# Citizen Science and Artificial Intelligence in *Horizon 2020* and *Horizon Europe* Projects: Communication and Scientific Impact

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## Abstract

The *Horizon 2020* and *Horizon Europe* framework programs are the key funding programs for the European Union's policy on innovation, research, and development (R&D&I) in all scientific subject areas. These instruments promote open science by using citizen science as a collaborative methodology and artificial intelligence as a disruptive technology, thereby encouraging public participation and engagement in scientific research. This paradigm shift in the scientific landscape is the impetus for this descriptive and exploratory study analyzing the effectiveness of communication policies and the quality of the dissemination and scientific impact of 28 R&D&I projects developed using citizen science and artificial intelligence, which were selected from the *Community Research and Development Information Service* (*CORDIS*) repository. This case study employs a methodological procedure grounded in content analysis and bibliometric indicators to meet four specific objectives: to determine the main formats and channels used in the projects' communication strategies, as well as which category the projects' papers fall into; to analyze the effectiveness of the projects' scientific dissemination using articles published in *Scopus* according to subject area; to analyze the quality of scientific impact of the 234 articles that the projects produced using the *SCImago* Journal Rank (SJR) indicator; and to evaluate their specific and comparative impact using the standardized indicators *Field-weighted citation impact (FWCI)* and *CiteScore*. The findings confirmed that there were substantial differences in terms of the effectiveness of communication and the quality of dissemination and scientific impact among the projects analyzed. In this context, communication science could help efficiently navigate the challenges and opportunities in scientific communication.

**Keywords**

Citizen Science, Communication Studies, Artificial Intelligence, Open Science, Impact, Horizon 2020, Horizon Europe, Communication Strategy, Scientific Dissemination, FWCI, CiteScore, Research, Development, and Innovation Projects, Disruptive Technologies, *Scopus*, *CORDIS*.

## 1. Introduction

The economic crisis of the early twenty-first century, the impact of the information society, and globalization emphasized the structural weaknesses of the European Union (**Veugelers *et al.***, 2015; **Godin; Lane**, 2013). In response to these challenges, focus has been placed on creating a smarter, more sustainable, and more inclusive economy through greater engagement with research, development, and innovation (R&D&I).

The *Horizon 2020* (2014–2020) and *Horizon Europe* (2021–2027) framework programs were set up as the main financial and legal instrument of the European Union's innovation, research, and technological development policy in all scientific subject areas (**European Commission**, 2015; 2016; 2020; **Veugelers *et al.***, 2015; **Pérez-Aliende**, 2023). Indicating a break with the scientific policies of previous programs, they are focused on three basic issues: open innovation, maximization of the impact of results, and an approach to responsible research and innovation that considers the ethical and social impacts of research (**European Commission**, 2015).

This new direction in European policies in the scientific field can be seen in the institutional push toward open science and the promotion of formalized networks with collaborative methodologies such as citizen science (**European Commission**, 2016; **Sierra-Caballero**, 2022; **Martin**, 2017). It provides a new policy framework that is transforming the global scientific landscape, as it facilitates the immediate and free circulation of knowledge, fostering collaboration at all levels and promoting greater citizen participation in the research process. This new paradigm helps increase scientific impact through research capable of rising to current social challenges (**Ibercivis**, 2021; **Magalhaes *et al.***, 2022; **Ministry of Science and Innovation**, 2023).

> The disruptive digital technologies contribute to the globalization of scientific knowledge

In this context, disruptive digital technologies contribute to the globalization of scientific knowledge (**Sierra-Caballero**, 2012; **López-García**, 2018). With explosive development linked to the fourth industrial revolution, these technologies are blurring the boundaries between the physical, biological, and digital worlds through new computational capabilities, Big Data, and generative artificial intelligence tools (**López-García**, 2018; **França**, 2023). This poses new challenges for knowledge management, for both information and communication professionals and research project managers who must assess their scientific impact and develop effective communication processes (**Berens *et al.***, 2023; **Franganillo**, 2022; 2023).

European projects developed using citizen science, funded by *Horizon 2020* and *Horizon Europe*, are not unaffected by the emergence of artificial intelligence (AI). As a result, analyzing the consortia's communication and scientific dissemination policies to maximize the scope of their results and show their potential for social exploitation (**França**, 2023) is a key premise in assessing the impact of such projects. In this study, the effectiveness of communication and the quality of scientific dissemination of *Horizon 2020* and *Horizon Europe* projects, developed using citizen science as a collaborative methodology and AI as a disruptive technology, are analyzed to see whether there are substantial differences in communication and in their dissemination and scientific impact.

## 2. Citizen Science and Communication Science: A Critical Approach

Beginning with the shift in European policies in the scientific field (**European Commission**, 2015), open science, as a paradigm of open innovation, aims to improve the reproducibility and integrity of scientific research starting with the following key principles: open access (free access to research results online), open data (collected through scientific research and publicly available), open source (for software or algorithms shared through user, modification, and distribution licenses), open governance (for example, management and decision-making within the scientific community), and citizen science (as a collaborative approach that promotes public participation and engagement with scientific research; **Abadal-Falgueras and Anglada-Ferrer** (2020); **Abadal-Falgueras *et al.*** (2023)). All these principles aim to fast-track scientific-technological progress and democratize access to knowledge (**Ibercivis**, 2021; **Zaken *et al.***, 2021).

> Citizen science is one of the basic tenets of open science and is related to the active participation of individuals or nonprofessional groups in scientific research projects and activities

Citizen science is one of the basic tenets of open science and is related to the active participation of individuals or nonprofessional groups in scientific research projects and activities. It encourages active collaboration by citizens in research using their knowledge, resources, and intellectual effort. Participants contribute by providing experimental data and posing new questions and challenges that enable them, together with researchers, to create a new scientific culture (**Radicchi *et al.***, 2021; **Santa-Soriano**, 2021).

Its implementation as a collaborative research methodology stems from the Seventh Framework Program projects (2007–2013); however, with *Horizon 2020* (2014-2020) and *Horizon Europe* (2021–2027), its inclusion in various research areas (**Veugelers *et al.***, 2015; **Pérez-Aliende**, 2023) has significantly increased (**Radicchi *et al.***, 2021; **Kieslinger *et al.***, 2022; **Abadal-Falgueras *et al.***, 2023; **Ministry of Science and Innovation**, 2023).

This methodology's growing importance is driven both by the recognition of its value to science and society (**Magalhaes *et al.***, 2022; **Kieslinger *et al.***, 2022) and by the evolution of emerging and disruptive technologies such as artificial intelligence (AI) (**Monje; Caballero**, 2023; **França**, 2023; **Berens *et al.***, 2023). Its recent convergence with AI is not only optimizing its own processes but also helping increase the analytical and predictive capacity of the results obtained through citizen science, opening up new possibilities when it comes to tackling complex multidisciplinary challenges.

Citizen science challenges the traditional paradigms of knowledge production, fostering more extensive, more inclusive collaboration among those involved in research activities and projects (**European Commission**, 2016; **Ibercivis**, 2021; **Zaken *et al.***, 2021; **Kieslinger *et al.***, 2022). And in this sense, communication science becomes hugely important since the effectiveness of communication and dissemination policies of projects that have been developed through citizen science must be analyzed (**Gertrudix *et al.***, 2020; 2021).

Communication science is a science that analyzes, on the one hand, how communication is created, transmitted, and interpreted and, on the other hand, how these processes affect and are affected by social, cultural, technological, and political contexts (**Sierra-Caballero**, 2022). In this respect, open science (and citizen science in particular) is an area of critical interest, as it poses challenges and presents opportunities for science communication (**Abadal-Falgueras; Anglada-Ferrer**, 2020; **Abadal-Falgueras *et al.***, 2023; **Ministry of Science and Innovation**, 2023).

This interplay between communication science and citizen science poses three significant challenges (**Martin**, 2017; **Kelly *et al.***, 2019; **Jiménez-Rolland; Gensollen**, 2022): First, owing to the democratization of knowledge, nonspecialized individuals contribute to scientific research, which means that processes, communication strategies, and dissemination of scientific knowledge must be reconfigured. From a communication science perspective, this issue raises questions about the quality of the information produced (**Martin**, 2017). Therefore, the tension between nontraditional actors participating in knowledge generation processes and scientific rigor has sparked debate.

Second, the dissemination or disclosure of results of projects developed with citizen science leads to social construction of scientific knowledge itself, depending on how and where the resulting contributions are presented (**Jiménez-Rolland; Gensollen**, 2022). Therefore, it is essential, from a communication science perspective, to identify who determines the formats used in, and the dynamics that factor into, scientific communication.

Finally, although the citizen science methodology is characterized by its inclusivity, significant barriers limit participation: Socioeconomic differences, access to technology, and the digital divide can exclude certain sectors of the population from citizen science projects (**Johnston; Lane**, 2019). Using communication science can help overcome such barriers and encourage much more representative participation.

## 3. Use of Artificial Intelligence in Projects that Adopt a Citizen Science Methodology: Opportunities, Challenges, and Ethics

The emergence of artificial intelligence (AI) in the citizen science area has transformed knowledge generation procedures. This new platform presents significant challenges, which should be analyzed using an approach that balances innovation with protection of the core values, viz. ethical and responsible research (**Sadin**, 2020; **Terrones-Rodríguez**, 2020; **González-Alcaide**, 2024).

