

6G-MIRAI - Cooperation, dissemination, and impact: updated plan

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Acronyms and definitions

3GPP	3rd Generation Partnership Project
5G	Fifth generation (of telecommunication networks)
6G	Sixth Generation (of telecommunication networks)
6G-IA	6G Infrastructure Association
AI	Artificial Intelligence
AI-RAN	AI-enabled Radio Access Network
CC	Creative Commons licenses
CSI	Channel State Information
DOI	Digital Object Identifier
DU	Distributed Unit
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
FAIR	Findable, Accessible, Interoperable, and Reusable
GA	General Assembly
GDPR	General Data Protection Regulation
HW	Hardware
IEEE	Institute of Electrical and Electronics Engineers
IP	Intellectual Property
IPR	Intellectual Property Right

ITU	International Telecommunication Union
JP	Japan
KPI	Key Performance Indicator
KVI	Key Value Indicator
(m)MIMO	(massive) Multi-Input Multiple-Output
ML	Machine Learning
MNO	Mobile Network Operator
NOC	Network Operation Center
PoC	Proof of Concept
QoS	Quality of Service
RAN	Radio Access Network
RTI	Research and Technology Item
SDO	Standards Developing Organization
URLLC	Ultra Reliable Low Latency Communications
WG	Work Group
WP	Work Package
XGMF	xG Mobile Promotion Forum (Japan)
xG-RIC	xG Research and Innovation Cluster (German BMFTR-funded research cluster)

Table Of Partners

Short Name	Partner
Ericsson France	ERICSSON FRANCE
Fraunhofer	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV
Telefonica	TELEFONICA INNOVACION DIGITAL SL
ISR D	ISR D SP Z O.O.
SEQ	SEQUANS COMMUNICATIONS SA
APPLE	APPLE TECHNOLOGY ENGINEERING BV & CO KG
KUL	KATHOLIEKE UNIVERSITEIT LEUVEN
CNIT	CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LE TELECOMUNICAZIONI
UNIFI	UNIVERSITA DI PISA

Executive Summary

This deliverable, D4.2 "Cooperation, Dissemination, and Impact: Updated Plan", reports on the implementation and impact of the 6G-MIRAI-HARMONY project's Dissemination, Communication, and Exploitation strategy and execution during the first 18 months (M1–M18) of the project, updating the initial plan set out in D4.1.

On Open Science, the consortium has operationalised its FAIR data commitment through a dedicated Zenodo community, well-defined tracking procedures, and a defined dataset publication methodology, ensuring project documents, datasets, and software remain findable, accessible, interoperable, and reusable.

In Communication, the project has established a coherent visual identity and a well-performing digital presence: the project website (6g-mirai-harmony.eu) has seen steadily growing traffic since launch, and the LinkedIn channel has generated over 14,000 impressions and nearly 200 followers across 17 posts. A dedicated EU-JP cooperation page reflects the project's distinctive cross-regional character, structured around three “pillars”: Research, (Pre-)Standardization, and PoC/Datasets.

On Dissemination, the consortium delivered strong results at EuCNC 2026, co-leading the organization of an international workshop on "International Cooperation for AI-Native RAN for 6G" backed by 13 collaborative research projects (thereby achieving milestone M5 ahead of schedule) and an accepted tutorial on "AI/ML for 6G MIMO". Active participation in SNS-JU working groups and multiple EU-JP coordination activities further reinforced the project's positioning within the wider 6G ecosystem.

In Standardization and Regulation, partners contributed multiple 3GPP RAN1/RAN2 documents on AI/ML-based physical layer and network coordination topics, while the regulatory landscape (GDPR, Data Act, AI Act) relevant to the project's AI-native RAN work was reviewed and accordingly outlined in this deliverable.

On Exploitation, the industrial roadmap remains on track, with two early results, AI-based CSI acquisition and Generative Channel Modelling, both submitted to the SNS JU Innovation

Radar. Individual partners report concrete progress in publications, datasets, standardization contributions, and initial patent evaluation activities.

Overall, the project's dissemination, communication and exploitation objectives remain fully aligned with the original plan with no major deviations identified as can be seen in the KPI scorecard table below.

Dissemination activity	KPI planned in proposal	KPI achieved to date
“AI-Native RAN” workshops (industry/ academia)	2	1
Peer-reviewed journal paper	>6	2 (submitted: 2)
Peer-reviewed conference and workshop paper	>15	12 (submitted: 2)
Workshops and demos participation/ organization	>5	9
Peer-reviewed conference tutorials	2	1
Whitepapers (incl. 6GIA contributions) and/or book, book chapters	>6	1
Webinars	2	2
Standardization contributions; participation in key SDO workshops	>10	7
Datasets, Models, Software publications	>4	3

1 Introduction

The 6G-MIRAI project (grant agreement 101192369), funded under the Smart Networks and Services Joint Undertaking (SNS JU) as part of Horizon Europe, is developing Machine Intelligence based Radio Access Infrastructure to shape the future of 6G cellular networks. Operating jointly with its Japanese partner project HARMONY under the combined identity "6G-MIRAI-HARMONY", the project brings together a consortium of nine partners spanning industry and academia across Europe, coordinated by Ericsson France with technical leadership from Fraunhofer HHI.

This deliverable, D4.2 "Cooperation, dissemination, and impact: updated plan", presents the second iteration of the project's Dissemination, Communication, and Exploitation strategy, building on the initial plan established in Deliverable D4.1 [D4.1]. Covering the first 18 months of project activity (M1–M18), it documents the concrete implementation of the plans laid out at project start, reports on measurable impact achieved to date, and outlines the roadmap for the remainder of the project.

The document is structured around four core areas of project impact.

- First, it describes the consortium's Open Science practices, covering the FAIR-compliant handling of documents, datasets, and software outputs, including the establishment of the project's Zenodo [ZENODO] community and associated internal tracking procedures.
- Second, it details the Communication, Dissemination and Cooperation activities carried out during the reporting period, including the project's visual identity, website, and social media presence, its dissemination through peer-reviewed publications and high-profile events such as the EuCNC 2026 workshop and tutorial, and its cooperation within the SNS-JU/6G-IA ecosystem and with the Japanese HARMONY consortium.
- Third, it addresses the project's engagement with the Standardization and Regulatory Framework, summarizing contributions to 3GPP standardization bodies

and the relevance of key EU regulatory instruments (GDPR, Data Act, AI Act) to the project's technical work.

- Finally, it reports on Exploitation activities, presenting the updated industrial and academic exploitation roadmap, early exploitation results reported to the SNS JU Innovation Radar, and individual partner exploitation plans.

Taken together, this deliverable demonstrates that the project's dissemination, communication and exploitation objectives remain firmly on track and provides the consortium and its stakeholders with a transparent, up-to-date account of the project's growing scientific, industrial, and international impact.

2 Open Sciences practices and output

Open Science lies at the heart of the 6G-MIRAI-HARMONY consortium's research philosophy. From the outset of the project, the consortium has actively established a robust set of mechanisms to ensure that all results and outcomes generated throughout the project's lifespan adhere to open science principles. This section provides an overview of the procedures put in place and summarizes the activities carried out to date.

As introduced in Deliverable [D 5.2], the consortium has identified three distinct categories of research outputs:

- **Documents**, encompassing project deliverables and scientific publications of all kinds.
- **Software**, including all implementations developed during the project, such as algorithms, models, protocols, and interfaces.
- **Datasets**, which are expected to emerge as a significant output of the project, particularly given the central role of artificial intelligence techniques in the project

Across all three output categories, 6G-MIRAI-HARMONY is committed to upholding the FAIR principles, ensuring that every project outcome is **Findable, Accessible, Interoperable, and Reusable**, cf. [D 4.1]. This commitment reflects the consortium's broader dedication to transparency, reproducibility, and the long-term value of the knowledge it generates.

2.1 Documents

To streamline the registration and tracking of project outcomes, the WP4 lead introduced a set of tracking Excel sheets within its collaboration platform, SharePoint, enabling an efficient and standardized process across all partners. Complementing this, a 6G-MIRAI-HARMONY community has been established on Zenodo [ZENODO] to serve as a centralized repository for all project results, guaranteeing their long-term preservation and open accessibility. Underpinning both efforts, a well-defined procedure has been put in place to guide partners through the registration of any new publication, ensuring consistency and

completeness across all recorded outputs. It instructs the partners what, when and how to update the sheets, ensuring a comprehensive and up-to-date record of all project outputs:

- Email for internal **GA Approval**: for certain outputs, particularly publications, prior approval from the General Assembly (GA) might be required as per the Consortium Agreement. Required information items are:
 - Authors, abstract
 - A link to the current version of the work in the sharepoint Publications folder
 - A deadline (when the planned submission takes place)
 - Stating if its publication of own results (1 partner), joint results (≥ 2 partners), or representing the whole consortium (i.e., a 6G-MIRAI-HARMONY publication)
- **Registration of the output internally via the 6G-MIRAI-HARMONY xls in sharepoint (status: submitted)**
 - Dissemination and Communication outputs: 6G-MIRAI Dissemination and Communication.xlsx
 - Publications: 6G-MIRAI Publications.xlsx
- **Upload to Zenodo**: once an output / publication has been cleared internally and accepted / published externally, the authors are responsible for uploading the appropriate version (e.g., author version of an IEEE publication) to the Zenodo 6G-MIRAI-HARMONY Community, including all the required, detailed information there. After the upload, the output needs to be submitted for review (Zenodo works like a ticketing / workflow system incl. e-mail reporting. Once approved for publication, the output will immediately visible in Zenodo.
- **Update the output internally in the 6G-MIRAI-HARMONY xls in sharepoint (status: accepted/published)** (with the inclusion of as much information as the authors can provide, in particular include the DOI and the Zenodo URL)
 - Dissemination and Communication outputs: 6G-MIRAI Dissemination and Communication.xlsx
 - Publications: 6G-MIRAI Publications.xlsx

