymanski, E., Minari, J., Smith, R., & Vermeulen, N. (2026). The Rise of Public Engagement in Japan and the UK: Reconsidering Conventional Narratives through a Cross-country Dialogue. *East Asian Science, Technology and Society: An International Journal*, 1-27.

Ministerio de Ciencia, T. e. I. (2026). Tasks. *Minciencias*. https://minciencias.gov.co/node/96

Montoya-Alzate, M. S., & Álvarez-Estrada, L. Y. (2026). Política científica y apropiación social del conocimiento en Colombia: avances, tensiones y rutas de fortalecimiento. *Trilogía Ciencia Tecnología Sociedad*, *18*(39), e3648-e3648.

Mosleh, H., Albashayreh, A., & Yousef, M. (2025). Optimizing task scheduling in cloud computing with deep learning: A diabetes detection case study. 2025 International Conference on New Trends in Computing Sciences (ICTCS),

Niño-Sandoval, Y., Alvarez-Risco, A., Simbaqueba-Uribe, J., Del-Aguila-Arcentales, S., Villalobos-Alvarez, D., & Yañez, J. A. (2023). Processes of communication and dissemination of science: the challenges of science policy guidelines in Colombia. Frontiers in Education,

Olaopa, O. R. (2025). Political commitment, Science, Technology, and Innovation (STI) policy design and sustainable development: Lessons from Nigeria. *African Journal of Science, Technology, Innovation and Development*, *17*(4), 463-474.

Parthasarathy, S. (2025). From the bench to public policy: Enhancing public trust in science. *Social Studies of Science*, *55*(2), 295-302.

Perez-Alvaro, E., & Boswell, R. (2025). Integral oceans heritage of indigenous communities: Its value for good health and well-being. *Social Sciences & Humanities Open*, *11*, 101245.

Pinedo-López, J., Baena-Navarro, R., Carriazo-Regino, Y., Torres-Hoyos, F., & Nieves-Garces, D. (2025). Science, technology, and innovation policy and regional scientific production in Colombia: a methodological framework to address asymmetries in developing countries. *Journal of Innovation and Entrepreneurship*, *14*(1), 89.

Poliakoff, E., & Webb, T. L. (2007). What factors predict scientists' intentions to participate in public engagement of science activities? *Science Communication*, *29*(2), 242-263.

Potochnik, A., & Jacquart, M. (2025). *Public engagement with science: Defining the project*. Cambridge University Press.

Qusef, A., Murad, S., Alsalhi, N. R., & Al Gharaibeh, F. (2025). Leveraging artificial intelligence to identify students with learning challenges. *International Journal of Learning, Teaching and Educational Research*, *24*(5), 623-643.

Rizki, S. P., & Maulana, H. (2026). Examining the Role of Price and Comfort Perception in Shaping Urban Transit Behaviour: A TPB-Based Study of TransJakarta Users. *Futurity of Social Sciences*, *4*(1), 40-57.

Rubio-Vargas, A. C., Castro-Valencia, F. L., Diaz-Carmona, D. C., Molina-Campos, D. F., Criollo-Rayo, Á. A., Bohórquez-Lozano, M. E., & de Polanco, M. M. E. (2026). Building Knowledge Through Intercultural Dialogue: A Qualitative Study with Indigenous Communities in Colombia. *International Journal of Interdisciplinary Social & Community Studies*, *21*(2), 109.

Savari, M., & Khaleghi, B. (2023). Application of the extended theory of planned behavior in predicting the behavioral intentions of Iranian local communities toward forest conservation. *Frontiers in psychology*, *14*, 1121396.

Silva-Flores, M. L., Pedroza-Zapata, Á. R., & Vázquez-Elorza, A. (2025). Transforming persistent failures into public value: Policy design for innovation oriented to the common good. *Innovation Journal*, *30*(2).

Simis, M. J., Madden, H., Cacciatore, M. A., & Yeo, S. K. (2016). The lure of rationality: Why does the deficit model persist in science communication? *Public Understanding of Science*, *25*(4), 400-414.

Sohad, M. K. N., & Mafrolla, E. (2025). Bridging science and society: the integration of indigenous and scientific knowledge management. *Journal of Knowledge Management*, *29*(7), 2258-2284.

Vallejo Sierra, R. H., & Pirela Morillo, J. (2025). Prácticas de Ciencia Abierta en investigadores colombianos de Ciencias Sociales. *Revista de Ciencias Sociales (13159518)*, *31*.

Voicu, D. D. (2025). Predictors of media engagement: factors impacting materials scientists' intentions to communicate science. *Frontiers in Communication*, *10*, 1568771.

Yang, Y. (2026). Knowledge culture in the postdigital era: Reclaiming knowledge as a public good. *Educational Philosophy and Theory*, *58*(3), 227-248.

Yuan, S., Besley, J. C., & Dudo, A. (2019). A comparison between scientists' and communication scholars' views about scientists' public engagement activities. *Public Understanding of Science*, *28*(1), 101-118.