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D4.3 – Scientific competition and impact assessment

BINGO

Brain Imagined-Speech Communication

Greece 2.0
NATIONAL RECOVERY AND RESILIENCE PLAN

Funded by the European Union
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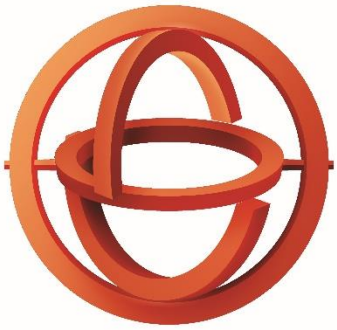

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The research project is implemented in the framework of H.F.R.I call "Basic research Financing (Horizontal support of all Sciences)" under the National Recovery and Resilience Plan "Greece 2.0" funded by the European Union – NextGenerationEU (H.F.R.I. Project Number: 15986).

Dissemination level:	Public (PU)
Contractual date of delivery:	Month 24, 27/11/2025
Actual date of delivery:	Month 24, 21/11/2025
Work Package:	WP4 Dissemination, communication and uptake of scientific results
Task:	T4.3 – Uptake of BINGO's results
Type:	Report
Approval Status:	Final
Version:	v1.0
Number of pages:	20
Filename:	D4.3_ScientificCompetition_ImpactAssessment.docx

Abstract: This deliverable reports on the scientific competition and impact assessment of the BINGO project at Month 24 (M24). It provides a structured and evidence-based overview of communication, dissemination, and uptake activities implemented during the project, alongside documentation of the design and submission of a scientific competition as a complementary dissemination instrument. The assessment covers scientific and societal dimensions of impact, drawing on documented dissemination outputs, conference participation, digital communication activities, and monitored engagement indicators. Particular emphasis is placed on the organisation and submission of the BINGO NATO Alphabet dataset to the Kaggle platform (decision still pending), which has the potential to establish an open and reproducible benchmarking framework for electroencephalography (EEG)-based imagined speech decoding. The deliverable demonstrates that, by M24, BINGO has implemented a coherent, monitored, and adaptive approach to communication, dissemination, and scientific competition activities, resulting in verifiable scientific outputs, sustained outreach, and the establishment of infrastructure supporting ongoing scientific engagement.

HISTORY

Version	Date	Reason	Revised by
v0.1	6/10/2025	Table of Contents	Fotis Kalaganis
v0.2	14/11/2025	Initial Draft	Fotis Kalaganis
v1.0	21/11/2025	Final Draft	Spiros Nikolopoulos

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ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
BCI	Brain–Computer Interface
D	Deliverable
EEG	Electroencephalography
EUSIPCO	European Signal Processing Conference
IEEE	Institute of Electrical and Electronics Engineers
M24	Month 24
NATO	North Atlantic Treaty Organization
WP	Work Package

Contents

INTRODUCTION

BACKGROUND

The present deliverable (D4.3) reports on the scientific competition and impact assessment of the BINGO project at Month 24 (M24). Its purpose is to provide a structured and evidence-based overview of the communication, dissemination, and uptake activities implemented during the project, as well as to document the organisation of a scientific competition carried out as part of these activities.

BINGO addresses the challenge of EEG-based imagined speech decoding, a research area characterised by high methodological complexity and relevance for assistive communication technologies. Within this context, communication and dissemination activities were implemented to support transparent reporting of research progress, facilitate exchange with the scientific community, and ensure accessibility of information beyond specialist audiences. These activities were complemented by the submission to the Kaggle platform of a scientific competition, which can provide an additional, focused framework for engaging external researchers and practitioners.

This deliverable addresses two complementary aspects. First, it examines the impact of BINGO's communication, dissemination, and uptake actions with respect to both scientific and societal dimensions. This includes an examination of how project activities and outputs contributed to scientific visibility, knowledge exchange, awareness raising, and engagement with relevant stakeholder groups. Second, the deliverable documents the actions undertaken to organise, curate, and submit the EEG data recorded under the NATO experimental protocol to the Kaggle platform. This effort aims to support the organisation of a scientific competition, conceived as a structured mechanism for external engagement, comparative benchmarking, and interaction with the broader research and innovation community, while promoting transparency, reproducibility, and wider reuse of the dataset.