2.2 Datasets

6G-MIRAI-HARMONY adopts a comprehensive methodology for dataset definition, management, and utilization, as established in Deliverable D3.1 [D3.1], to follow a standardized and structured procedure ensuring transparency, reusability, and compliance with Open Science principles. This methodology is based on a well-defined data lifecycle covering all stages from dataset conception and collection to preprocessing, documentation, dissemination, and long-term archival, ensuring that datasets are consistently designed, high-quality, and reusable across different research activities. To address the challenges introduced by data-driven AI/ML workflows (such as variability in datasets, preprocessing pipelines, and experimental conditions) the framework emphasizes transparent reporting, standardized metadata, and detailed contextual documentation to support repeatability and reproducibility of results. A key element of this approach is the introduction of dataset cards and harmonized metadata formats, providing a common description layer for heterogeneous datasets and capturing essential information such as data origin, content, intended use, and associated KPIs/KVIs.

Deliverable D3.2 [D 3.2] represents the first concrete step toward implementation, reporting the initial datasets made available by project partners for benchmarking and validation purposes, together with their detailed description and documentation. Each dataset is described using a common template capturing essential metadata, including the dataset name, contributor, intended use case, data type, volume, scenario, repository, and licensing conditions. Whenever possible, datasets are made publicly accessible through recognized repositories (e.g., DOI-based platforms) and accompanied by clear usage licenses (such as Creative Commons) to facilitate reuse. In addition, datasets are complemented by detailed descriptions of the measurement or simulation setups and structured content definitions, including data formats, metadata, and supporting scripts, enabling reproducibility and interoperability. In cases where datasets cannot be openly shared due to confidentiality or proprietary constraints, their key characteristics and reproducibility guidelines are documented to allow equivalent data generation by third parties. This approach ensures that all datasets within the project are either openly published or transparently described,

aligning with FAIR principles (Findable, Accessible, Interoperable, Reusable) and supporting the broader research and standardization community.

2.3 Software

In addition to datasets, 6G-MIRAI-HARMONY promotes the sharing of software assets and modules. Building on the methodology established in D3.1 [D3.1], software components developed within the project (such as simulation tools, data processing pipelines, AI/ML models, and evaluation frameworks) are thoroughly documented, modularized, and, where feasible, shared through common repositories alongside the corresponding datasets. This tight coupling between data and software is essential to ensure repeatability and reproducibility of results. Shared software modules are targeted to be interoperable across partners and scenarios. Whenever feasible, software artifacts will be released with clear licensing conditions, usage documentation, and configuration details, while in cases of restricted dissemination, sufficient methodological descriptions will be provided to enable re-implementation by third parties. The first tangible results in this are due with Deliverable D3.2 ([D3.2], September 2026).

2.4 Result summary for Period 1 (M1-M18)

Table 1 below shows the “KPI scorecard” for the dissemination and communication at the time of the submission of this deliverable (September 2026), i.e., after one and a half year of project execution.

It can be seen that the project is well on track to meet its dissemination and communication objectives across the different categories (international collaboration visibility through workshops and tutorials, academic exposure through peer-reviewed journal and conference publications, contributions to the industrial community through fora and SDOs, research community visibility through published datasets / software and workshop presence). Once the external publication process is completed these results and as well as the project deliverables are iteratively made visible through the 6G-MIRAI-HARMONY Zenodo [ZENODO]

community. The consortium will continue to monitor the effectiveness of the overall registration and upload mechanism to ensure its continued efficiency and completeness.

Table 1 6G-MIRAI-HARMONY KPI scorecard

Dissemination & communication activities	KPI planned in proposal	KPI achieved to date
“AI-Native RAN” workshops (industry/ academia)	2	1
Peer-reviewed journal paper	>6	2 (submitted: 2)
Peer-reviewed conference and workshop paper	>15	12 (submitted: 2)
Workshops and demos participation/ organization	>5	9
Peer-reviewed conference tutorials	2	1
Whitepapers (incl. 6GIA contributions) and/or book, book chapters	>6	1
Webinars	2	2
Standardization contributions; participation in key SDO workshops	>10	7
Datasets, Models, Software publications	>4	3

3 Communication, Dissemination and Cooperation

The communication and dissemination plan is designed both to fulfil the project's contractual obligations and to maximise the uptake and broader impact of 6G-MIRAI-HARMONY's results. The following core goals shaped activities during this period:

Maximising the visibility of project objectives and results. Technical outputs and research data were made Findable, Accessible, Interoperable, and Reusable (FAIR) through open-access publishing and dedicated platforms such as Zenodo. This approach ensures that research progress remains transparent and that outputs are readily accessible and usable by the wider scientific community.

Engaging effectively with target audiences. Communication activities were tailored to reach four primary audiences — the scientific community, industry, policymakers, and the general public — using targeted messaging and appropriate platforms for each. The strategy emphasises two-way communication, enabling the project to gather feedback that directly informs technical work packages and enhances the relevance of its outcomes.

Building a strong and recognisable project identity. Establishing 6G-MIRAI-HARMONY as a recognisable presence within the 6G landscape required consistent and disciplined use of the project's brand identity across all external-facing materials. This encompassed the coherent application of the 6G-MIRAI-HARMONY logo, visual guidelines, and mandatory EU funding acknowledgment across deliverables, presentations, the project website, and social media channels.

Fostering collaboration within the SNS JU ecosystem. Active participation in SNS JU bodies and working groups served as a key mechanism for building relationships with other SNS-funded projects and strengthening collective impact. These collaborative activities are described in section 3.4

Fostering international collaboration in particular with the partner JP HARMONY consortium

Due to the cross-regional nature of 6G-MIRAI-HARMONY, the joint EU-JP Dissemination and Communication is a specific characteristic and interest of the project. It shows the framework for dissemination and communication agreed with the EU project officer and the JP HARMONY project.

The EU and JP project parts appear with **one common name “6G-MIRAI-HARMONY”** to express the cross-region intention and maximize the commonality in communication and dissemination. On the other hand, the internal short names towards the respective funding authority are kept for simplicity and to minimize associated overhead. The respective “full name” (subtitle) reflects the respective specific orientation of the EU vs. the JP part of 6G-MIRAI-HARMONY. All of the above is reflected on the website for which the domain name is 6g-mirai-harmony with a TLD .eu extension for the European part on the one hand, and a specific page describing the EU-JP collaboration from an EU perspective. For the EU and JP parts social media posts, tailored to the respective region, can be mutually cross-referenced to express the collaboration initiatives.

Table 2 Updated EU-JP Framework for Dissemination and Communication

Category	EU project	JP project
Public short name (EU: “acronym name”)	6G-MIRAI-HARMONY	
Internal short name (EU: “GAP name”)	6G-MIRAI	HARMONY
Full name	Machine Intelligence based Radio Access Infrastructure	R&D for 6G Mobile System Optimization with Cross-

		Layer/Multi-Domain AI Integration
Domain (website, mailing lists)	6g-mirai-harmony.eu	(no website)
Website content	Cf. EU 6G-MIRAI proposal (partners: EU consortium & Ericsson Japan) 1 sub-page on EU-JP cooperation referencing the collaboration with the JP HARMONY partners in the 3 “pillars”	-
Logo	6G MIRAI	HARMONY
	(both logos shown together represent the EU-JP collaboration)	
Social media channel names (LinkedIn, YouTube)	6G-MIRAI-HARMONY	(no dedicated accounts but activity by the consortium coordinator The University of Tokyo)
	(no common social media channels but mutual referencing of the individual EU and JP channels)	

3.1 Communication plan and impact

During the first review period of the project, communication activities were focused on promoting 6G-MIRAI-HARMONY's results to as broad an audience as possible. To maximise impact, the project's communication activities pursued four key objectives:

Raising awareness and visibility of the project's key facts, objectives, activities, and findings among civil society and the wider public.

Announcing and promoting 6G-MIRAI-HARMONY events and dissemination materials to reach relevant audiences in a timely and effective manner, with emphasis on EU-JP cooperation

Fostering engagement and support from the public, industry, and academia through active and targeted outreach.

Supporting the project's dissemination, standardisation, and exploitation objectives by ensuring that results are communicated in ways that encourage uptake and practical application.

To meet these objectives, 6G-MIRAI-HARMONY employed a combination of modern communication tools and channels, each selected to reach the widest and most relevant audience. These are described in detail in the sections that follow.

3.1.1 Branding and templates

To ensure an easily recognizable and coherent appearance for the 6G-MIRAI-HARMONY result, a visual “identity” was established. This includes the 6G-MIRAI-HARMONY logo and a specific font “Gen Shin Gothic” which are being applied across all communication materials. Figure 1 shows the logo.



Figure 1 6G-MIRAI logo

Furthermore, a presentation (Figure 2) and a deliverable template (Figure 3) were created and distributed (via the project-internal sharepoint workspace) to all partners, incorporating the visual identity and the mandatory EU funding acknowledgment ("Co-funded by the European Union").