> AI can facilitate the development of citizen science projects by automating complex or tedious tasks and can help make science more accessible

Regarding opportunities, AI can facilitate the development of citizen science projects by automating complex or tedious tasks and can help make science more accessible (**Solaiman *et al.***, 2023; **Franganillo**, 2022). Thanks to the development of AI tools, citizens can participate in research projects and activities without needing specialized training. Moreover, AI's ability to process and analyze large quantities of data enables it to surpass human limitations, improving data analysis in research projects. Consequently, using AI in combination with the knowledge resulting from such projects developed using citizen science allows innovative solutions to be provided in fields such as health, the environment, and sustainability (**European Commission**, 2024).

However, there are also certain risks and challenges: First, data collection and analysis raise major ethical and privacy issues, as the possibility of unchecked surveillance, misuse of personal data, and lack of informed consent are significant concerns in a scientific research context (**Monje; Caballero**, 2023). Moreover, AI algorithms may perpetuate existing biases if data sets are not curated or cleaned (**Terrones-Rodríguez**, 2020; **Franganillo**, 2022). Additionally, reliance on AI-developed technology applications could widen the digital divide by excluding individuals who do not have access to technology or basic skills (**Solaiman *et al.***, 2023; **Franganillo**, 2023; **Sadin**, 2020).

Undertaking the creation of solid ethical frameworks, the development of transparent and understandable algorithms, and the promotion of digital literacy are crucial for the responsible integration of AI into citizen science projects (**Solaiman *et al.***, 2023). Therefore, we can affirm that citizen science in the age of AI has great potential despite the

significant challenges, as it is a powerful tool that expands human knowledge and promotes a much more informed, empowered, and engaged society.

## 4. Impact of R&D&I Projects from Horizon 2020 and Horizon Europe

In recent decades, the European Union has advanced its research agenda, which has evolved from linear management models to network models arising from the needs and expectations related to the social network environment (**Sierra-Caballero**, 2012; **Godin; Lane**, 2013), starting with the open science paradigm (**Abadal-Falgueras *et al.***, 2023; **Abadal-Falgueras; Anglada-Ferrer**, 2020). And this is reflected in *Horizon 2020* and *Horizon Europe*: Both framework programs have been key in promoting projects developed using citizen science that have incorporated disruptive technologies such as AI into their design, implementation, and dissemination of scientific results.

The impact achieved by these European projects has been broken down into three main areas: communication, dissemination, and exploitation of results (**European Commission**, 2015; **Pérez-Aliende**, 2023; **Santa-Soriano**, 2021). The aim is to democratize access to valuable information, encourage the social and economic exploitation of the results from funded projects, broaden the dialogue with society, and promote scientific evidence as a supporting element in formulating public policies.

### 4.1. Strategies for Communication, Dissemination, and Exploitation of European R&D&I Projects

The three main management areas in the European projects are regulated and are mandatory for all beneficiary consortia (**Gertrudix *et al.***, 2020). Constant communication is required throughout the project, whereas management of the dissemination and exploitation of results occurs once the initial results are obtained (**Pérez-Aliende**, 2023; **European Commission**, 2015).

The *European Commission* provides guidance for obtaining results through strict guidelines, templates, and forms. One of these is the proposed Plan for the Dissemination and Exploitation of Research Results (PEDR), which details activities to carry out in the three areas, both during the project and after its completion (**Gertrudix *et al.***, 2021; **Campos; Codina**, 2021; **Santa-Soriano**, 2021). It also establishes priorities for impact, potential users, communication channels, contingency plans, actions aimed at engaging stakeholders, and the final global impact assessment reports (**Martin**, 2017; **Santa-Soriano**, 2021). In addition to this guidance, there is information about disseminating results in public databases or open access repositories such as the *Community Research and Development Information Service* (*CORDIS*), which compiles projects and results funded by the various framework programs (**Lopez-Garcia**, 2018; **Gertrudix *et al.***, 2020; 2021).

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Communication about projects developed using citizen science and artificial intelligence in *Horizon 2020* and *Horizon Europe* is a cross-sectoral stage with the goal of drawing attention to the proposals' added value and its contribution to social innovation (**Gertrudix *et al.***, 2020; **Campos; Codina**, 2021; **Giardullo *et al.***, 2021; **Sanz-García *et al.***, 2021; **Berens *et al.***, 2023; **Leguina *et al.***, 2023; **Magalhaes *et al.***, 2023). Therefore, from the first stage of the project onward, it is essential to identify the communication activities and formats used: Websites, social networks, learning platforms and tutorials, newsletters, management of media relations, events and webinars, audiovisual and graphic material, informative material, mobile applications, advertising campaigns, living labs, blogs, and bots, along with developing the project's visual identity and brand, are used as recurrent communication activities in the scientific environment (**Lucente-Briceño; Salazar-Loggiodice**, 2020; **López-García**, 2018; **Túñez-López *et al.***, 2018; **European Commission**, 2020; 2024).

In contrast, dissemination includes those practices aimed at sharing research results with potential users, researchers in the same field of knowledge, the business and industrial sector, other economic stakeholders, and public policy managers (**Campos; Codina**, 2021; **Gertrudix *et al.***, 2021; **Santa-Soriano**, 2021; **Pérez-Aliende**, 2023; **Sanz-García *et al.***, 2021; **Leguina *et al.***, 2023). This area of management, aimed at maximizing scientific impact, involves public dissemination of project results, in particular through promotional, informative, or academic publications or documents that impact the government such as reports (**Santa-Soriano *et al.***, 2023; **Giardullo *et al.***, 2021; **Sanz-García *et al.***, 2021).

> Dissemination of or disclosure about R&D&I projects is crucial to recruit future participants into European consortia, increase awareness of the results obtained, and ensure collaboration among public institutions, companies, and research organizations

Exploitation, as a process, refers to the transmission of scientific achievements based on tangible or intangible results (knowledge, data, or information) that have sufficient potential for application in the academic, social, political, industrial, or business spheres (**Gertrudix *et al.***, 2020; **Santa-Soriano**, 2021).

### 4.2. Evaluation of the Scientific Impact of European R&D&I Projects

Dissemination of or disclosure about R&D&I projects is crucial to recruit future participants into European consortia,

increase awareness of the results obtained, and ensure collaboration among public institutions, companies, and research organizations (**Radicchi *et al.***, 2021; **Sanz-García *et al.***, 2021; **Giardullo *et al.***, 2021).

Measuring their scientific impact involves assessing the quality of the academic papers produced, using various bibliometric activity (quantitative) and impact (qualitative) indicators (**Velasco *et al.***, 2012). Among the quantitative indicators, those related to production, such as the number of scientific publications produced by R&D&I projects, stand out. Among the qualitative indicators, the most noteworthy are the impact factor of academic journals, the number of citations of an article, and the relative impact of citations. These indicators express tangible measurements of the recognition and influence of the research results in the scientific community (**Guevara-Pezoa**, 2023; **Ibercivis**, 2021).

When it comes to the application of these indicators, there are limitations inherent to their absolute values, underscoring the importance of using standardized metrics to make the analysis more accurate and allow for a more context-driven assessment of scientific impact. Specifically, the standardized impact takes into account the context of each paper by considering the citations received by a paper in relation to the average number of citations of other similar papers according to subject area, year of publication, and type of document. These are more equitable weighted values that reduce biases in the identification of citation patterns (**Torres-Salinas *et al.***, 2018).

In the case of *Scopus* (*Elsevier*), which has more journals and subject classifications than *Web of Science* (*Clarivate*) (**Baas *et al.***, 2020; **Okagbue *et al.***, 2020), the most noteworthy metrics include: *SCImago Journal Rank (SJR)*, which weights the value of scientific contributions according to the prestige of the platform on which they appear, based on its relative position by quartile (**Calò**, 2022); *Field-weighted citation impact (FWCI)*, a standardized indicator for assessing the comparative scientific impact that a contribution has had, according to the citations received in analogous scientific publications in similar subjects or areas of knowledge in the year of publication and in the following 3 years; and CiteScore, which indicates a journal's impact based on the average number of citations received during a given year and in the previous 3 years divided by the articles published during that year and the previous 3 years (**Calò**, 2022). These indicators are relevant for this research because they provide a more accurate, reliable, and context-specific view of scientific impact.

## 5. Objectives and Methodology

This descriptive and exploratory study is based on an initial hypothesis that there are substantial differences in terms of both the communication and the scientific dissemination of the European projects under study. The main objective of the case study is to analyze the effectiveness of communication and the quality of dissemination and scientific impact of the European projects from *Horizon 2020* and *Horizon Europe* developed using the citizen science methodology and artificial intelligence as a disruptive technology. To achieve this objective, four specific objectives were established:

1. To determine the main formats and channels used in the projects' communication strategies, as well as which category the projects' papers fall into.
2. To analyze the effectiveness of the projects' scientific dissemination using the articles published in *Scopus* according to subject area.
3. To analyze the quality of the scientific impact of the articles that the projects produced based on the academic journals in which they have been published.
4. To evaluate the specific and comparative impact of the articles that the projects produced using standardized metric indicators.