The assessment presented in this report is based on verifiable evidence collected throughout the reporting period, including documented communication and dissemination actions, scientific outputs, participation in conferences and events, digital communication activities, and internal monitoring of Work Package (WP) 4 actions. By consolidating this information, the present deliverable provides a comprehensive overview of how communication, dissemination, and competition-related activities were implemented and how their impact can be characterised at the conclusion of the project.

OBJECTIVES AND SCOPE OF THE DELIVERABLE

A number of objectives were set for D4.3 to address the assessment of communication, dissemination, and scientific competition activities within the BINGO project. These are to:

- Evaluate the impact of BINGO's communication and dissemination activities in relation to the project's core scientific objectives, including progress in EEG-based imagined speech decoding.
- Assess societal and community-level impact in terms of awareness raising, accessibility of information, and engagement with relevant stakeholder groups.
- Document the implementation of the BINGO scientific competition, ensuring alignment with principles of transparency, fair evaluation, and open science.

- Analyse the role of the scientific competition in supporting methodological exploration, external validation, and future uptake of project outputs.

IMPACT ASSESMENT FRAMEWORK

OVERVIEW OF COMMUNICATION AND DISSEMINATION STRATEGY

Communication and dissemination activities within BINGO were implemented as coordinated, multi-channel processes designed to ensure visibility, accessibility, and structured uptake of project results. These activities were not treated as isolated actions but were embedded throughout the project lifecycle, evolving in parallel with scientific progress and milestone achievement. The communication component focused on raising awareness, explaining project objectives, and providing accessible information to non-specialist audiences, while dissemination activities prioritised the structured sharing of scientific knowledge through recognised academic and professional channels. Together, these actions supported knowledge exchange, transparency, and informed engagement across stakeholder groups. Consistency of messaging, accuracy of information, and alignment across channels were treated as core principles. Particular care was taken to avoid overstating impact, ensuring that all communication reflected achieved results and verifiable activities.

TARGET AUDIENCES

Communication and dissemination actions addressed a clearly defined set of target audiences:

- **Scientific and research community**, including researchers in signal processing, neuroscience, machine learning, and brain–computer interfaces, targeted primarily through publications, conferences, and scientific events.
- **Industry stakeholders**, particularly organisations active in neurotechnology and assistive communication, addressed through professional networks and conference visibility.
- **Healthcare professionals**, with an interest in emerging assistive technologies and communication systems, targeted through accessible summaries and outreach material.
- **Policy makers and regulators**, concerned with innovation, ethics, and governance of neurotechnologies, addressed through high-level communication outputs.
- **General public**, including non-specialist audiences, targeted through digital communication channels and simplified project updates.

Tailored communication approaches were applied to reflect differences in technical background, information needs, and preferred channels, ensuring that messages were appropriately framed, content depth was adapted to each audience, and dissemination formats were selected to maximise clarity, relevance, and engagement across stakeholder groups.

COMMUNICATION CHANNELS AND TOOLS

A combination of complementary communication and dissemination channels was employed to maximise reach, effectiveness, and continuity of outreach activities. Scientific dissemination relied primarily on peer-reviewed publications and participation in international conferences and scientific events, which provided established forums for presenting research outputs, receiving peer feedback, and engaging with the research community.

In parallel, digital communication channels were used to support continuous outreach and to amplify scientific dissemination activities beyond traditional academic settings. These channels enabled timely communication of project milestones, dissemination outputs, and competition-related updates, and supported interaction with a broader audience, including stakeholders who may not regularly engage through scientific venues.

In-person events played an important role in enabling direct interaction, discussion, and exchange of perspectives. These face-to-face engagements complemented digital and written communication by fostering dialogue, facilitating clarification of technical concepts, and strengthening engagement beyond one-way communication. Together, the combined use of scientific, digital, and in-person channels ensured coherent and sustained communication throughout the project.