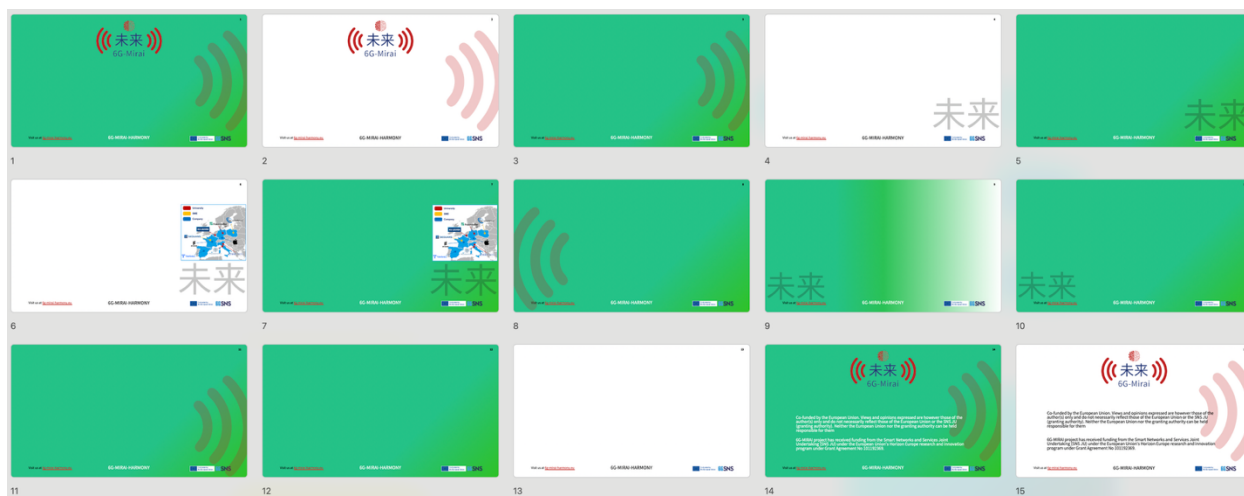
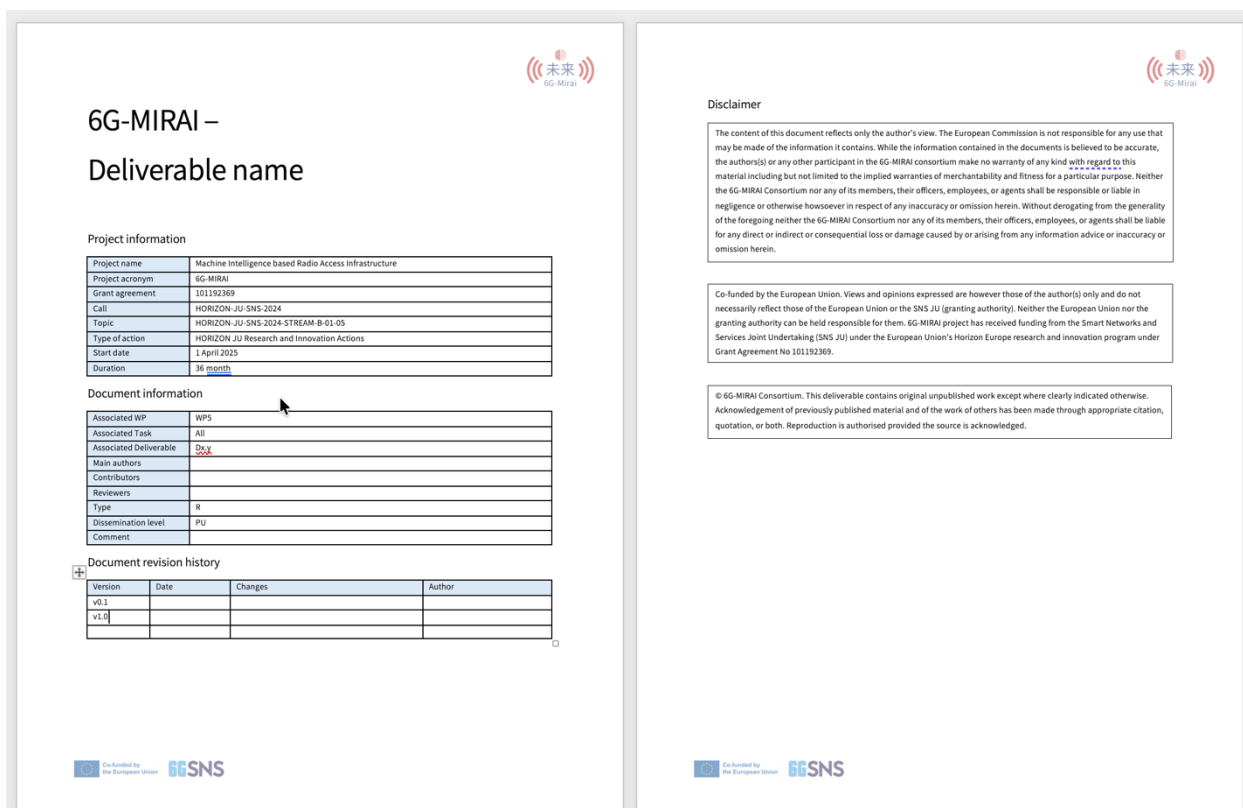


Figure 2 6G-MIRAI-HARMONY presentation template

For both the logo and the presentation template, a contract with a professional designer, Oliver Wick <https://www.oliverwick.de>, was negotiated, and the logo design and characteristics of the presentation template were developed iteratively involving the designer, the WP4 lead and the consortium.



6G-MIRAI –
Deliverable name

Project information

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Co-funded by the European Union **6G SNS**

Figure 3 6G-MIRAI-HARMONY deliverable template

The presented identity governs the creation of all promotional materials, including displayed slides, posters, flyers, roll-up banners etc., which are key elements for disseminating information about the project at events.

3.1.2 Website and social media

Digital channels serve as the primary vehicle through which 6G-MIRAI-HARMONY reaches a global audience. Since the project's inception, a comprehensive digital strategy has been implemented to ensure continuous engagement with stakeholders. This strategy comprises a project website, which serves as the main repository of information, and dedicated social media channels designed to meet audiences where they are most active. This multi-channel

approach ensures that both high-level announcements and in-depth technical results reach their appropriate audience. Each of these channels is described below.

Website <https://6g-mirai-harmony.eu>



Figure 4 6G-MIRAI-HARMONY website home page

Starting even before the official project start on April 1st, 2025, the website creation and hosting company IONOS <https://www.ionos.de>, Germany, was contracted to design, deploy and operate the website. The WP4 lead created a 13-page requirements document to explain the purpose of the website and provide the initial contents, based on the project proposal. In a meeting series with the website design department of IONOS the basic design of the website was updated and verified iteratively. Finally, the website went live in March 2025, just ahead of the project launch, and well ahead of the associated milestone M2 scheduled for June 2025. The website is optimized for access with different devices (smartphones / iPhones, tablets / iPads and PCs / Macs).

The website, managed by Apple as the WP4 lead, is main entry point for external audiences, helping to promote project-related activities and results to all target groups. It offers a

general description of the project — including its main objectives, vision, and outputs — alongside sections on news, deliverables, dissemination, and a contact page for reaching the project consortium.

The website content is maintained throughout the project lifetime, i.e., regularly updated.

6g-mirai-harmony.eu is organised into the following sections:

- Home: The landing page (Figure 4) introduces the project and its basic vision, explains that 未来 “Mirai” means “future” in the Japanese language and links to the other pages featuring below

Furthermore, the “page footer” (which remains unchanged when navigating the site) offers direct access to the official 6G-MIRAI-HARMONY social media channels and features the project’s funding acknowledgment and disclaimer

- Consortium and Objectives: introducing the EU consortium as well as the four major project objectives. Being a Call 3 project, the page introduces also 6G-MIRAI-HARMONY’s timeline in relation to the 3GPP standardization schedule
- Concept and Methodology: 6G-MIRAI-HARMONY defined five Research and Technology Items (RTIs) to realize the project’s vision and fulfil the above objectives. The page introduces the RTI definitions, the inter-relationship of the different RTIs as well as the contribution of the respective consortium partner to the RTIs (all of this in a easy to digest graphical representation). Also, the concept picture representing the project’s vision and scope is featured here
- EU-JP cooperation (Figure 5): as introduced in Table 2 this page introduces the framework for the EU-JP collaboration and features the latest activities in the three defined “pillars” of joint work in “Research” (academic exchange, workshop, etc.), “(Pre-) Standards” (interaction on research topics with standards relevance) as well as “PoC / datasets” (cooperations on datasets, methodology, etc.)



6G-MIRAI-HARMONY: 6G-MIRAI (EU) & HARMONY (Japan)

6G-MIRAI-HARMONY is the EU-JP cross-regional 6G research project. Based on the EU-Japan third Digital Partnership Council (held May 2025 in Tokyo), the [EC announced](#): „The partners agreed to expand their cooperation on beyond 5G/6G research, with a focus on the joint project 6G MIRAI-HARMONY which aims to develop AI powered networks for user-focused communications.“

For the collaboration on advancing AI-native wireless communication systems, EU 6G-MIRAI and Japan's HARMONY project have defined the following three pillars:

1. Research: academic exchange, workshops, etc.

Latest status: On February 24, 2026, Dr. Renato L. G. Cavalcante (Fraunhofer HHI) delivered a tutorial on resource allocation for wireless networks for EU 6G-MIRAI and Japan HARMONY, showing how fixed point theory in Thompson and Hilbert projective metric spaces enables a systematic derivation of optimal algorithms for joint power control, beamforming, and site selection within a unified framework. The presented theory, which also finds applications in other fields — including machine learning —, is an elegant example of how advanced mathematical tools can provide efficient and scalable solutions to complex wireless system design problems.