Descriptive exploratory analyses are used for specific objectives 1, 2, and 3 and correlational analysis for objective 4.

The *CORDIS* database, the official repository collecting projects and results funded by the various framework programs of the *European Commission* (as of January 31, 2024), was used as a source of secondary documentary information in project selection. The methodological process used for our research was structured in five stages:

1. A search for preliminary projects representative of the universe of study: the *CORDIS* repository was searched using keywords (citizen science, artificial intelligence, and citizen science and artificial intelligence). A total of 59 potentially relevant projects were identified (Annex I).
2. Selection, according to criteria, of final projects representative of the sample: the relevance of the projects identified in the previous stage was determined, using dichotomous exclusive categories, allowing us to check for initiatives or activities grounded in citizen science and artificial intelligence both on the projects' websites and in the documentation on *CORDIS* (deliverables[1] and scientific articles). In all, 28 projects were identified (Table 1): 26 belong to *Horizon 2020* and 2 to *Horizon Europe*.

[1]Documents submitted to *CORDIS* that projects funded by *Horizon 2020* and *Horizon Europe* must deliver under the conditions of their contract: we selected those that mentioned communication about the project, citizen science being applied during its undertaking, and the use of artificial intelligence at some phase in the process.

Table 1: *Horizon 2020* and *Horizon Europe* Projects Using Citizen Science Methodology and AI.

| Number | Acronym | Project |
|---|---|---|
| 1 | **CROWD4SDG**<br>ID 872944<br>https://crowd4sdg.eu | **Citizen Science for Monitoring Climate Impacts and Achieving Climate Resilience**<br>**Objective:** analyze how CS is applied in measuring progress toward reaching the SDGs, focusing on monitoring extreme climate impacts and strengthening community resilience to climate disasters. AI and machine learning applied in its methodology.<br>**Coordinator:** *Université de Geneve* (Switzerland) |
| 2 | **RECLAIM**<br>ID 101070524<br>https://www.reclaim-project.eu/project/ | **AI-Powered Robotic Material Recovery in a Box**<br>**Objective:** develop a portable robotic unit for material recovery with proven technologies in robotics, AI, and data analysis. Supplement with CS for innovative solutions to current industrial challenges.<br>**Coordinator:** *Universidad Politécnica de Madrid* (Spain) |
| 3 | **STARS4ALL**<br>ID 688135<br>http://stars4all.eu | **A Collective Awareness Platform for Promoting Dark Skies in Europe**<br>**Objective:** develop an incubation platform for light pollution initiatives from specialized working groups. Use of crowdfunding tools, citizen participation, and digital technologies such as data acquisition through instruments and through games played by the public.<br>**Coordinator:** *Universidad Politécnica de Madrid* (Spain) |
| 4 | **ENJOI**<br>ID 101006407<br>https://enjoiscicomm.eu | **Engagement and Journalism Innovation for Outstanding Open Science Communication**<br>**Objective:** examine the role that engagement plays in fighting fake news and develop standards and principles for science communication through co-creative methodologies. It also intends to create a collaborative journalism monitoring center and explores using AI to optimize science communication.<br>**Coordinator:** *Formicablu SRL* (Italy) |
| 5 | **NEWSERA**<br>ID 873125<br>https://newsera2020.eu | **Citizen Science as the New Paradigm for Science Communication**<br>**Objective:** transform science communication through CS by evaluating science communication strategies aimed at stakeholders in European CS programs. Analyze case studies and advance examples of projects that apply AI in CS.<br>**Coordinator:** *Science for Change, S.L.* (Spain) |
| 6 | **PARCOS**<br>ID 872500<br>https://parcos-project.eu | **Participatory Communication of Science**<br>**Objective:** improve communication and public participation in science by creating interactive science stories that link to the source material, allowing the public to interpret the data and results for themselves, using the project's own tools. It also studies AI experiences.<br>**Coordinator:** *Lappeenrannan-Laheden Teknillinen Yliopisto Lut* (Finland) |
| 7 | **TRESCA**<br>ID 872855<br>https://trescaproject.eu | **Trustworthy, Reliable and Engaging Scientific Communication Approaches**<br>**Objective:** analyze public trust in social science communication, using large-scale experimental surveys and qualitative research, seeking to increase the production, exchange, and consumption of scientific communication specialized in digitization and automation.<br>**Coordinator:** *Erasmus Universiteit Rotterdam* (The Netherlands) |
| 8 | **RETHINK**<br>ID 824573<br>https://www.rethinkscicomm.eu | **RETHINK**<br>**Objective:** explore how science communication faces digitization, analyzing barriers and inequalities that affect the interaction between science and society. In addition to CS, it evaluates science communication practices in Europe and collects opinions from the research and innovation sectors in relation to challenges such as food security, climate change, AI, and COVID-19.<br>**Coordinator:** *Stichting VU* (the Netherlands) |
| 9 | **QUEST**<br>ID 824634<br>https://questproject.eu | **Quality Management Investments for Energy Efficiency**<br>**Objective:** study how to improve scientific communication through journalism and social networks. Develop quality indicators and support tools. Promote community interaction in science, addressing challenges such as climate change, vaccines, and AI, among others.<br>**Coordinator:** *Synavision GMBH* (Germany) |
| 10 | **COACT**<br>ID 873048<br>http://coactproject.eu | **Co-designing Citizen Social Science for Collective Action**<br>**Objective:** promote an innovative approach to engaging vulnerable citizens as co-researchers for specific social challenges. Explores using AI to support their inclusion in collaborative research, and its use for data analysis and evidence-based decision-making.<br>**Coordinator:** *Universitat de Barcelona* (Spain) |
| 11 | **WENET**<br>ID 823783<br>https://www.internetofus.eu | **WeNet –The Internet of Us**<br>**Objective:** improve human interactions through a social platform that uses AI to understand diversity. Develop profiles based on previous behaviors and interactions, using learning models to connect compatible people, fostering relationships across disparate cultural and geographic contexts.<br>**Coordinator:** *Universita Degli Studi Di Trengo* (Italy) |
| 12 | **REINFORCE**<br>ID 872859<br>https://www.reinforceeu.eu | **Research Infrastructures for Citizens in Europe**<br>**Objective:** reduce the knowledge gap between science and society by applying CS in advanced physics. Analyze data from the KM3NeT neutrino telescope with citizen help, boosting scientific understanding and fighting anti-intellectual prejudice. Apply AI to prove its usefulness in research.<br>**Coordinator:** *European Gravitational Observatory* (Italy) |
| 13 | **MICS**<br>ID 824711<br>https://mics.tools | **Developing Metrics and Instruments to Evaluate Citizen Science Impacts on the Environment and Society**<br>**Objective:** develop tools that use AI to evaluate the impact and cost of CS in sectors such as society, economy, environment, science, and governance. Its objective is to provide a deeper understanding of the value and effect of CS, improving the way its impact is measured.<br>**Coordinator:** *Conservation Education and Research Trust* (United Kingdom) |
| 14 | **ACTION**<br>ID 824603<br>https://actionproject.eu | **Participatory Science Toolkit against Pollution**<br>**Objective:** leverage CS to fight pollution by training volunteers to lead initiatives and use the results in policy formulation. Its accelerator supports projects aligned with the SDGs and creates supporting tools, including a study on the perception of AI in participatory science.<br>**Coordinator:** *King's College London* (United Kingdom) |
| 15 | **INCREASE**<br>ID 862862<br>https://pulsesincrease.eu | **Intelligent Collections of Food Legumes Genetic Resources for European Agrofood Systems**<br>**Objective:** improve the management and use of genetic resources for legumes to strengthen legume crops in Europe. Uses CS and AI to improve the management of these resources.<br>**Coordinator:** *Universita Politecnica Delle Marche* (Italy) |
| 16 | **VIDIS**<br>ID 952433<br>https://vidis-project.org | **Virtual Centre for Distributed Atmospheric Sensing for Reduction of Pollution Pressures**<br>**Objective:** to improve air pollution monitoring technology. This includes using CS and AI to improve the ability to detect and understand air quality, creating new opportunities for monitoring and collaborative research in the field.<br>**Coordinator:** *Univerzitet u Begradu* (Serbia) |
| 17 | **SAFERS**<br>ID 869353<br>https://safers-project.eu | **Structured Approaches for Forest Fire Emergencies in Resilient Societies**<br>**Objective:** improve society's ability to cope with forest fires by developing an emergency management system using Big Data, advanced models, and AI. Integrates Earth observation data, social networks, and mobile applications to act in all stages and spheres of emergency management.<br>**Coordinator:** *Fundazione Links* (Italy) |
| 18 | **RESET**<br>ID 101017857<br>https://www.h2020reset.eu | **Restarting the Economy in Support of Environment, through Technology**<br>**Objective:** restructure economic systems according to the Green New Deal, taking advantage of available technologies and environmental solutions. Uses spatial models, AI, and interoperable environmental sensors to reconfigure agricultural and urban development in Europe, assessing impacts on employment and the economy.<br>**Coordinator:** *King's College London* (United Kingdom) |
| 19 | **RE-SAMPLE**<br>ID 965315<br>https://www.re-sample.eu | **RE-SAMPLE**<br>**Objective:** facilitate timely and preventive care for patients with complex chronic diseases. Applies AI to preserve privacy in a personalized care model, and a citizen science approach to ensure data quality and meet patient needs.<br>**Coordinator:** *Universiteit Twente* (the Netherlands) |
| 20 | **ILIAD**<br>ID 101037643<br>https://www.ocean-twin.eu | **Integrated Digital Framework for Comprehensive Maritime Data and Information Services**<br>**Objective:** develop a digital twin of the ocean to analyze the impact of climate change. Use AI to integrate data and forecast the future for the marine environment, and establish a marketplace to distribute applications, CS data, and value-added services.<br>**Coordinator:** *Netcompany-Intrasoft* (Belgium) |
| 21 | **SMARTLAGOON**<br>ID 101017861<br>https://www.smartlagoon.eu | **Innovative Modelling Approaches for Predicting Socio-environmental Evolution in Highly Anthropized Coastal Lagoons**<br>**Objective:** develop a tool for real-time monitoring, analysis, and management of coastal lagoons in Europe, focusing on Mar Menor. Address its environmental degradation through advanced technology and citizen participation.<br>**Coordinator:** *Fundación Universitaria San Antonio* (Spain) |