IMPACT ASSESSMENT METHODOLOGY

BINGO's impact assessment approach is grounded in a structured and systematic methodology designed to capture the effects of communication, dissemination, and uptake activities across both scientific and societal dimensions. The approach follows the structure and monitoring logic defined in the project's Communication and Dissemination Plan and reflects the range of activities implemented under WP4, including project communication, scientific dissemination, stakeholder engagement, and structured monitoring through key performance metrics.

Impact assessment activities were implemented as an ongoing process rather than a single reporting exercise. A continuous monitoring cycle was applied, encompassing the planning, implementation, evaluation, and refinement of communication and dissemination actions. This ensured that activities were not only implemented as planned but were also reviewed in light of observed engagement, reach, and feedback. Such an approach supports consistency with defined communication goals, target audiences, and channels, while allowing for informed adjustments where appropriate.

Given the research-oriented nature of the project, the assessment focuses on demonstrable outputs, engagement metrics, and qualitative evidence of interaction and visibility, rather than on long-term uptake or downstream exploitation outcomes, which extend beyond the project timeframe.

INDICATORS AND DATA SOURCES

Impact was assessed using a combination of qualitative and quantitative indicators selected to reflect the breadth of communication and dissemination activities implemented during the reporting period. These indicators were aligned with the Communication and Dissemination Plan and supported by multiple data sources, enabling triangulation and reliable documentation of impact.

The indicators used include, but are not limited to:

- **Implementation status of planned communication and dissemination activities**, assessing whether actions were carried out as intended and within the defined timeframe.
- **Engagement through defined channels**, including interaction with scientific venues, digital communication platforms, and the project website, capturing reach and visibility across different audiences.

- **Participation in structured dissemination actions**, such as scientific conferences, poster presentations, and the scientific competition, reflecting active engagement with external researchers and practitioners.
- **Internal tracking against predefined metrics**, enabling structured monitoring of progress and comparison against expected levels of activity.

These indicators prioritise observable outputs and engagement patterns and are consistent with the project's emphasis on transparency, accessibility, and measurable progress.

MONITORING AND EVALUATION

Monitoring and evaluation activities followed established principles defined in the Communication and Dissemination Plan and were supported by regular internal reviews of communication and dissemination actions. These reviews enabled systematic documentation of activities, identification of trends in engagement, and consolidation of evidence for reporting purposes.

The evaluation process focused on assessing the extent to which communication and dissemination actions reached their intended audiences and supported awareness raising, knowledge exchange, and external engagement. At the same time, care was taken to avoid premature conclusions regarding long-term uptake or societal impact beyond the project's duration. Instead, the evaluation emphasises verified achievements and documented engagement, providing a reliable and proportionate assessment of impact at the conclusion of the project.

OBSERVED IMPACT AND KEY OUTCOMES

WITHIN-PROJECT EVALUATION OF COMMUNICATION CHANNELS AND ADAPTIVE ADJUSTMENTS

Digital communication channels were subject to ongoing monitoring throughout the project as part of the structured tracking of communication and dissemination activities. Monitoring focused on assessing the performance of selected channels in terms of visibility, interaction, and alignment with the project's communication objectives and target audiences.

At an early stage, a project presence was established on Facebook to support dissemination of project updates and to explore its suitability as a general communication channel. Platform analytics were reviewed periodically to assess levels of interaction and reach. These observations indicated that Facebook was less effective for communicating project content of a technical or scientific nature, reflecting its predominantly general audience and limited engagement from users with a professional or research-oriented interest in the project's thematic area. Analytics collected during the reporting period, consistently showed comparatively low levels of interaction.

Based on these monitored outcomes, communication activities will be adjusted to prioritise LinkedIn as the primary digital channel for post-project dissemination and sustainability activities. A dedicated LinkedIn presence will be established, as it is better aligned with the project's communication needs, providing an appropriate professional environment for disseminating project updates, conference participation, and scientific developments beyond the project's lifetime. This strategic shift will support more targeted communication and improved alignment between dissemination channels and the project's intended audiences.