2. (Pre-)Standards: interaction on research topics with standards relevance

Latest status: On March 4, 2026, JP HARMONY and EU 6G-MIRAI with presentations by KDDI, Kyocera, University of Tokyo (HARMONY) and Ericsson, Telefonica, Apple (6G-MIRAI) launched the discussion on the targeted project results which are relevant for [3GPP](#) RAN1, RAN2, SA2, the [AI-RAN alliance](#) and [XGMF](#). The work will be synchronised again at the next 6G-MIRAI-HARMONY plenary co-located with EuCNC 2026, Malaga.

References: A. Nakao, [6G-AI WG](#), XGMF, 2025.

3. PoC / datasets: cooperation on datasets, methodology, etc.

Figure 5 EU-Japan cooperation page

Publications

6G-MIRAI-HARMONY papers and presentations are accessible in our [Zenodo community](#) which is part of the [EU Open Research Repository](#).

6G-MIRAI-HARMONY in [SNS Journal 2025](#).



Workshops & Presentations

EU SNS 6G-MIRAI-HARMONY presented @

- [SNS JU Call 3 Projects Introduction Webinars](#) – SNS JU, Feb. 2025
- [Digital Partnership Stakeholders Consultation Roundtable](#), March 2025
- [Berlin 6G conference, AI for Radio Access Networks](#), July 2025 (Panel participation)
- [ITU-T "AI and Machine Learning in Communication Networks Workshop"](#), AI for Good summit, July 2025

6G-MIRAI-HARMONY (EU & JP) presented @

- [EU Japan Digital Week](#), April 2025
- EuCNC, Special Session on [Research collaborations beyond Europe towards 6G](#), June 2025
- [INSTAR](#) Webinar on cross-regional partnerships towards 6G standardization, June 2025

Deliverables

Num-ber.	Deliverable Name	WP	Leader	Type	Dissemination Level	Del. Date
D1.1	Initial results on integrating realistic wireless channels and hardware designs into AI-native 6G air interface	1	CNT	R	PU	M15
D1.2	Initial results on AI-based baseband design for 6G communication	1	Fraunhofer	R	PU	M15
D1.3	AI-native 6G air interface development	1	CNIT	R	PU	M28
D2.1	Initial results on intelligent network control and architecture design for 6G networks	2	ISRD	R	PU	M21
D2.2	Final results on intelligent network control and architecture design for 6G networks	2	KU Leuven	R	PU	M31
D3.1	Definition of initial common scenarios, data management and benchmarking methodology	3	SEQ	R	PU	M10
D3.2	Initial datasets for benchmarking and validation	3	KU Leuven	DATA	PU	M18

Figure 6 Deliverables, Publications and Workshops page

- Deliverables, Publications and Workshops (Figure 6): the page publishes all public project deliverables (technical reports, data management plans, communication strategies, and validation results) produced throughout the project's lifetime. It collects all dissemination materials, including information on the individual EU project and joint EU-JP project presentations. It links into the project's Zenodo community thereby offering direct access to the project's scientific publications, datasets and software releases.
- News: blog-style updates and specific highlighted news items on activities, achievements, events, and media coverage, cf. Figure 7, thereby keeping stakeholders informed and increasing the project's visibility
- Contact us: Provides a contact form to reach the project coordination team regarding general enquiries, collaboration opportunities, media requests, and other project-related communications. The web form submissions are linked to the info@6g-mirai-harmony.eu account / email forwarder which can be flexibly mapped to the project-internal requirements

The WP4 leader monitors continuously the website's impact by collecting performance statistics including the number of visitors, sessions, average session duration, bounce rate, etc.. Specifically, web analytics were gathered from April 1, 2025 (project start) to July 23, 2026, to evaluate impact and monitor user engagement over this period. These metrics offer insight into how different audiences access and interact with the website.

Shaping AI Native 6G Innovation: [Sequans Joins Europe–Japan Collaboration in the 6G MIRAI Program](#)

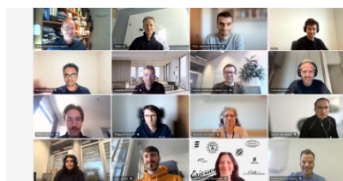
Blog / press release by our partner [Sequans](#)



Shaping the Future of 6G: Join us for the [International Cooperation for AI-Native RAN Workshop !](#)

6G-MIRAI-HARMONY will be participating in a landmark workshop at the EuCNC & 6G Summit 2026. As 6G moves from definition to early realization, the shift toward AI-native RAN is a game-changer. We'll be joining global experts from the EU, UK, US, Japan, Korea, Taiwan, Brazil, and Africa to discuss:

- AI/ML-based use cases for future RAN.
- Advanced experimental platforms for AI/ML.
- Cross-regional collaboration on interoperable and sustainable 6G AI/ML infrastructures.



TOWARDS THE PROJECT'S SECOND YEAR

Second 6G-MIRAI-HARMONY plenary meeting

On March 18, 2026, the consortium got together for a focused, highly interactive virtual meeting. We reviewed the progress, addressed open issues, and agreed on the next steps in the project. The consortium concluded by reinforcing the momentum we have in this challenging research area and highlighting the importance delivering towards the project KPIs in quality and in time, as well as the ongoing cooperation with the Japanese HARMONY consortium across research, alignment towards standards as well as data & validation.



6G-MIRAI-HARMONY (EU) PRESENTING IN JAPAN

AI in 6G air interface keynote at ICETC in Osaka

In Nov. 2025 Adrian Garcia Rodriguez from Ericsson Research France delivered a [keynote on the role of AI in the 6G air interface](#) at the International Conference on Emerging Technologies for Communications (ICETC) in Osaka, Japan. The talk summarized the 3GPP standardization developments, Ericsson 6G positions and shared some early results from the 6G-MIRAI-HARMONY project illustrating the performance of an AI/ML physical layer functionality when trained and evaluated with real-world measurement data.



6G-MIRAI-HARMONY: THE EU-JP CROSS-REGIONAL 6G RESEARCH PROJECT

EU and Japan reinforce tech and digital partnership

On May 12, 2025 the EU and Japan held their third Digital Partnership Council in Tokyo to reinforce tech and digital cooperation between the EU and Japan. The SNSJU 6G-MIRAI-HARMONY project is prominently featured in the [press release](#): „the partners agreed to expand their cooperation on beyond 5G/6G research, with a focus on the joint project 6G MIRAI-HARMONY which aims to develop AI powered networks for user-focused communications.“

Figure 7 News page

Figure 8 shows the number of visitors per month. As it can be seen it has significantly increased since the project start and is comparable to other EU projects (which are on average significantly larger than 6G-MIRAI). The time series shows peaks after significant outreach / social media activity (2025: after conference appearances in the second half of the year: EuCNC, AI for Good, ICETC, 2026: after EuCNC).

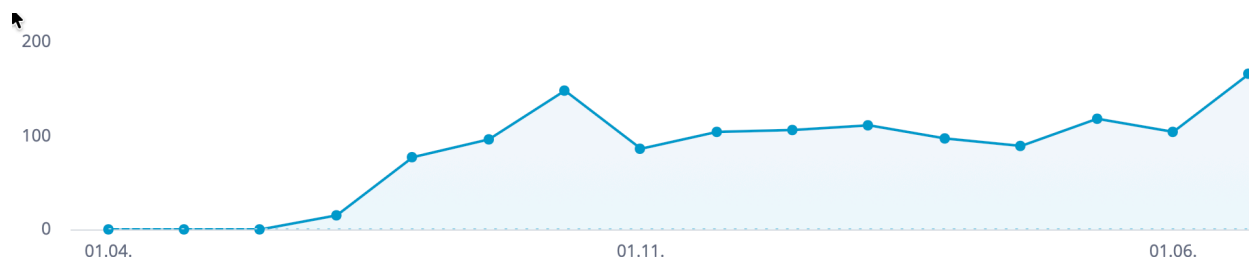


Figure 8 6G-MIRAI-HARMONY website visitor number per month

On Figure 9 the most accessed content on the website is shown. While it's obvious that the landing page has the highest count, it is hereby highlighted that the EU-JP cooperation gets significant attention (3rd most accessed page) as intended by creating a specific page highlighting the specific EU-JP collaboration mission of the project.