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|---|---|---|
| 22 | **SCOREWATER**<br>ID 820751<br>http://www.scorewater.eu | **Smart City Observatories Implement Resilient Water Management**<br>**Objective:** develop online services to improve water management and increase cities' resilience to climate change. Involves the community in developing solutions and uses AI to optimize water management, offering business opportunities for small water and technology companies.<br>**Coordinator:** *IVL Svenska Miljoeinstitutet AB* (Sweden) |
| 23 | **DALI**<br>ID 695662<br>http://www.dali-ambiguity.org | **Disagreements and Language Interpretation**<br>**Objective:** deal with disagreements in natural language interpretation through computational methods. Develops online games to collect Big Data and coordinates work on CS projects, thus involving the analysis of large volumes of data, their interpretation, and the creation of specialized content.<br>**Coordinator:** *Queen Mary University of London* (United Kingdom) |
| 24 | **EOSC-NORDIC**<br>ID 857652<br>https://www.eosc-nordic.eu | **EOSC-NORDIC**<br>**Objective:** promote open research and innovation in Nordic and Baltic countries to leverage the EU's CS cloud potential. Apply CS and AI to coordinate initiatives and improve research infrastructure.<br>**Coordinator:** *Nordforsk* (Norway) |
| 25 | **RISE**<br>ID 739578<br>http://www.rise.org.cy | **Research Centre in Interactive Media, Smart Systems and Emerging Technologies**<br>**Objective:** establish a Center of Excellence in Cyprus to connect scientific research and innovation, focusing on emerging technologies and interactive media. Apply CS and AI to advance research and technology development.<br>**Coordinator:** *Lefkosia Municipality* (Cyprus) |
| 26 | **PANELFIT**<br>ID 788039<br>https://www.panelfit.eu | **Participatory Approaches to a New Ethical and Legal Framework for ICT**<br>**Objective:** help companies adapt to changes in information and communication technology regulations. Uses AI to create ethical and legal standards, involving citizens in developing them.<br>**Coordinator:** *Universidad del País Vasco* (Spain) |
| 27 | **DEEP-HYBRID DATA CLOUD**<br>ID 777435<br>https://deep-hybrid-datacloud.eu | **Designing and Enabling E-infrastructures for Intensive Processing in a Hybrid DataCloud**<br>**Objective:** promoted e-infrastructures for EU researchers using state-of-the-art technologies, such as deep learning, in the exploitation of large sources of data. In addition, it is involved in determining new requirements of CS.<br>**Coordinator:** *Agencia Estatal Consejo Superior de Investigaciones Científicas* (Spain) |
| 28 | **OEMC**<br>ID 101059548<br>https://earthmonitor.org | **Open-Earth-Monitor Cyberinfrastructure**<br>**Objective:** use Earth observation data to generate easily accessible, high-quality environmental information to support the European Green Deal. Use AI and encourage citizen participation in science for better monitoring of biodiversity and the environment, thereby helping improve citizens' quality of life and companies' competitive advantages.<br>**Coordinator:** *Stichting Opengeohub* (The Netherlands) |
| Source: **CORDIS** (2024). | | |

3. Configuration of the corpus of analysis: the documentation from each of the 28 projects in which citizen science and artificial intelligence are explicitly mentioned was downloaded from *CORDIS* to analyze communication regarding the projects and their scientific dissemination (deliverables and 234 scientific articles indexed in *Scopus*).
4. Designing of the Code Book (Annex II) and content analysis (**Wilson**, 2011) of the communication regarding the projects through the deliverables, and training for coding the units of analysis and objectivity check using the intercoder reliability process (**Piñeiro-Naval**, 2020): a percent agreement observed (PAo) index of 93% (higher than the desirable index of 80%) allowed us to confirm that the data were coded on the basis of similar interpretations.
5. Establishment of metric indicators for analyzing the scientific impact of articles indexed in *Scopus* (**Migani**, 2023; **Calò**, 2022; **Okagbue *et al.***, 2020): quartile ranking of the journal in which they were published (SJR), impact of its citations weighted by scientific field *(Field-weighted citation impact)*, and the journal's average citation impact in *Scopus (CiteScore)*.

## 6. Research Results

The results presented herein are the main formats and channels that the projects under study used for communication and the category the projects' papers fell into (specific objective 1), their main areas of research and the publication of articles as scientific dissemination (specific objective 2), and the quality of the scientific impact based on the articles published in *Scopus*, according to their position by quartile (specific objective 3).

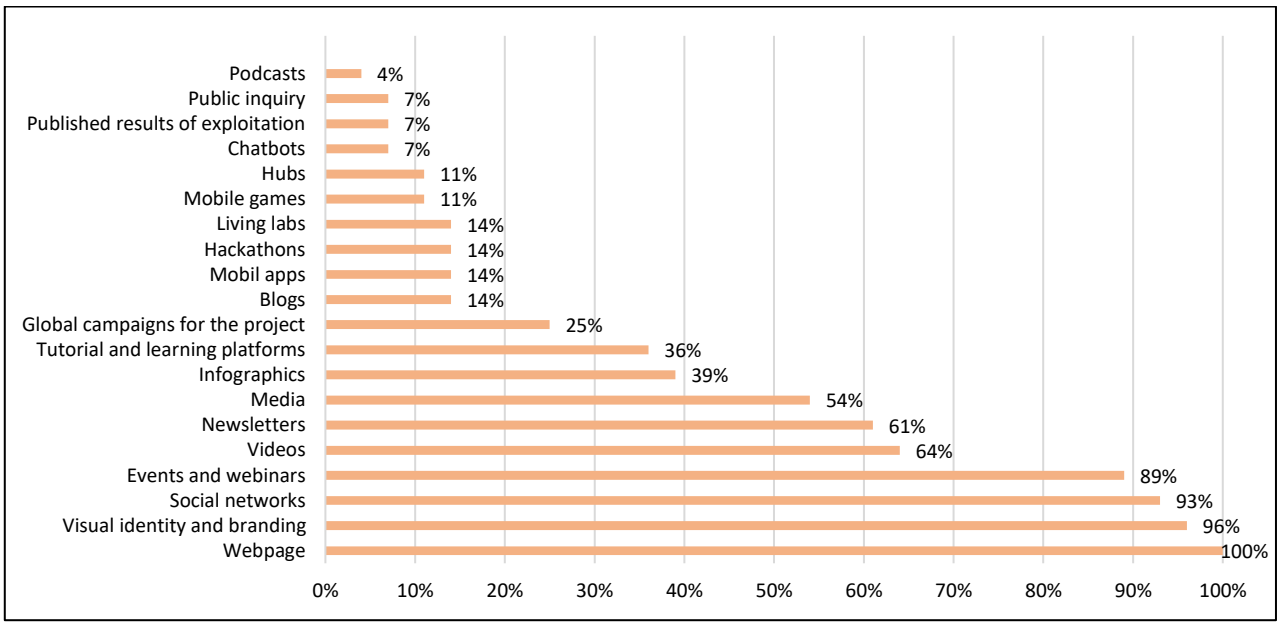


Figure 1: Formats and Channels Used for Communication in *Horizon 2020* and *Horizon Europe* Projects (with CS Methodology and AI).

Figure 1 illustrates the distribution of the formats and channels that the projects used for communication. It is evident that a wide range of resources were used; however, the ones used most were those that the *European Commission* itself required, such as the website (100%), a visual brand identity with a logo design and its graphic applications (96%), social media profiles (93%), and events and webinars (89%). Of the moderately used resources, audiovisual content creation (64%), the creation and dissemination of newsletters (61%), the management of media relations (54%), infographics (39%), and learning platforms with tutorials (36%) stood out. If we look at more traditional communication strategies –global campaign projects (25%) and advertising of specific operating results (7%)– we can see that their integration was considerably reduced in the different stages of the project; this was even more pronounced in formats linked to digital technologies and AI, such as mobile applications (14%), mobile games (11%), chatbots (7%), and podcasts (4%). Meanwhile, other activities aimed at stakeholder involvement and participation, such as living labs and hackathons (14%, respectively), hubs (11%), and public inquiry (7.14%), were shown to be activities specific to the citizen science methodology.