The monitoring and subsequent refinement of digital communication channels illustrate the application of the impact assessment framework described earlier in this deliverable. These actions ensured that communication efforts remained aligned with observed performance and evolving project needs and provided a clear link between the monitoring methodology and the outcomes reported in the following sections.

SCIENTIFIC IMPACT

SCIENTIFIC PUBLICATIONS AND CONFERENCE PRESENCE

During the reporting period, BINGO carried out targeted scientific dissemination activities resulting in peer-reviewed output and active participation in a major international conference. In particular, a

scientific paper[1] was published in the *Proceedings of the IEEE 2024 32nd European Signal Processing Conference (EUSIPCO)*[2], presenting a novel Deep Learning–based methodology for decoding EEG-based inner speech signals. At the time of reporting, the publication has received **190 views/downloads** and **2 citations**, indicating early visibility and engagement within the research community. The publication contributes to ongoing research efforts in neural signal processing by introducing and evaluating an innovative computational approach.

To further enhance the scientific dissemination of the project, further scientific publications and conference presentations are planned for 2026, following the completion of the analysis of the full BINGO dataset for EEG-based imagined speech decoding. The timing of these dissemination activities reflects two key factors. First, due to the inherent complexity of EEG data acquisition, each participant required recordings across three separate sessions conducted on different days, which substantially extended data collection and, consequently, the downstream data processing and analysis workflow. Second, technical limitations of the Kaggle platform particularly with respect to the public release of ground-truth labels, introduced additional constraints on the timing of data publication and associated analyses. Together, these factors necessitated a later dissemination timeline; however, the resulting publications will be based on a uniquely comprehensive and rigorously collected dataset, thereby strengthening the scientific impact and long-term contribution of the project.

DIGITAL COMMUNICATION AND ONLINE PRESENCE

In addition to dissemination through scientific venues, BINGO established and actively maintained a structured digital communication presence to support continuous outreach and visibility of scientific outputs. Digital channels were used to complement traditional dissemination by providing accessible and up-to-date information on project activities, results, and dissemination actions.

The **project website**[3] functioned as a central repository for project-related information and scientific dissemination outputs. It hosted detailed descriptions of the project's objectives and activities, as well as dedicated content related to scientific publications, conference contributions, and the scientific competition. During the reporting period, the website was used to communicate **scientific outputs**, including peer-reviewed publications, poster presentations, and competition-related materials. These outputs were made available through dedicated pages and updates, ensuring traceability and accessibility for interested researchers and stakeholders.

In parallel, a dedicated **project page on Facebook** was used as an active communication channel to disseminate project updates, highlight scientific outputs published on the website, and communicate key milestones in a timely manner.

The project website and Facebook page aimed to fulfill complementary roles within BINGO's digital communication strategy. While the website provided a stable and comprehensive reference point for scientific outputs, Facebook aimed to support dynamic outreach and increased visibility of these outputs through professional networks. Together, these channels ensured that scientific results were communicated in a timely, accessible, and traceable manner throughout the project.

INTEGRATION OF SCIENTIFIC COMMUNICATION AND DISSEMINATION ACTIVITIES

Scientific dissemination and communication activities were implemented in a coordinated manner to support and reinforce the scientific impact of BINGO's research outputs. Peer-reviewed publications, poster presentations, and conference contributions were complemented by targeted digital

[1] https://ieeexplore.ieee.org/abstract/document/10715364/

[2] https://eusipcolyon.sciencesconf.org/

[3] https://bingo-project.gr/

communication actions that extended the visibility and accessibility of scientific results beyond their initial dissemination contexts.

Following their publication or presentation, scientific outputs were referenced and communicated through the project's digital channels, providing additional points of access for researchers and facilitating continued engagement with the work. This approach supported sustained visibility of research outputs and enabled interested audiences to identify and access related materials over time.