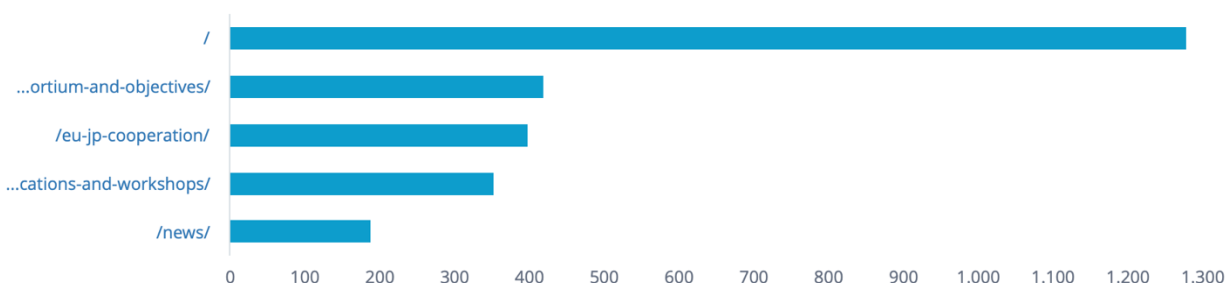


Figure 9 most accessed content on 6G-MIRAI-HARMONY website

Figure 10 shows the webpage of origin for visitors of the website (unfortunately this statistic is only available in German language). The largest detectable distinctive category is “Direct” (23%), i.e., users who accessed the website by typing the URL directly (which shows that users remember the URL based on earlier interactions, other media types). This category is followed unsurprisingly by “search engines” with 20%. The only other distinguishable category is “social media” which shows that the ramp-up of social media and its synergy with the project’s website seems to start working.

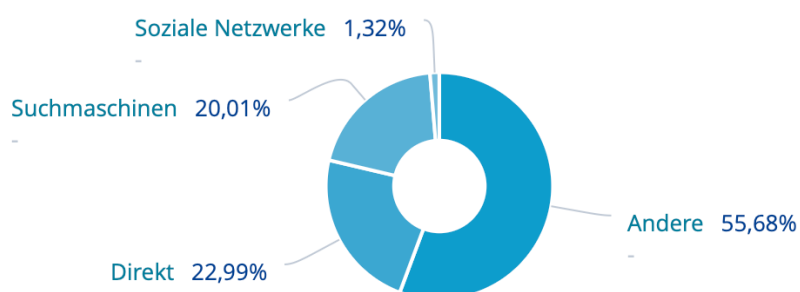


Figure 10 Origin website of the visitors linking to the 6G-MIRAI-HARMONY website

Social media

6G-MIRAI-HARMONY has established a solid presence on multiple social networks to disseminate news, events, and achievements. To maximize reach and engagement across different demographics, the project maintains active accounts on the following platforms:

- **LinkedIn** <https://www.linkedin.com/company/6g-mirai-harmony>

LinkedIn, as the world's leading business and employment-oriented social network, provides an ideal platform for reaching professionals and communicating the activities and contributions of the 6G-MIRAI-HARMONY project. The 6G-MIRAI-HARMONY WP4 lead, Apple, established a dedicated LinkedIn “company page” for the project (Figure 11), aimed at broadening 6G-MIRAI-HARMONY's visibility among its target audience. The page serves as a hub for fostering discussions on key project topics, sharing news and events, and gathering stakeholder opinions.

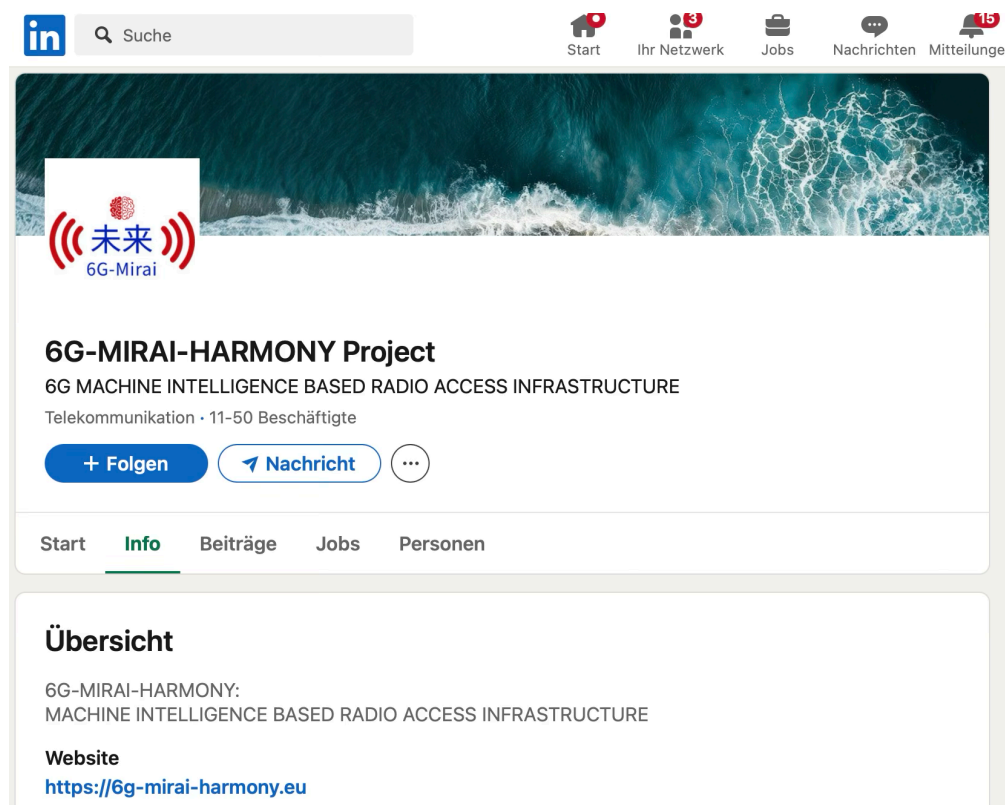


Figure 11 6G-MIRAI-HARMONY LinkedIn landing page

The channel has already proven its value. To date, 17 posts have been published, spanning technical progress, partner contributions, and event participations. As illustrated in Figure 12, the page has already generated over 14000 impressions and attracted almost 200 followers. Similar to the website above, the number of impressions time series shows peaks after the significant outreach activities in the second half of 2025 and 2026 respectively.

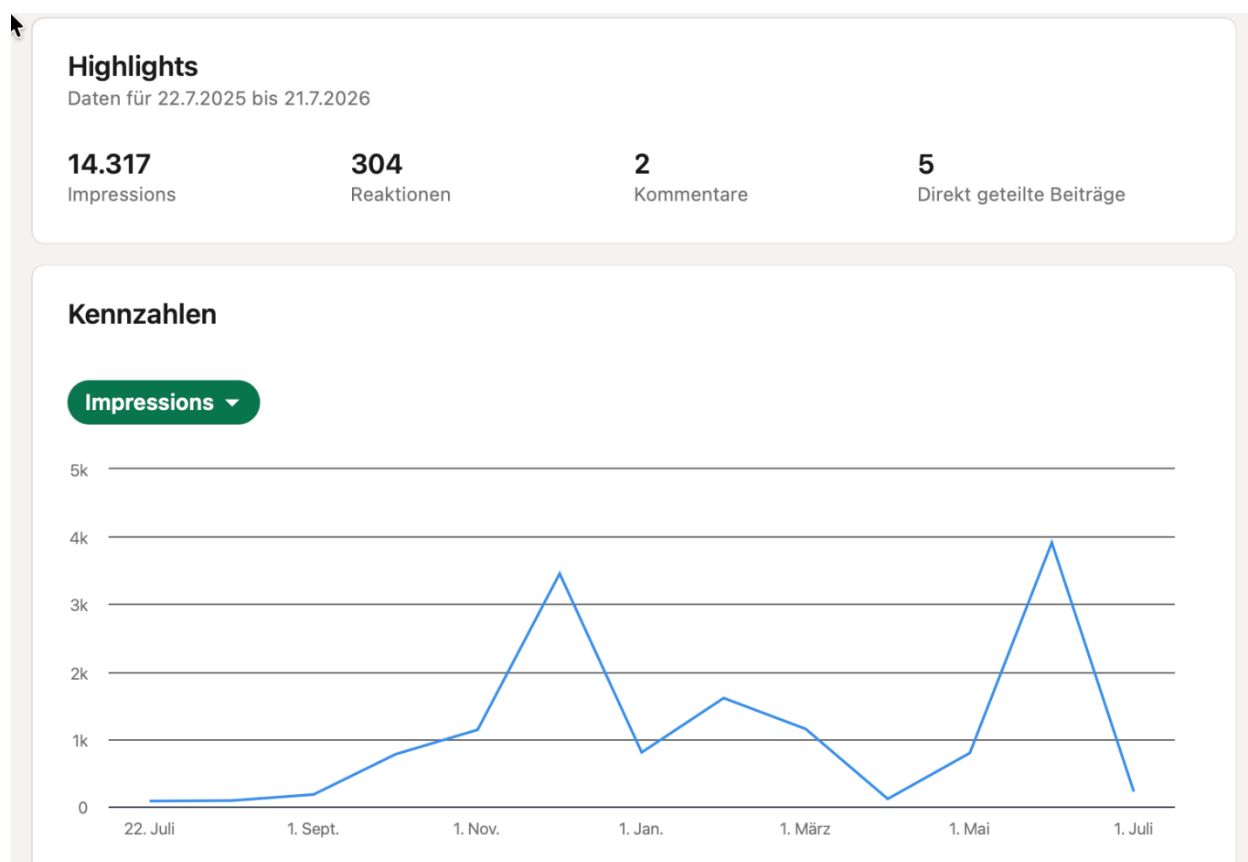


Figure 12 6G-MIRAI-HARMONY LinkedIn analytics

Besides the project-level information also individual partner actions like the Sequans press release (<https://sequans.com/shaping-ai-native-6g-innovation-sequans-joins-europe-japan-collaboration-in-the-6g-mirai-program/>) were featured. Finally, Figure 13 shows an example for the dual, coordinated outreach approach across social media / LinkedIn and the project website.