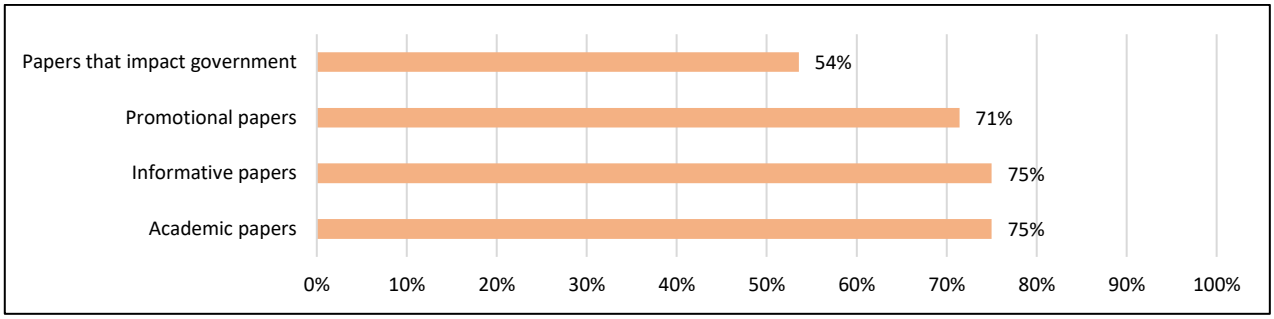


Figure 2: Categories that the Papers Produced by *Horizon 2020* and *Horizon Europe* Projects (with CS Methodology and AI) Fell Into.

Figure 2 presents the percentage distribution of the categories of the papers produced by the projects included in the sample, as products created for dissemination. The prevalence of academic and informative papers is evident (75%, respectively), followed by promotional material (71%). There was significant production of specialized materials such as factsheets, policy briefs, and specialized reports (54%), aimed at using this dissemination strategy to influence the government in their development of future public policies.

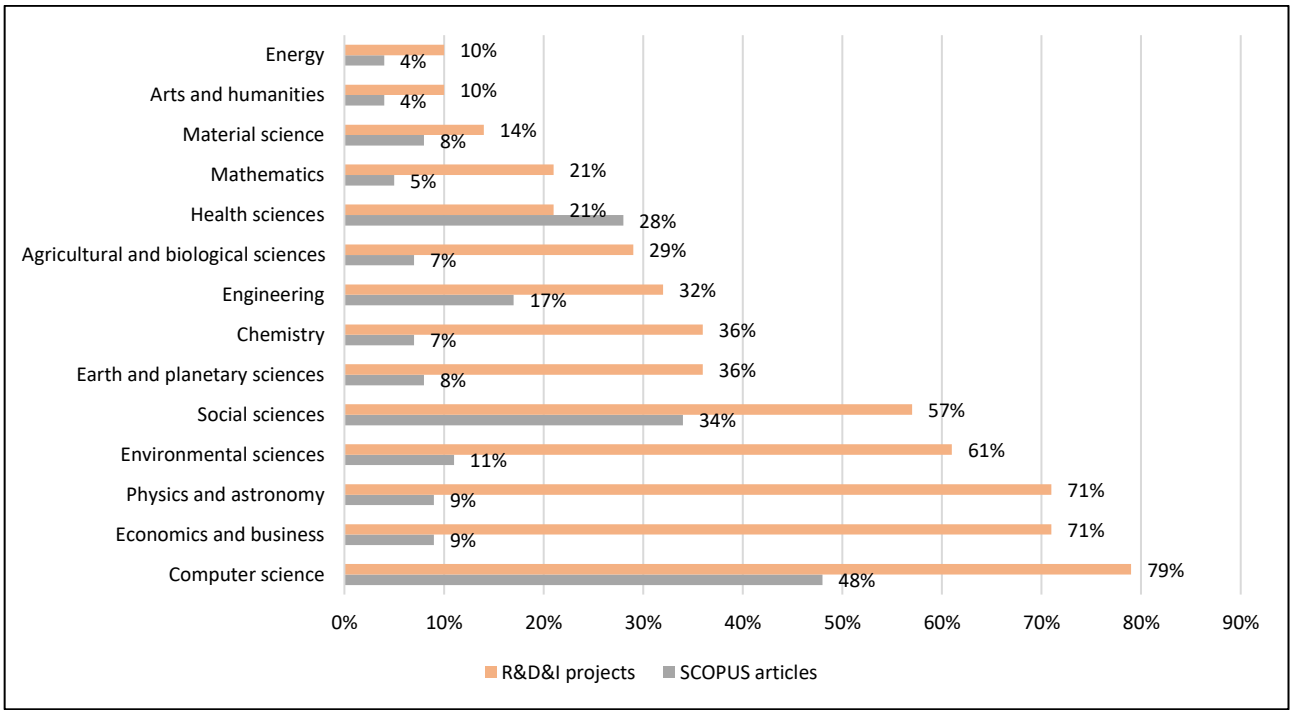


Figure 3: Subject Areas of the *Horizon 2020* and *Horizon Europe* Projects (with CS Methodology and AI) and Articles Published in *Scopus*.

Figure 3 reflects the interdisciplinarity of the 28 projects analyzed and the articles produced by them published in *Scopus* as a means of scientific dissemination. In this sense, it is observed that more than 50% of the projects funded by the *Horizon 2020* and *Horizon Europe* framework programs focused on subject areas such as computer sciences (79%), economics and business, physics and astronomy (71%, respectively); environmental sciences (61%); and social sciences (57%). It is particularly of note that the production of scientific articles in *Scopus* focused on the subject areas of computer sciences (48%) and social sciences (34%), along with health sciences (28%), despite the fact that research projects with this focus had a lower impact (21%).

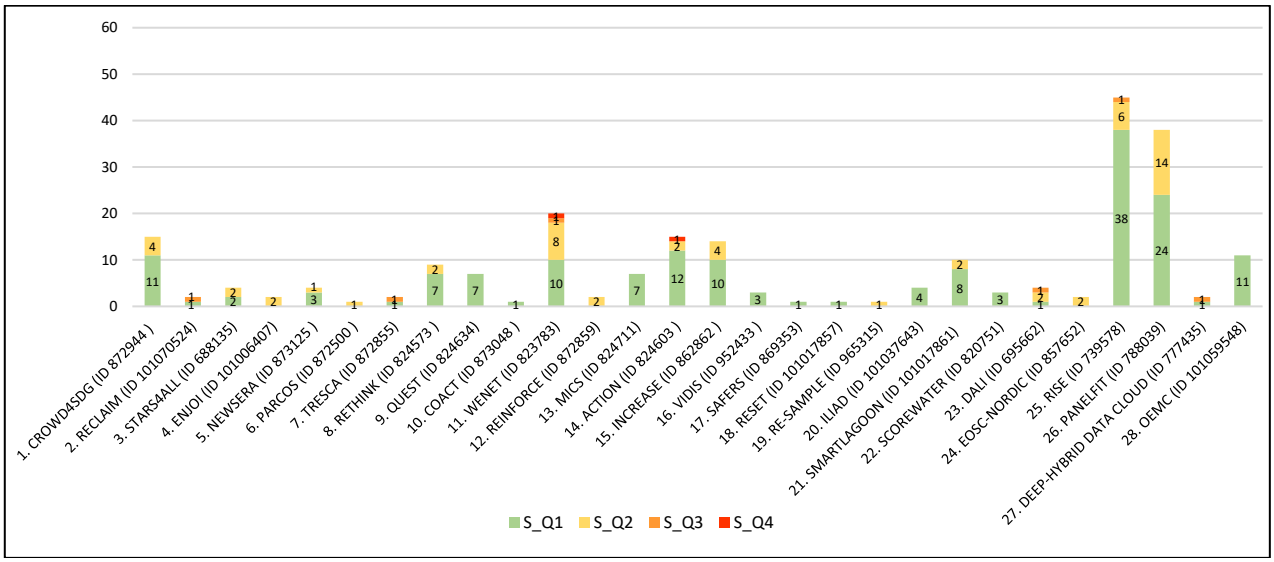


Figure 4: Impact Quality of Articles Produced by *Horizon 2020* and *Horizon Europe* Projects (with CS Methodology and AI) in *Scopus*. S_Q1, Quartile 1 of *Scopus*; S_Q2, Quartile 2 of *Scopus*; S_Q3, Quartile 3 of *Scopus*; S_Q4, Quartile 4 of *Scopus*.

Figure 4 presents dissemination related to projects via academic articles published on *Scopus* and their scientific quality, based on the categorization of journals (SJR) and their quartile ranking (2022). Of the 28 projects representing the study sample, the following stand out: RISE (45 articles), PANELFIT (38 articles), WENET (19 articles), CROWD4SDG (15 articles), ACTION (15 articles), INCREASE (14 articles), and OEMC (11 articles). These articles present the following key topics from the subject areas highlighted in Figure 3: emerging technologies and interactive media, information and communication technology, ethical and legal standards through AI implementation, human interactions and their diversity in cultural and geographical contexts, reaching the SDGs, genetic resources, biodiversity, environment, and climate change.