The coordination between dissemination and communication activities also supported consistency and traceability of scientific outputs. By linking publications and conference contributions to central online resources, the project ensured that scientific results were presented within a coherent framework, contributing to a clear and recognisable scientific profile. Through this integrated implementation, communication activities functioned as a supporting mechanism for scientific dissemination, enhancing the reach and continuity of research outputs and contributing to their overall scientific impact, without duplicating or substituting formal dissemination channels.

Taken together, the scientific dissemination and communication activities described above contributed to the visibility, accessibility, and continuity of BINGO's research outputs within the scientific community. In parallel, these activities also supported broader awareness and understanding beyond academic audiences, providing the basis for assessing societal impact, as discussed in the following section.

SOCIETAL IMPACT

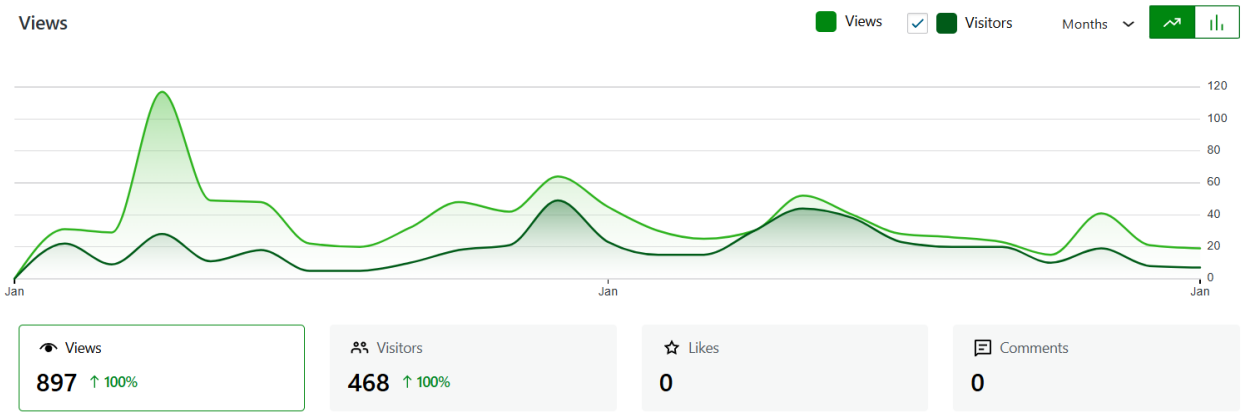
The assessment of societal impact within BINGO is based on monitored communication activities aimed at awareness raising, accessibility of information, and informed engagement with non-specialist audiences. Given the research-oriented nature of the project, societal impact is understood in terms of reach, visibility, and contribution to broader understanding, rather than immediate adoption or deployment of project outcomes.

Societal impact was primarily supported through digital communication channels, which enabled dissemination of project-related information beyond the scientific community and facilitated access to publicly available content.

AWARENESS RAISING AND REACH

Awareness raising was supported through a combination of the project website and selected digital communication channels. The project website served as the central public interface for communicating project objectives, activities, and results to a broad audience, while social media channels were used to amplify visibility and direct interested audiences towards more detailed information. Quantitative reach metrics reported in this section relate specifically to the project website, which provided a stable and openly accessible reference point for non-specialist stakeholders.

During the reporting period, the project website recorded **468 total visits** and **897 page views**, indicating sustained interest in project-related content. Website access originated from **19 countries**, reflecting international reach and visibility at societal level. In detail, the majority of visitors, as expected, originated from Greece, reflecting strong national visibility, while a substantial international audience was also reached, primarily from the United States and several European countries, with the most prominent being Germany, the Netherlands, and Belgium.



These website analytics provide quantitative evidence of awareness raising and reach among non-specialist audiences. They complement qualitative indicators of engagement and interaction presented elsewhere in this deliverable, including documented interaction with researchers and practitioners at scientific events and observed engagement patterns across digital communication channels.

ACCESSIBILITY OF INFORMATION

Accessibility of information was addressed through the structured presentation of project-related content via the project website, which functioned as the primary public access point for information about BINGO. The website provided consolidated and openly accessible information on the project's aims, activities, and dissemination outputs.