6G-MIRAI-HARMONY (EU) PRESENTING IN JAPAN

AI in 6G air interface keynote at ICETC in Osaka

In Nov. 2025 Adrian Garcia Rodriguez from Ericsson Research France delivered a [keynote on the role of AI in the 6G air interface](#) at the International Conference on Emerging Technologies for Communications ([ICETC](#)) in Osaka, Japan. The talk summarized the 3GPP standardization developments, Ericsson 6G positions and shared some early results from the 6G-MIRAI-HARMONY project illustrating the performance of an AI/ML physical layer functionality when trained and evaluated with real-world measurement data.



Figure 13 Example for joint LinkedIn and webpage coverage of an event

- Youtube @6G-MIRAI-HARMONYProject

The project's dedicated YouTube channel serves as a comprehensive repository for visual content. In the later phase of the project it will host different videos, including webinars, technical demonstrations and explainer videos. This channel is relevant for making complex 6G concepts accessible to a wider audience through visual storytelling.

3.2 Dissemination plan and impact

The 6G-MIRAI-HARMONY consortium recognizes dissemination as a fundamental driver of scientific and industrial impact, ensuring that the knowledge generated throughout the project reaches and resonates with the communities best positioned to build upon it. Rather than limiting outreach to broad awareness efforts, the consortium has pursued a targeted dissemination strategy centered on deep technical engagement and the tangible uptake of results. This is achieved through a deliberate focus on high-impact channels, most notably peer-reviewed publications and participation in prominent industry events and conferences, all of which contribute directly to the ongoing advancement of 6G technologies. The activities outlined in this section stand as a testament to the consortium's dedication to scientific rigor and its meaningful contribution to defining the future landscape of 6G networks.

3.2.1 Guidelines and tools

The dissemination strategy is built around sharing 6G-MIRAI-HARMONY 's research results and technical outcomes with expert audiences, with the dual aim of validating findings and ensuring their uptake by the broader scientific community. To uphold consistency and quality across all dissemination efforts, the consortium has put in place a set of common guidelines and tools available to all partners.

As introduced in section 2.1, there is a set of tracking Excel sheets, shared in the project's sharepoint space, enabling the systematic and accurate tracking of all dissemination activities across the consortium.

With regard to scientific publications, all contributions are mandated to be Open Access, guaranteeing barrier-free availability to the global research community. To this end, Zenodo [ZENODO] serves as the project's primary Green Open Access repository, hosting all published papers, datasets, and project deliverables under a dedicated 6G-MIRAI-HARMONY community page (<https://zenodo.org/communities/6g-mirai-harmony>). The 6G-MIRAI-HARMONY community is linked to the EU Open Research Repository

<https://zenodo.org/communities/eu/>. This approach supports the principles of open science while ensuring the long-term preservation and accessibility of all project outputs.

Finally, all dissemination materials adhere to the project's visual identity guidelines, and every publication carries the following mandatory acknowledgment: *“6G-MIRAI project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union’s Horizon Europe research and innovation program under Grant Agreement No 101192369.”*

3.2.2 Publications and workshops

A highlight of the project’s dissemination and communication activities was the Workshop on “International Cooperation for AI-Native RAN in 6G” at EuCNC 2026.

6G-MIRAI-HARMONY WP4 reached out at an early stage to the closely related SNS-JU Call3 AI/ML-focused projects 6G-LEADER and 6GARROW (EU-Korea) wrt. a joint EuCNC workshop AI-in-RAN Research proposal, also considering international, cross-regional cooperation. Based on the initial discussion the CHIST-ERA project PASSIONATE joined the effort (due to the well-aligned targets of PASSIONATE, also bringing in the experience from an AI-in-RAN workshop at EuCNC 2025 the project organized). The workshop proposal was accepted by the EuCNC 2026 workshop chairs under the condition to merge with an “incumbent” proposal, i.e., a proposal on AI-in-RAN experimental platforms which already had a significant history at EuCNC. This resulted in a workshop backed by 13 collaborative research projects including 6G-MIRAI-HARMONY.

Henning Sanneck, Apple (for 6G-MIRAI-HARMONY / the initial “AI in RAN Research” workshop proposal) on the one hand, and Serge Fdida, Sorbonne University (for CONVERGE / the initial “AI in RAN experimental platforms” workshop proposal) were the lead organizers of the joint workshop. An updated workshop outline was worked out which focused on strengthening international cooperation across AI in RAN Research and the associated experimental platforms. The workshop aimed at bringing together academia, industry, experimental platform operators, and funding agencies, as a forum to exchange results, align research

directions, and foster collaboration across basically all regions (US, Japan, Korea, Brazil, Africa) considered by the EC / SNS-JU wrt. its international scope.

Figure 14 shows the final workshop agenda with the 6G-MIRAI-HARMONY visibility highlighted in red text colour.

- Welcome & Opening
 - **Henning Sanneck, Apple**; Odysseas Pyrovolakis, SNS JU
- Session 1 Challenges (**Chair: Henning Sanneck, Apple**)
 - AI in 6G RAN Research, Emilio Calvanese-Strinati - CEA-Leti
 - AI Research Platforms, Luis Pessoa - INESC TEC
- Session 2 Perspectives on international collaboration on AI in 6G with the EU (**Chair: Martha Vlachou-Konchylaki, Ericsson**)
 - **Japan, Akihiro Nakao – The University of Tokyo / 6G-MIRAI-HARMONY project**
 - Republic of Korea, Seong-Lyun Kim – Yonsei University / 6GARROW project
 - US, Abhimanyu Gosain – Northeastern University / 6G-XCEL and SLICES-RI projects
- Coffee break*
 - Brazil, Christian Esteve Rothenberg – Unicamp / SMARTNESS project
 - Africa, Damien Saucez – INRIA Sophia Antipolis / DIGITAfrica project
- Session 3 Panel “Cross-regional research and experimentation on AI in 6G” (Moderator: Ana Armada, UC3M)
 - **Panelists:** Jen-Feng Huang (ITRI), **Akihiro Nakao (UTokyo)**, Rolando Guerra Gomez (Telefonica), Dan Kilper (TCD), Panayiotis Andreou (UCLAN), Abhimanyu Gosain (NEU)
- Conclusion and Take away
 - Adam Kapovits, Eurescom; Odysseas Pyrovolakis, SNS JU

Figure 14 EuCNC Workshop 16 Agenda

Figure 15 shows the specific banner co-created by 6G-LEADER and 6G-MIRAI-HARMONY for the workshop.

Below we give a short summary of the actual workshop which took place at EuCNC 2026: after welcoming words from Dr. Odysseas Pyrovolakis, Smart Networks and Services Joint Undertaking (SNS JU) and Henning Sanneck (Apple), Emilio Calvanese Strinati (CEA-LETI) provided an overview of challenges in AI in RAN Research from the perspective of the EU 6GARROW, 6G-MIRAI-HARMONY, 6G-LEADER and PASSIONATE projects, e.g.:

- “Wireless foundation models” which are trained only once / centrally but are adapted locally
- Trading of the AI gains with the energy consumption to achieve them



Figure 15 EuCNC Workshop 16 banner

Luis Pessoa (INESC TEC) introduced the corresponding Research Platforms with focus on 6G-XCEL and CONVERGE:

- CONVERGE on adding vision to optimise wireless (similar to Sensing-Assisted Communication in ISAC) and enhancing vision with wireless (adding RF as a sensor)
- 6G-XCEL (EU-US) on interconnection of the major EU (SLICES) and US (COSMOS) testbeds

Akihiro Nakao (Japan), Abhimanyu Gosain (US), Christian Esteve Rothenberg (Brazil), Damien Saucez (Africa) provided the regional views on applied AI technology research, experimentation and the associated collaboration activities with the EU, in a session chaired by Martha Vlachou, Ericsson:

- AI-RAN alliance: has significant industry penetration now (industry / government / academia)
- Some (probably US-politically driven) approach to use the O-RAN architecture (dApps, i.e., RT-capable Apps on DU) for ISAC

- Nvidia ARC-OTA as the O-RAN DU compute platform promoted by the US representative
- Discussion on 3GPP/O-RAN interaction: recently there was a joint 3GPP and O-RAN SMO workshop; a study item on 6G is established in O-RAN (intent/AI)
- Info on region-specific use cases (for developing / emerging countries) and regional testbeds

Ana Garcia Armada (UC3M) moderated the following panel, featuring Jen-Feng Huang (ITRI), Akihiro Nakao (The University of Tokyo), Rolando Guerra-Gómez, (Telefonica), Dan Kilper (Trinity College Dublin), Panayiotis Andreou (UCLancashire/Cyprus) and Abhimanyu Gosain (Northeastern University), discussing key AI in 6G RAN use cases, architectures, showstoppers for adoption, the strong need for thorough experimentation as well as best practices in data / AI management (with all of these aspects encouraging an increased level of global cooperation):

Showstoppers

- AI increases cost of infrastructure: energy & cost problem (recently at one large US operator: huge surge in consumption of tokens, stopped due to immense cost) -> hardware-optimized, lightweight models
- Nvidia “AI telco engineer” -> towards a “Dark NOC” (like “dark factory”, i.e. no humans)
- Just standardise minimal interfaces -> currently RAN1: let’s leave rest to implementation, flipping back and forth
- Still access to high-quality data is a problem (MNOs have data, but internal fragmentation)
- Collaboration 3GPP/ORAN wrt. data: upfront investment, then benefit (e.g. Energy saving); uniform API for multi-vendor RAN; Metadata of open datasets is a problem
- Cloud economics: build it and it will come; telco economics is different (telcos operate on strict commercial viability and will not deploy new services unless they can be clearly and effectively monetized)

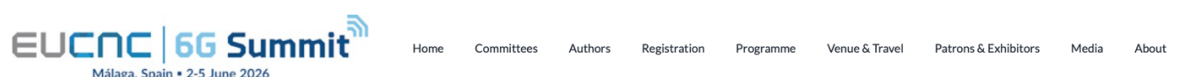
Experimentation

- High need for AI experiments (provide the empirical, reproducible evidence needed for standardization and act as safe sandboxes for policy and regulatory compliance) but all should driven by monetisation; attractive for industry to do; resources/ funding
- Privacy of data, but different significance in the different regions

Global Cooperation

- essential to validate complex topics, such as global roaming and security
- diverse, representative training datasets to completely avoid localized AI bias
- best practices (reproducibility): standardized metadata, strict control of data provenance, open access repositories with version control, auditing (model drift).