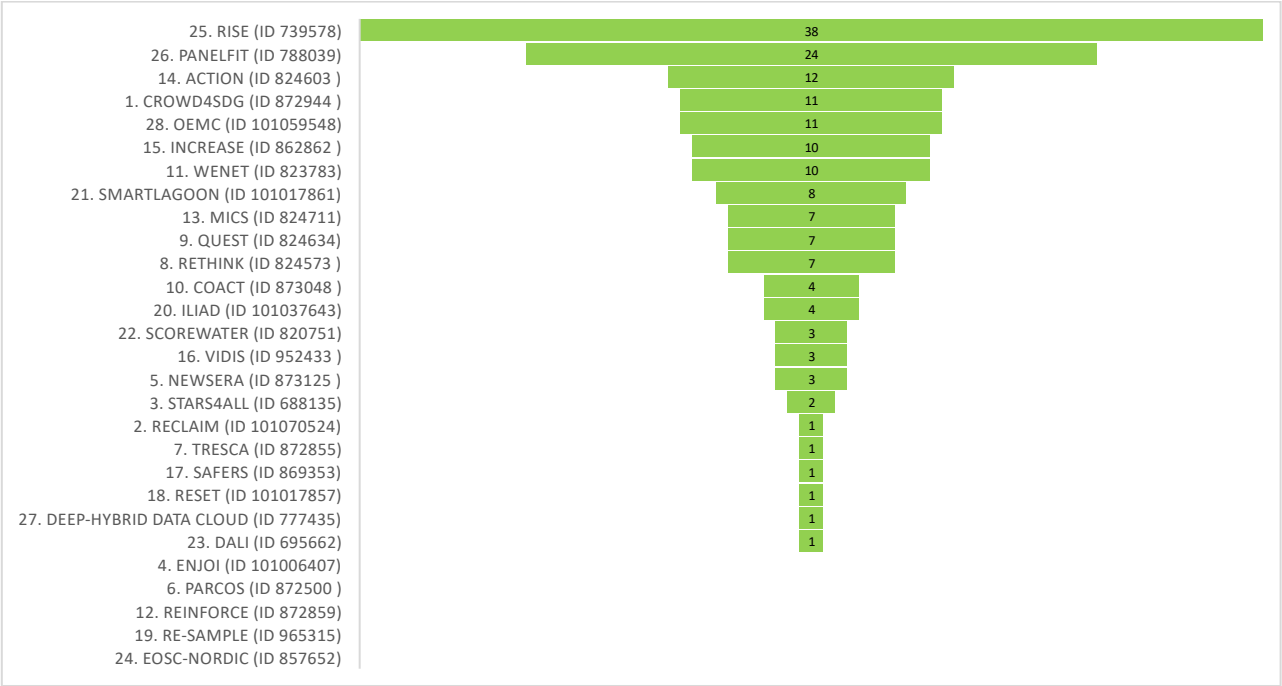


Figure 5: *Scopus* Q1 Articles Produced by *Horizon 2020* and *Horizon Europe* Projects (with CS Methodology and AI).

Figure 5 presents two projects that stand out because they have a very high number of articles published in *Scopus* Q1 journals: RISE (with 38 articles) and PANELFIT (with 24 articles). This indicates the effectiveness and quality of the dissemination strategy used in both projects, which, through citizen science and AI, have made scientific contributions regarding emerging technologies, interactive media, and development of ethical and legal standards. The projects are presented in descending order to reflect the level of scientific impact in journals positioned in the first quartile of *Scopus*, with projects with few papers or no publications having modest or no representation, respectively.

Following the results from Figures 1, 2, 3, 4, and 5, Table 2 presents a correlational analysis of the academic articles produced by the projects based on the standardized impact indicators *Field-weighted citation impact (FWCI)* and *CiteScore* from *Scopus* (specific objective 4).

Table 2: Metric Analysis Using *FWCI* and *CiteScore* of Articles Produced by *Horizon 2020* and *Horizon Europe* Projects (with CS methodology and AI).

| Project | FWCI | | CiteScore | | Pearson corr. | Spearman corr. |
|---|---|---|---|---|---|---|
| | Average | Standard Deviation | Average | Standard Deviation | | |
| 1. CROWD4SDG (ID 872944) | 1,40 | 1,41 | 8,14 | 5,69 | 0,34 | 0,59 |
| 2. RECLAIM (ID 101070524) | 1,23 | 0,21 | 4,85 | 1,34 | -1 | -1 |
| 3. STARS4ALL (ID 688135) | 2,21 | 1,48 | 8,18 | 4,52 | 0,86 | 0,74 |
| 4. ENJOI (ID 101006407) | 0,58 | - | 3,10 | | | |
| 5. NEWSERA (ID 873125) | 0,58 | | 3,10 | | | |
| 6. PARCOS (ID 872500) | 0,31 | | 4,90 | | | |
| 7. TRESCA (ID 872855) | 0,51 | 0,49 | 2,60 | 2,97 | 1 | 1 |
| 8. RETHINK (ID 824573) | 0,58 | | 3,10 | | 0,18 | 0,28 |
| 9. QUEST (ID 824634) | 2,08 | 1,85 | 6,77 | 3,61 | 0 | -0,43 |
| 10. COACT (ID 873048) | 1,93 | 1,24 | 8,03 | 7,62 | -0,39 | -0,11 |
| 11. WENET (ID 823783) | 1,21 | 1,15 | 5,30 | 2,62 | 0,43 | 0,51 |
| 12. REINFORCE (ID 872859) | 4,56 | | 3,20 | | | |
| 13. MICS (ID 824711) | 1,49 | 0,59 | 7,69 | 2,42 | 0,39 | -0,04 |
| 14. ACTION (ID 824603) | 1,39 | 1,24 | 7,54 | 4,01 | 0,4 | 0,48 |
| 15. INCREASE (ID 862862) | 1,56 | 0,94 | 10,18 | 7,97 | 0,53 | 0,23 |
| 16. VIDIS (ID 952433) | 0,84 | 0,97 | 4,50 | 0,00 | 0,29 | 0 |
| 17. SAFERS (ID 869353) | 0,58 | - | 9,00 | | | |
| 18. RESET (ID 101017857) | 0,92 | | 10,90 | | | |
| 19. RE-SAMPLE (ID 965315) | 0,37 | | 3,20 | | | |
| 20. ILIAD (ID 101037643) | 1,05 | 0,87 | 9,43 | 4,56 | -0,45 | -0,63 |
| 21. SMARTLAGOON (ID 101017861) | 2,18 | 1,07 | 9,68 | 4,62 | 0,25 | 0 |
| 22. SCOREWATER (ID 820751) | 1,21 | 1,09 | 10,73 | 9,78 | 0,99 | 0,5 |
| 23. DALI (ID 695662) | 1,22 | 0,93 | 4,63 | 2,00 | 0,52 | 0,8 |
| 24. EOSC-NORDIC (ID 857652) | 3,05 | 3,05 | 4,25 | 3,04 | 1 | 1 |
| 25. RISE (ID 739578) | 5,86 | 26,59 | 8,90 | 4,56 | 0,6 | 0,15 |
| 26. PANELFIT (ID 788039) | 0,98 | 0,85 | 18,75 | 17,75 | 0,47 | 0,47 |
| 27. DEEP-HYBRID DATA CLOUD (ID 777435) | 3,90 | | 9,00 | | 1 | 1 |
| 28. OEMC (ID 101059548) | 3,35 | 3,23 | 21,75 | | 0,32 | 0,54 |

The analysis of *FWCIs* and *CiteScores* is performed for each project, using the mean and standard deviation to measure the average value and variation of the data, respectively. The mean determines the average FWCI and CiteScore using all the articles from the same project, whereas the standard deviation reveals the consistency or variability of scientific impact. Subsequently, *Pearson and Spearman correlation coefficients* were used to evaluate the relationship between *FWCIs* and *CiteScores*: The former identifies the direct linear relationship, assessing how one indicator varies in proportion to the other; the latter detects monotonic relationships between them. Not a Number (NaN) values (no data in the table), particularly prevalent in the correlation and standard deviation measures, show that some projects may have had insufficient or consistent data that prevented the calculation of these statistics.

The *FWCIs*[2] are displayed as averages ranging from a minimum of 0,31 (PARCOS project) to a maximum of 5,86 (RISE project), reflecting considerable variability in citation impact. Of the projects, 18 (64,3%) obtained a good *FWCI* by exceeding 1. The standard deviation of the *FWCI* underscores this asymmetric distribution, with minimum values of 0,21 and maximum values of 26,59, showing a significant variation in terms of the consistency of the impact.

Regarding *CiteScores*[3], all projects obtained a value higher than 2, with a minimum of 2,60 (TRESCA project) and a maximum of 21,75 (OEMC project). Five projects (17,8%) had an exceptional impact (greater than 10) in terms of the quality of the journal in which the articles were published, and the rest confirmed that citation values among the projects were heterogeneous. Therefore, our findings indicate that both *FWCIs* and *CiteScores* exhibit significant variability, reflecting substantial differences in terms of the citation impact of the articles and the quality of the scientific journals in which they were published.