Information was organised in a clear and navigable manner, enabling users to identify relevant content without requiring specialist knowledge. Project descriptions, dissemination outputs, and information related to the scientific competition were presented using concise explanatory text and structured page layouts, supporting comprehension by non-specialist audiences.

Scientific outputs disseminated through formal channels were referenced through the website, providing contextual information and direct access to related materials. This approach supported transparency and ensured that interested stakeholders could locate and access project outputs without barriers, while maintaining appropriate separation between high-level communication and detailed scientific content.

Overall, the emphasis on clear organisation, open access, and contextual presentation contributed to improved accessibility of information and supported informed engagement with the project's results across a diverse range of audiences.

CONTRIBUTION TO SOCIETAL UNDERSTANDING

Through consistent and transparent communication of its research activities and outcomes, BINGO contributed to improved societal understanding of EEG-based imagined speech decoding and brain–computer interface research. Communication efforts aimed to explain the project's objectives, methodological approach, and scientific progress in a balanced and accessible manner, while avoiding simplified or overstated claims.

Particular emphasis was placed on presenting research results within their appropriate scientific context, including clarification of methodological challenges, limitations, and the exploratory nature of the work. This approach supported informed dialogue and helped manage expectations regarding the maturity and potential applications of the technologies under investigation.

The societal impact assessment therefore draws on a combination of documented communication actions, website-based reach indicators, and engagement metrics from digital communication channels.

Together, these elements provide a proportionate and evidence-based characterisation of the project's contribution to societal awareness and understanding within the timeframe of the project.

SCIENTIFIC COMPETITION: BINGO KAGGLE CHALLENGE

RATIONALE AND ALIGNMENT WITH PROJECT OBJECTIVES

The organisation of a scientific competition represents a key mechanism for advancing BINGO's research objectives and for enabling structured engagement with the wider research community. The competition was conceived as a means to support transparent evaluation, external validation, and comparative assessment of computational approaches for EEG-based imagined speech decoding, in line with the project's overarching scientific ambition.

By providing a common evaluation framework and clearly defined benchmarking conditions, the scientific competition enables independent researchers to test, compare, and refine decoding approaches using shared data and metrics. The selection of the Kaggle platform to host the competition was motivated by its global visibility, established community of machine learning practitioners, and built-in support for reproducible evaluation, leaderboard-based comparison, and open participation.

Through its design, the competition directly supports BINGO's research objectives by:

- **Establishing a publicly accessible benchmark** for EEG-based imagined speech decoding, enabling systematic comparison of alternative modelling approaches under consistent conditions.
- **Encouraging methodological innovation**, particularly the development of machine learning models capable of addressing challenges inherent to EEG data, such as low signal-to-noise ratios, non-stationarity, inter-session variability, and subject-specific differences.
- **Promoting interdisciplinary collaboration** by attracting participants from neuroscience, biomedical engineering, signal processing, and data science, thereby fostering cross-fertilisation of methods and perspectives.
- **Supporting transparency and reproducibility**, as competition participants are required to adhere to predefined data splits, evaluation criteria, and submission rules, facilitating fair and interpretable comparison of results.

Overall, the scientific competition operationalises BINGO's commitment to open and rigorous scientific practice, while providing a structured pathway for extending the project's research impact through external participation and independent evaluation.

COMPETITION DESIGN AND ORGANISATION

The scientific competition was designed to provide a realistic, rigorous, and transparent benchmarking environment for EEG-based imagined speech decoding. The task focuses on the classification of imagined speech corresponding to the complete NATO phonetic alphabet using multi-channel EEG recordings, reflecting a challenging and well-defined supervised learning problem.

The dataset provided for the competition consists of multi-channel EEG recordings collected from healthy participants across three separate recording days, as detailed in D3.1 v2. This multi-session design was intentionally selected to introduce controlled temporal and session-related variability, which is a known challenge in non-invasive brain–computer interface research. During the first two recording days, participants imagined speaking subsets of the NATO phonetic alphabet, forming the training data, while the third recording day served as a test condition, including the complete alphabet. This structure enables

systematic evaluation of cross-session and subject-agnostic decoding performance under realistic conditions.