The successful workshop organization and execution in June 2026 fulfilled the 6G-MIRAI-HARMONY milestone M5 achieved (ahead of the planned deadline of January 2027).



Tutorial 2

Home > Programme > Tutorials > Tutorial 2

AI/ML for 6G MIMO: From fundamentals to industrialization

Tuesday, 2 June 2026, 14:00-17:30, Sala de Conferencias 1 (1.2)

Speakers:

- Luca Sanguinetti (University of Pisa and CNIT, IT)
- Adrian Garcia-Rodriguez (Ericsson Research,)
- Tanguy Kerdoncuff (Ericsson Research, FR)
- Renato Luís Garrido Cavalcante (Fraunhofer Institute for Telecommunications, DE)
- Paul Almasan (Telefónica Innovación Digital, ES)

Motivation and Context

The advent of 6G marks a pivotal moment in the evolution of mobile communications, with artificial intelligence and machine learning (AI/ML) expected to play integral roles in the design, optimization, and operation of the future air interface. As 3GPP has just initiated the first studies on 6G technologies, the community stands at a unique juncture: the lessons learned during 5GAdvanced—particularly on AI-enabled air interface procedures—provide valuable foundations, yet the scalability, reliability, and interpretability requirements of 6G MIMO bring an entirely new set of challenges.

Massive MIMO will remain a cornerstone of radio access in 6G, but its increasing dimensionality, the push for extreme energy efficiency, and the ambition to support highly dynamic and heterogeneous deployments call for solutions that go beyond classical signal processing. AI/ML promises substantial gains in areas such as reference signal design, beam management, or hardware impairment compensation. However, turning this promise into reality requires addressing key obstacles related to dataset generation, model generalization, real-time feasibility, robustness, and standardization.

This tutorial aims to provide clarity on these opportunities and challenges by combining fundamental theory, latest 3GPP insights, and hands-on industrial perspectives. Building on the presenters' contributions to the MIMO fundamentals field and 3GPP RAN1 6G studies, we will highlight where AI/ML has demonstrated tangible potential, where open questions remain, and which research directions we believe are most critical for shaping the 6G MIMO landscape.

Given the strong momentum within 3GPP, the ongoing wave of academic activity, and the strategic importance of AI-native radio designs, this topic is exceptionally timely for the 2026 EuCNC & 6G Summit.

Figure 16 EuCNC Tutorial Screenshot

Furthermore, 6G-MIRAI-HARMONY was successful to have an accepted Tutorial at EuCNC 2026. Figure 16 shows the screenshot of the tutorial outline on the EuCNC webpage. Luca Sanguinetti, Renato Luis Garrido Cavalcante, Adrian Garcia Rodriguez, Tanguy Kerdoncuff and Paul Almasan delivered the tutorial on "AI/ML for 6G MIMO: From fundamentals to industrialization": the highly interactive tutorial, featuring experts from leading institutions across Europe and covering the full journey from theory to real-world deployment. The tutorial attracted more than 30 participants and was very well received by the audience. Based on the very valuable received comments and questions the tutorial will be further evolved within the 6G-MIRAI-HARMONY Project and be submitted to future conferences.

For the second review period of 6G-MIRAI-HARMONY it is envisaged to:

- Team up with JP HARMONY (and other projects) to submit a “2nd issue” of the international collaboration workshop to EuCNC and/or to submit a workshop proposal to an IEEE conference (e.g., IEEE Infocom 2027)
- Re-submit the tutorial to another suitable conference

with considering the received feedback and inputs from the 2026 events.

Table 3 shows the list of publications

Table 3 6G-MIRAI-HARMONY list of publications

6G-MIRAI partner author names	Publication title	Type	Name of publication /venue	Status
		e.g., magazine/journal/conference/ workshop	e.g., IEEE Communication Magazine, IEEE Globecom	e.g., submitted, accepted, published
Paul Almasan, Sina Beyraghi	Site-Specific RIS Deployment in Cellular Networks via Calibrated Ray Tracing	Workshop	IEEE Globecom 2025 3rd Workshop on Data Driven and AI-Enabled Digital Twin Networks and Applications (TwinNetApp)	Accepted
Paul Almasan, Sina Beyraghi	Data-Driven Deployment of Reconfigurable Intelligent Surfaces in Cellular Networks	Journal	IEEE JSAC	Accepted
André F. Zanella	Exploring the Digital Life of Urban Parks Through Mobile Traffic	Conference	NetMob 2025	Accepted
A. U. Noor, L. Mireti, Renato L. G. Cavalcante, and Sławomir Stańczak	Performance Analysis of Cell-Free Massive MIMO under Imperfect LoS Phase Tracking	Conference	IEEE ICC 2026	Accepted
Rouaa Diab, Jochen Fink, Renato L. G. Cavalcante, Sławomir Stańczak	Joint Power Control, Beamforming and Time-Sharing in Cell-Free Massive MIMO Networks	Conference	IEEE ICC 2026	Published
R. L. G. Cavalcante, T. Piotrowski, and S. Stańczak	Cellular, Cell-less, and Everything in Between: A Unified Framework for Utility Region Analysis in Wireless Networks	Journal	IEEE TSP	Accepted
U. Uçak, F. Armandoust, M. Mehlhose, D. Schüftele, J. Fink, R. L. G. Cavalcante, and Sławomir Stańczak	Uplink Multi-User MIMO Testbed Implementation in OpenAirInterface	Conference	EuCNC 2026	Accepted
Hiroki Kuroda, Renato L. G. Cavalcante, and Masahiro Yukawa	Theoretical Validation of the Latent Optimally Partitioned- ℓ_2/ℓ_1 Penalty with Application to Angular Power Spectrum Estimation	Conference	Eusipco 2026	Accepted
Norman Goris, Ahmed Helmy, Amr Y. Mostafa, Nil Zaev, Hesham Elhelw, Henning Sanneck, Ayman Naguib	Non-Collocated Carrier Aggregation: A Unified L2 Architecture for 6G Multi-Node Connectivity	Conference	EuCNC 2026	Published
Paul Almasan,	From Waves to Graphs: A Ray-Tracing-Inspired Neural Radio Propagation Model	Workshop	IEEE ICC Workshop on Open Radio Access Networks 2026	Accepted
Paul Almasan, Sina Beyraghi	Site-Specific MIMO Channel Generation via Diffusion and Flow Matching: Fidelity, Efficiency, and Downstream Utility	Journal	IEEE Journal of Selected Topics in Signal Processing	submitted
Robbert Beerten	Receiver-Aware Fronthaul Compression: Neural Network-Based Non-Linear Transform Coding			submitted
	Joint User Scheduling and Fronthaul Resource Allocation in Cell-Free Massive MIMO with Multiple Sequential Finite-Capacity Links			submitted
Cel Thys	Low Complexity Neural Network Digital Predistortion of Wideband Power Amplifiers through Feature Selection	conference	IEEE SIPS 2026	Accepted
Tanguy Kerdoncuff, Adrian Garcia Rodriguez	AI/ML 6G channel state information reference signal (CSI-RS) overhead reduction	Forum	XGMF	Accepted
F. Armandoust, J. Fink, U. Uçak, M. Mehlhose, D. Schüftele, R. L. G. Cavalcante, and Sławomir Stańczak	Joint Delay and CFO Estimation for TDD Reciprocity Calibration: Theory and OpenAirInterface Implementation	Conference	IEEE GLOBECOM 2026	Accepted
J. J. Brune, Renato L. G. Cavalcante, J. Fink, Sławomir Stańczak	Hybrid Operator Learning for Angular Power Spectrum Estimation Under Imperfect Antenna Array Knowledge	Conference	IEEE GLOBECOM 2026	Accepted
Renato L. G. Cavalcante, Noor Al Uin, Lorenzo Miretti, and Sławomir Stańczak	Beyond the Use-and-then-Forget (UatF) Bound: Fixed Point Algorithms for Statistical Max-Min Power Control	Conference	IEEE GLOBECOM 2026	Accepted
Marco Moretti	Load-Coupling-Enabled Base Station Sleep Mode Optimization Using Deep Reinforcement Learning	Journal	IEEE TWC	Submitted

In Table 4 the list of dissemination and communication activities is shown.