*Spearman's correlation coefficient* measures the monotonic relationship between the *FWCI* and *CiteScore*, assessing how one variable increases or decreases with the other. This coefficient also varied between projects, with values ranging from −1 (negative correlation) to 1 (positive correlation). The average *Spearman* value for the projects was 0,292, indicating a weak overall positive monotonic correlation. In the analysis, *Spearman* values ranged from −1 to 1, reflecting both strong negative and positive correlations in different projects. This suggests that, although there is a slight tendency for a higher *FWCI* to be associated with a higher CiteScore, the relationship was not uniform across the board.

[2]The *FWCI* measures the citation impact of an article compared with the overall average in the same field. An FWCI of 1,0 indicates an average impact, in which an article received as many citations as would be expected overall. An *FWCI* greater than 1,0 indicates a better than average impact score, whereas an *FWCI* lower than 1,0 indicates a below-average impact.

[3]*CiteScore* measures the impact of a journal by calculating the average number of citations received by the article during a period of 3 years. A value of 1,0 indicates that each article, on average, received one citation; a score greater than 2,0 is considered a good level of impact; a score greater than 5,0 indicates a very high level of impact; and scores above 10,0 reflect an exceptional level of impact, indicating huge influence in the scientific community.

Both coefficients indicated a weak positive correlation between *FWCIs* and *CiteScores*, showing that, although there was a slight tendency for articles with higher *FWCIs* to be published in journals with higher *CiteScores*, the relationship was not strong. The difference between the projects' *Pearson and Spearman coefficients* also reflected this nonlinearity as well as extreme values in the data, with the Spearman coefficient demonstrating greater sensitivity. As a result, despite the positive correlation between the two variables, it has been confirmed that other factors that could influence the *FWCI* and *CiteScore*, such as the key topic areas of research in the *Horizon 2020* and *Horizon Europe* projects or the quality of the scientific impact of the articles produced by them according to quartiles, must be taken into account.

## 7. Discussion and Conclusions

The *Horizon 2020* and *Horizon Europe* framework programs have been the leading benchmarks when it comes to promoting projects developed using citizen science that have incorporated disruptive technologies such as artificial intelligence in their design, implementation, and dissemination of results. Citizen science, by encouraging citizens to collaborate actively in research, is one of the basic tenets of open science and promotes a new social culture rooted in public participation and engagement with scientific research. Regarding the above-mentioned interplay between communication science and citizen science, studies such as that of **Gertrudix *et al.*** (2020; 2021) have noted that it was necessary to analyze the effectiveness of communication policies and assess the dissemination and scientific impact of R&D&I projects. To this end, a sample was established according to project criteria, and three specific descriptive objectives and one correlational objective were defined.

The research results indicated that the formats and channels most frequently used in the communication strategies of the projects analyzed were websites, a visual brand identity, social network profiles, and events and webinars. With respect to the categories that the projects' papers fell into, it was observed that academic publications, along with informative publications, were the most prominent type in the projects' dissemination stage. A great deal of interdisciplinarity was seen in the topics of the projects analyzed, as well as in the scientific articles that the projects produced, with subject areas such as computer sciences, economic and business sciences, and physics and astronomy standing out.

Production for scientific dissemination (quantitative indicator) was measured on the basis of the number of articles indexed in *Scopus*. The quality of the impact of the articles (qualitative indicator) was determined using the journals' categorization in *SJR* according to quartiles: the most noteworthy articles were produced by the *Research Centre in Interactive Media, Smart Systems and Emerging Technologies* (*RISE*), *Participatory Approaches to a New Ethical and Legal Framework for ICT* (PANELFIT), and *WeNe*t –The Internet of Us (WENET) projects, whose contributions focused on the development of emerging technologies and interactive media, information and communication technology, ethical and legal standards, human interactions, reaching the SDGs, genetic resources, biodiversity, and the environment and climate change. These three projects showed high efficiency and quality in terms of their dissemination and scientific impact.

To supplement the assessment of the scientific impact of the articles that the analyzed projects produced, using the contributions of **Torres-Salinas *et al.*** (2018), **Okagbue *et al.*** (2020), and **Calò** (2022) as a starting point, a correlational analysis was carried out with two standardized metric indicators, allowing us to place the quality of the impact of academic publications into context using the *Field-weighted citation impact (FWCI)* and *CiteScore*. This analysis showed a weak positive correlation between the two indicators, and it was found that, despite a slight tendency for articles with higher *FWCI* to be published in journals with a high *CiteScore* value, the relationship between standardized indicators was not strong. In addition, the Pearson and Spearman coefficients were applied to the projects, and it was confirmed that other factors that could influence the *FWCI* and *CiteScore*, such as the most important subject areas in the *Horizon 2020* and *Horizon Europe* projects or the quality of the articles' scientific impact according to the SJR indicator, need to be considered.

In regard to *FWCIs*, the *Research Centre in Interactive Media, Smart Systems and Emerging Technologies* (*RISE*) project stood out, with a maximum value of 5.86. With regard to *CiteScores*, the *Open-Earth-Monitor Cyberinfrastructure* (*OEMC*) project had a maximum value of 21.75. Therefore, both projects had a higher scientific impact quality index than the rest of the consortia analyzed, according to the standardized indicators. The *Research Centre in Interactive Media, Smart Systems and Emerging Technologies* (*RISE*) project stood out for its efficiency and quality both in dissemination and in standardized scientific impact.

Therefore, the initial hypothesis that there are substantial differences in terms of both communication and the efficiency and quality of scientific dissemination of the European projects analyzed has been confirmed. This allows for the development of future strategies for disseminating results in the framework programs, which, alongside scientific communication and the exploitation of results, are fundamental instruments of the European Union's R&D&I policy. In this sense, communication science could help efficiently navigate challenges and opportunities in scientific communication.

For future lines of research, we propose using altimetric indicators (**Calò**, 2022) in addition to the bibliometric indicators used in this research. Scientific impact would thus reach the economic and social sphere, with the promotion and dissemination of results to a variety of stakeholders such as associations and networks, companies, public administrations, citizens, investors, end users, and the media (**Campillo-Alhama; Martínez-Sala**, 2017; **Zaken *et al.***, 2021; **Kieslinger *et al.***, 2022; **Pérez-Aliende**, 2023; **Campillo-Alhama**, 2011).

Adoption by consortia would lead to progress in assessing the social impact of R&D&I projects (**Ibercivis**, 2021). Using such indicators, the social impact could be assessed, identifying new working methods, AI algorithms, and technological tools implemented during the various stages of the projects. In addition, it would be possible to analyze the impact of formalized collaborations that emerge in citizen science and AI projects, identifying strategic alliances between academic institutions; nongovernmental, public, or private organizations; and citizen science communities, reflecting consortia's ability to bring together different interest groups for common scientific objectives.

## 8. Funding

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Annex 1: Universe of the Study: Preliminary Projects.