Several key design elements were implemented to ensure methodological robustness and fair evaluation:

- **A large, standardised, and openly released EEG dataset**, comprising multi-dimensional time-series data recorded using a consistent acquisition and preprocessing pipeline. The dataset represents a comprehensive resource for imagined speech decoding, incorporating both pre- and post-stimulus neural activity and auxiliary resting-state recordings for calibration purposes.
- **Clearly defined training and test splits**, explicitly structured to assess generalisation across sessions and recording days, rather than performance under narrowly optimised conditions.
- **A well-defined classification task**, requiring participants to predict, in a subject-agnostic manner, which of the 26 NATO phonetic alphabet words was internally articulated, based solely on EEG signals.
- **Transparent evaluation metrics**, with classification accuracy used as the primary performance measure, reflecting the balanced nature of the dataset and enabling straightforward comparison across submissions.
- **Provision of baseline methods and documentation**, supporting participant onboarding, interpretability of results, and reproducibility of the evaluation process.
- **Explicit consideration of ethical, legal, and data protection requirements**, with dataset sharing and competition organisation aligned with approved ethics procedures, informed consent, and an open licensing framework that supports responsible reuse.

The organisational setup of the competition includes clear submission guidelines, documentation of data structure and evaluation procedures, and a leaderboard-based comparison mechanism. Together, these elements ensure that the competition operates as a robust and transparent benchmarking exercise, enabling independent evaluation of decoding approaches and supporting meaningful methodological comparison within the scope of the project.

SCIENTIFIC AND SOCIETAL IMPACT OF THE BINGO KAGGLE CHALLENGE

The BINGO KAGGLE challenge constitutes a key instrument for supporting both scientific and societal impact within the BINGO project. From a scientific perspective, the launch of the competition establishes an open and structured benchmarking environment that enables independent researchers to engage with the project's data, task definition, and evaluation framework. By providing open access to a well-defined dataset and transparent evaluation procedures through a widely used platform, the competition creates the conditions for reproducible experimentation, comparative assessment, and methodological innovation in EEG-based imagined speech decoding.

The competition is designed to facilitate systematic comparison of machine learning approaches under consistent conditions, particularly with respect to challenges such as session variability, subject independence, and generalisation. Although no results are available at the time of reporting, the competition framework itself represents a concrete scientific output, enabling ongoing and future exploration of decoding strategies and supporting independent validation of approaches beyond those developed within the project.

From a societal perspective, the competition contributes to openness, accessibility, and awareness by lowering barriers to engagement with advanced neurotechnology research. The public availability of the dataset, documentation, and evaluation process supports transparency and enables a broader audience, including early-career researchers, interdisciplinary practitioners, and technically skilled non-specialists, to engage with the research problem. By presenting a clearly framed and ethically governed challenge, the competition also contributes to informed understanding of both the potential and limitations of EEG-based brain–computer interface technologies.

At the time of reporting, Kaggle's decision with respect to sponsoring the competition is still pending. Upon formal acceptance, the competition is expected to be launched within three months. The forthcoming launch is conceived as an impact-relevant activity in its own right, designed to support sustained scientific engagement, enable comparative evaluation of methodological approaches, and promote open, transparent, and responsible research practices. Once active, participation and engagement are expected to evolve progressively as submissions are received and assessed, further reinforcing the competition's role in fostering interaction within the research community and generating scientifically meaningful insights.

SUMMARY OF KEY IMPACT INDICATORS

To support transparent and structured reporting, Table 1 summarises the key indicators used to monitor communication, dissemination, and scientific competition activities up to M24. The indicators reflect documented outputs and monitored engagement, in line with the impact assessment framework described earlier in this deliverable.

Table 1. Summary of Key Impact Indicators at M24

Impact Dimension	Indicator	Description	Status
Scientific dissemination	Peer-reviewed publication	Publication of a conference paper on a Deep Learning approach for EEG-based imagined speech decoding	Ongoing (Pending: Scientific Publications for the two recorded datasets and novel algorithms applied on BINGO's data)
Scientific dissemination	Conference presence	In-person poster presentation at an international signal processing conference	Achieved
Scientific engagement	Scientific competition	Launch of a sponsored Kaggle-based competition	Ongoing (Awaiting Decision)
Communication & outreach	Digital communication channels	Maintenance of project website and Facebook page for dissemination of outputs and updates	Ongoing (Creation of a LinkedIn profile to further promote BINGO's dissemination activities)
Accessibility & transparency	Online availability of outputs	Public access to scientific outputs, competition materials, and project information via the website	Achieved
Monitoring & management	Metrics-based tracking	Continuous monitoring of communication and dissemination activities against predefined indicators	Ongoing

KEY LESSONS AND CONCLUDING REMARKS

LESSONS LEARNED AND RECOMMENDATIONS

The implementation of communication, dissemination, and scientific competition activities within BINGO has provided a number of practical insights that are relevant for similar research-oriented projects operating at the interface of neuroscience, machine learning, and assistive technologies.

A key lesson learned concerns the importance of **continuous monitoring and adaptive management** of communication channels. The systematic review of digital communication performance enabled timely identification of channels that were less effective for communicating technical and scientific content, and supported evidence-based adjustments to improve alignment between communication tools and target audiences. This highlights the value of treating communication activities as dynamic processes that evolve in response to observed engagement patterns rather than as static dissemination actions.

The experience of integrating scientific dissemination with digital communication demonstrates that **coordination across channels enhances the visibility, accessibility, and traceability of scientific outputs**. Linking publications, conference contributions, and competition-related materials to central online resources supported sustained visibility over time and facilitated access for interested researchers and stakeholders beyond the immediate context of dissemination events.

With respect to the scientific competition, the preparatory work required to curate datasets, define evaluation procedures, and ensure ethical and legal compliance underscored the importance of **early planning and clear documentation**. Establishing a transparent and reproducible competition framework prior to launch proved essential for enabling open participation and independent evaluation, even before results become available.

Based on these observations, the following recommendations can be drawn:

- Future projects should allocate sufficient effort to **ongoing monitoring of communication activities**, allowing for timely refinement of channels and messaging based on observed performance.
- Digital communication should be used strategically to **complement, rather than replace, formal scientific dissemination**, ensuring consistency and traceability of research outputs.
- Scientific competitions should be planned as **standalone scientific outputs**, with clear documentation, ethical safeguards, and evaluation logic established early to support sustained engagement and reuse beyond the project timeframe.

CONCLUSIONS

This deliverable has reported on the scientific competition and impact assessment of the BINGO project at M24, focusing on communication, dissemination, and uptake activities implemented within the project lifetime. The assessment demonstrates that these activities were carried out in a structured, monitored,

and adaptive manner, supporting both scientific visibility and broader engagement without overstating impact beyond the available evidence.

Scientific impact was primarily achieved through peer-reviewed publication, conference participation, and the application for launching of a sponsored scientific competition that provides an open benchmarking framework for EEG-based imagined speech decoding. These activities were reinforced through coordinated digital communication, ensuring accessibility and traceability of scientific outputs.

Societal impact was addressed through awareness raising, accessibility of information, and engagement via digital channels, supported by monitored website analytics and interaction indicators. The assessment remains proportionate to the research-oriented nature of the project and avoids premature conclusions regarding long-term uptake or deployment.

Finally, the launch of the BINGO Kaggle competition represents a significant milestone, establishing an open and reproducible framework for independent evaluation and ongoing scientific engagement. While the competition remains open at the time of reporting, its design, documentation, and availability already constitute a concrete contribution to open and responsible research practice. Together, the evidence presented in this deliverable confirms that BINGO has implemented a coherent and well-documented approach to communication, dissemination, and scientific competition activities by M24.