| Acronym | Cordis Fact Sheet | Web | Framework Program |
|---|---|---|---|
| 4D PICTURE | https://cordis.europa.eu/project/id/101057332 | https://4dpicture.eu/ | Horizon Europe |
| ACROSSING | https://cordis.europa.eu/project/id/676157 | http://www.acrossing-itn.eu/ | H2020 |
| ACTION | https://cordis.europa.eu/project/id/824603 | https://actionproject.eu/ | H2020 |
| AD4GD | https://cordis.europa.eu/project/id/101061001 | https://ad4gd.eu/ | Horizon Europe |
| AI4theSciences | https://cordis.europa.eu/project/id/945304 | Not available | H2020 |
| Arqus R.I. | https://cordis.europa.eu/project/id/101017448 | https://arqus-alliance.eu/research/arqus-ri/ | H2020 |
| AUGMENTED-HUMANS | https://cordis.europa.eu/project/id/101023024 | https://augmented-humans.com/ | H2020 |
| C2IMPRESS | https://cordis.europa.eu/project/id/101074004 | www.c2impress.com | Horizon Europe |
| CANVAS | https://cordis.europa.eu/project/id/700540 | https://mooc.canvas-project.eu/ | H2020 |
| CIO | https://cordis.europa.eu/project/id/740548 | https://cs.au.dk/research/pages/cio/ | H2020 |
| CitieS-Health | https://cordis.europa.eu/project/id/824484 | https://www.citieshealth.eu/ | H2020 |
| CoAct | https://cordis.europa.eu/project/id/873048 | https://coactproject.eu/ | H2020 |
| CONCISE | https://cordis.europa.eu/project/id/824537 | https://concise-h2020.eu/ | H2020 |
| COSMOS | https://cordis.europa.eu/project/id/788960 | https://www.cosmosproject.eu/ | H2020 |
| CROWD4SDG | https://cordis.europa.eu/project/id/872944 | https://crowd4sdg.eu/ | H2020 |
| CSI-COP | https://cordis.europa.eu/project/id/873169 | https://csi-cop.eu/ | H2020 |
| CULTUURCAMPUS | https://cordis.europa.eu/project/id/101079929 | https://www.putselaan.nl/ | Horizon Europe |
| DALI | https://cordis.europa.eu/project/id/695662 | https://dalicitizens.eu/ | H2020 |
| DEEP-HybridDataCloud | https://cordis.europa.eu/project/id/777435 | Off | H2020 |
| DiverSea | https://cordis.europa.eu/project/id/101082004 | https://ae4ria.org/ | Horizon Europe |
| ENJOI | https://cordis.europa.eu/project/id/101006407 | https://enjoiscicomm.eu/ | H2020 |
| EnviroCitizen | https://cordis.europa.eu/project/id/872557 | https://www.envirocitizen.eu/ | H2020 |
| EOSC-Nordic | https://cordis.europa.eu/project/id/857652 | https://www.eosc-nordic.eu/ | H2020 |
| EU-Citizen.Science | https://cordis.europa.eu/project/id/824580 | https://eu-citizen.science/ | H2020 |
| EXCITE2 | https://cordis.europa.eu/project/id/101131765 | Not available | Horizon Europe |
| GlobalSCAPE | https://cordis.europa.eu/project/id/101006436 | https://global-scape.eu/ | H2020 |
| GOT ENERGY | https://cordis.europa.eu/project/id/754382 | https://gotenergytalent.uah.es/ | H2020 |
| HumanE-AI-Net | https://cordis.europa.eu/project/id/952026 | https://www.humane-ai.eu/ | H2020 |
| ILIAD | https://cordis.europa.eu/project/id/101037643 | https://iliad-project.eu/ | H2020 |
| INCREASE | https://cordis.europa.eu/project/id/862862 | https://www.pulsesincrease.eu/es | H2020 |
| MICS | https://cordis.europa.eu/project/id/824711 | https://mics.tools/ | H2020 |
| NATALIE | https://cordis.europa.eu/project/id/101112859 | https://uwmh.eu/news/124-natalie-project.htm | Horizon Europe |
| NEWSERA | https://cordis.europa.eu/project/id/873125 | https://newsera2020.eu/ | H2020 |
| OBAMA-NEXT | https://cordis.europa.eu/project/id/101081642 | https://obama-next.eu/ | Horizon Europe |
| OEMC | https://cordis.europa.eu/project/id/101059548 | Not available | Horizon Europe |
| OptimCS | https://cordis.europa.eu/project/id/891052 | https://www.optics-project.eu/ | H2020 |
| PANELFIT | https://cordis.europa.eu/project/id/788039 | https://www.panelfit.eu/ | H2020 |
| ParCos | https://cordis.europa.eu/project/id/872500 | Off | H2020 |
| PataFEST | https://cordis.europa.eu/project/id/101084284 | https://www.patafest.eu/ | Horizon Europe |
| QUEST | https://cordis.europa.eu/project/id/824634 | https://questproject.eu/ | H2020 |
| RECLAIM | https://cordis.europa.eu/project/id/101070524 | https://www.reclaim-project.eu/project/ | Horizon Europe |
| REINFORCE | https://cordis.europa.eu/project/id/872859 | https://www.reinforceeu.eu/ | H2020 |
| RE-SAMPLE | https://cordis.europa.eu/project/id/965315 | https://www.re-sample.eu/ | H2020 |
| RESET | https://cordis.europa.eu/project/id/101017857 | https://wereset.eu/ | H2020 |
| RETHINK | https://cordis.europa.eu/project/id/824573 | https://www.rethinkscicomm.eu/ | H2020 |
| REUNICE | https://cordis.europa.eu/project/id/101035813 | https://eunice-university.eu/research/ | H2020 |
| RISE | https://cordis.europa.eu/project/id/739578 | http://www.rise-eu.org/ | H2020 |
| RNEst16-17 | https://cordis.europa.eu/project/id/722750 | http://www.researchersnight.ee/ | H2020 |
| SAFERS | https://cordis.europa.eu/project/id/869353 | https://safers-project.eu/ | H2020 |
| SCOREwater | https://cordis.europa.eu/project/id/820751 | https://www.scorewater.eu/ | H2020 |
| SMARTLAGOON | https://cordis.europa.eu/project/id/101017861 | https://www.smartlagoon.eu/ | H2020 |
| Solaris | https://cordis.europa.eu/project/id/101094665/fr | https://projects.illc.uva.nl/solaris/ | Horizon Europe |
| STARS4ALL | https://cordis.europa.eu/project/id/688135 | https://www.stars4all.eu/ | H2020 |
| SUNDIAL | https://cordis.europa.eu/project/id/721463 | Not available | H2020 |
| TOPIO | https://cordis.europa.eu/project/id/101131109 | https://topio.market/ | Horizon Europe |
| TRESCA | https://cordis.europa.eu/project/id/872855 | https://trescaproject.eu/ | H2020 |
| VIDIS | https://cordis.europa.eu/project/id/952433 | https://vidis-project.org/ | H2020 |
| WeCount | https://cordis.europa.eu/project/id/872743 | https://www.we-count.net | H2020 |
| WeNet | https://cordis.europa.eu/project/id/823783 | https://www.internetofus.eu/ | H2020 |

Annex 2: Code Book for Content Analysis of Horizon 2020 and Horizon Europe Project Communication.

| **Formats and Channels Used for Communication** | **Value** |
|---|---|
| (1) Webpage | Y/N |
| (2) Visual identity and branding | Y/N |
| (3) Social networks | Y/N |
| (4) Events and webinars | Y/N |
| (5) Videos | Y/N |
| (6) Newsletters | Y/N |
| (7) Media | Y/N |
| (8) Infographics | Y/N |
| (9) Tutorial and learning platforms | Y/N |
| (10) Global campaigns for the project | Y/N |
| (11) Blogs | Y/N |
| (12) Mobil apps | Y/N |
| (13) Hackathons | Y/N |
| (14) Living labs | Y/N |
| (15) Mobile games | Y/N |
| (16) Hubs | Y/N |
| (17) Chatbots | Y/N |
| (18) Published results of exploitation | Y/N |
| (19) Public inquiry | Y/N |
| (20) Podcasts | Y/N |
| (1) Academic papers | Y/N |
| (2) Informative papers | Y/N |
| (3) Promotional papers | Y/N |
| (4) Papers that impact government | Y/N |
| Project Topics | Value |
| (1) Computer science | Y/N |
| (2) Social sciences | Y/N |
| (3) Health sciences | Y/N |
| (4) Engineering | Y/N |
| (5) Environmental sciences | Y/N |
| (6) Economics and business | Y/N |
| (7) Physics and astronomy | Y/N |
| (8) Earth and planetary sciences | Y/N |
| (9) Material science | Y/N |
| (10) Agricultural and biological sciences | Y/N |
| (11) Chemistry | Y/N |
| (12) Mathematics | Y/N |
| (13) Arts and humanities | Y/N |
| (14) Energy | Y/N |
| * Articles Topics | Valor |
| (1) Computer science | Y/N |
| (2) Social sciences | Y/N |
| (3) Health sciences | Y/N |
| (4) Engineering | Y/N |
| (5) Environmental sciences | Y/N |
| (6) Economics and business | Y/N |
| (7) Physics and astronomy | Y/N |
| (8) Earth and planetary sciences | Y/N |
| (9) Material science | Y/N |
| (10) Agricultural and biological sciences | Y/N |
| (11) Chemistry | Y/N |
| (12) Mathematics | Y/N |
| (13) Arts and humanities | Y/N |
| (14) Energy | Y/N |

*(1) Artificial Intelligence; Computer Science; Computer Science Applications; General Computer Science; Software; Control and Systems Engineering; Computer Networks and Communications; Computer Graphics and Computer-Aided Design; Modeling and Simulation Computer Graphics and Computer-Aided Design; Computational Theory and Mathematics. (2) Multidisciplinary; Information Systems; Communication; General Social Sciences; Sociology and Political Science; Library and Information Sciences; Sociology and Political Science; Education; Information Systems and Management; Language Social and Linguistics; Media Technology Social Sciences. (3) Obstetrics and Gynecology; Radiation; General Pharmacology, Toxicology and Pharmaceutics; Biomedical Engineering; Public Health, Environmental and Occupational Health; Microbiology (medical); Safety Research; Cognitive Neuroscience; Health, Toxicology and Mutagenesis; Applied Psychology Human Factors and Ergonomics; Frontiers in Digital Health; Biotechnology; General Biochemistry; Genetics and Molecular Biology. (4) General Engineering; Instrumentation; Human Factors and Ergonomics. (5) General Environmental Science; Ecology; Plant Science; Geology; Foresty; Water Science and Technology. (6) Law; Statistics and Probability. (7) Mathematical Physics; Atomic and Molecular Physics, and Optics. (8) Space and Planetary Science; Earth and Planetary Sciences; General Earth and Planetary Sciences; Earth-Surface Processes; (9) Electronic; Optical and Magnetic Materials; General Materials Science; (10) Insect Science; Plant Science; Horticulture; Food Science. (11) Inorganic Chemistry. (12) Computational Theory and Mathematics; Numerical Analysis; Computational Mathematics; Applied Mathematics. (13) Visual Arts and Performing Arts; General Arts and Humanities; Arts and Humanities; Philosophy; Conservation. (14) Pollution; Renewable Energy, Sustainability and the Environment.