Table 4 6G-MIRAI-HARMONY list of dissemination & communication activities

6G-MIRAI partner author names	Title	Type	Description: venue, relevance to 6-MIRAI, etc.	Link / DOI	Date
Tobias Leyetal.	6G-MIRAI	Webinar	SNS JU Call 3 Projects Introduction Webinars – SNS JU	https://smart-networks.europa.eu/event/sns-ju-call-3-projects-introduction-webinars/	2025-02-17
Tobias Leyetal.	6G-MIRAI-Harmony EU-Japan collaboration	Invited talk	Digital Partnership Stakeholders Consultation Roundtable	https://eprd.pl/en/dpa/japan/stakeholders-roundtable/registration-5th-march/agenda-5th-march/	2025-03-05
Tobias Leyetal.	6G-MIRAI-HARMONY (EU & JP)	Invited talk	EU Japan Digital Week	https://inpacehub.eu/eu-japan-digitalweek-2025/%20%E2%80%8B	2025-04-01
Renato Cavalcante et al.	6G-MIRAI-HARMONY	Invited talk	Special Session on Research collaborations beyond Europe towards 6G	https://www.eucnc.eu/programme/special-sessions/special-session-14/	2025-06
Adam Flizkowski et al.	6G-MIRAI-HARMONY	Webinar	Shaping the Future of 6G Alignment with South Korea and Japan on Standardisation and Innovation (INSTAREU project)	https://instarstandards.org/events/shaping-future-6g-alignment-republic-korea-and-japan-standardisation-and-innovation	2025-06-02
Henning Sanneck et al.	6G-MIRAI-HARMONY: Machine Intelligence based Radio Access Infrastructure	Invited talk	ITU-T "AI and Machine Learning in Communication Networks Workshop", as part of the ITU "AI for Good" summit	https://aiforgood.itu.int/event/ai-and-machine-learning-in-communication-networks-2/	2025-07-10
	The role of artificial intelligence in the 6G air interface	Keynote	Keynote delivered in the 6th IEICE-CS International Conference on Emerging Technologies for Communications, Osaka, Japan, November 26-28, 2025.	https://www.ieice.org/cs/ieice/program.html/10.5281/zenodo.17858947	2025-11-27
Paul Almasan, Sina Beyraghi	Site-Specific RIS Deployment in Cellular Networks via Calibrated Ray Tracing	Presentation in conference	IEEE GLOBECOM		2025-12-09
Paul Almasan	From Waves to Graphs: A Ray-Tracing-Inspired Neural Radio Propagation Model	Presentation in conference	IEEE ICC Open-RAN Workshop	https://icc2026.ieee-icc.org/workshop/ws01-2nd-international-workshop-open-radio-access-networks-open-ran/program	2026-05-24
Renato Cavalcante et al.	Unified Theoretical Frameworks for Resource Allocation in Wireless Networks	Tutorial	EU-JP 6G-MIRAI-HARMONY Pillar 1		
Tanguy Kerdoncuiff, Adrian Garcia-Rodriguez et al.	AI/ML 6G channel state information reference signal (CSI-RS) overhead reduction	White paper	XGMF (Japan)	https://xgmf.jp/pdf/2026/Beyond-5G-White-Paper-AI-and-Digital-Twin_v2.0.pdf	2026-04-28
Henning Sanneck, Martha Vlachou	International collaboration on AI in 6G RAN	Workshop	EuCNC 2026	https://www.eucnc.eu/programme/workshops/workshop-16/	2026-06-02
Luca Sanguinetti (University of Pisa and CNIT, IT) Adrian Garcia-Rodriguez (Ericsson Research,) Tanguy Kerdoncuiff (Ericsson Research, FR) Renato Luis Gamido Cavalcante (Fraunhofer Institute for Telecommunications, DE) Paul Almasan (Telefónica Innovación Digital, ES)	AI/ML for 6G MIMO: From fundamentals to industrialization	Tutorial	EuCNC 2026	https://www.eucnc.eu/programme/tutorials/	Tuesday, 2 June 2026
Adrian Garcia Rodriguez	AI-Integrated Radio Access Networks	Panel Session	Panel discussion in Berlin 6G Conference 2026 involves AI use cases and standardization part of 6G-MIRAI	https://www.berlin-6g-conference.de/program/#aiintegrated	2026-09-09
Nil Zaev, Henning Sanneck	Non-Collocated Carrier Aggregation in 6G: towards a L2 "Cell-Free" Architecture"	Presentation in conference	Berlin 6G conference session on D-MIMO	https://www.berlin-6g-conference.de/program/#distributedmimo	2026-09-09

3.3 SNS-JU and 6G-IA cooperation

6G-MIRAI-HARMONY actively participates in SNS-JU and 6G-IA cooperation activities through coordinated engagement in working groups and cross-project initiatives.

The project is represented in several SNS-JU Working Groups and 6G-IA activities:

Table 5 6G-MIRAI-HARMONY representation in SNS-JU & 6G-IA WGs

Working group	6G-MIRAI-HARMONY Contact	Partner
Steering Board (SB)	Martha Vlachou-Konchylaki	(Project coordination) Ericsson
Technical Board (TB)	Renato L. G. Cavalcante & Jochen Fink	(Technical coordination) Fraunhofer HHI
6G Architecture WG	Md Arifur Rahman	IS-Wireless
Reliable Software Network WG	Adam Flizikowski	IS-Wireless
Test, Measurement and KPIs Validation WG	Efstathios Katranaras	Sequans
Pre-Standardization WG	Henning Sanneck Efstathios Katranaras	Apple Sequans
Hardware Technologies WG	Zhuangzhuang Cui	KU Leuven
Communications TF	Henning Sanneck	Apple
WiTaR (Women in Technology and Research)	Martha Vlachou-Konchylaki	Ericsson

Below is a short summary of some of the activities:

- SNS-JU Communications Task Force (Henning Sanneck, Apple): all meetings of Communications Task Force were attended. The meetings were very useful to understand the Dissemination & Communication methodology of SNS-JU / other projects and to involve 6G-MIRAI-HARMONY in the preparation of SNS-JU / cross-project events (MWC, EuCNC). The task force can support 6G-MIRAI-HARMONY wrt. specific promotion for certain events, publications, etc.
- 6G-IA Pre-Standardization WG (Efstathios Katranas, Henning Sanneck): all meetings of the Pre-Standardization WG were attended. The WG featured some very useful summary readouts of key 6G 3GPP meetings / plenaries (by Docomo & NEC delegates)

as well as intro presentations to ITU-T AINN FG, ETSI ISAC ISG. During the report period it was clarified that all AI/ML activities will take place in the “reliable SW networks” WG (i.e., not in pre-standardization WG). Furthermore, there was a discussion on a specific cross-project interest group on ISAC (which will happen in the (by invitation) SNS policy WG, i.e., not in the pre-standardization WG). Such a cross-project activity could be also considered for AI/ML (with specific benefits from a 6G-MIRAI-HARMONY perspective).

Project presentations

- February 17, 2025: 6G-MIRAI-HARMONY presented at SNS JU Call 3 Projects Introduction Webinars
- October 16, 2025: 6G-MIRAI-HARMONY presented at the SNS JU Communication Task Force meeting
- On 27 April 2026, INSTAR organized a workshop “6G INSTAR-Japan Standardisation Areas Alignment Workshop | Instar” where Prof. Dr. Akihiro Nakao, The University of Tokyo, Japan coordinator, 6G MIRAI HARMONY presented the Beyond-5G and 6G Directions towards Pre-Standardization and Dr Md Munjure Mowla, IS-Wireless, Poland, EU Side 6G-MIRAI presented 6G MIRAI-HARMONY and current standardisation collaboration mechanisms.

3.4 EU-JP cooperation

The EU–Japan cooperation framework within 6G-MIRAI-HARMONY has been structured around three collaboration pillars, which provide the basis for the ongoing cooperation roadmap. These pillars were agreed and established during the first EU–JP coordination activity in January 2026:

- Research Activities
- Standardization
- Demonstration/Proof-of-Concept (PoC)

Figure 17 EU-JP cooperation pillars



Pillar 1: Research Activities

The Research Activities pillar (Pillar 1) aims to establish regular scientific exchanges between the 6G-MIRAI and HARMONY projects, enabling partners to present ongoing work, share expertise, and discuss technical developments across work packages.

This pillar kicked off on February 24, 2026 and since July 2026 a regular series has been established for research exchange between the two projects, with the following topics presented so far:

- February 24, 2026: Dr. Renato L. G. Cavalcante (Fraunhofer HHI) - Unified theoretical frameworks for resource allocation in wireless networks
- March 26, 2026: Prof. Umebayashi (TUAT): SIMO Communications with Low-Resolution ADCs
- June 9, 2026: Prof. Luca Sanguinetti (CNIT): Towards 6G MIMO
- July 2, 2026: Tanguy Kerdoncuff (Ericsson): AI/ML in 6G MIMO (presenting AI/ML-based enhancements for 6G MIMO investigated in 3GPP and 6G-MIRAI)

- August 25, 2026: Assist. Prof. QuianQuian Pan (The University of Tokyo) - Intelligent Cross-Layer Congestion Control for Dynamic mmWave Networks with High Throughput and Fairness
- September 7, 2026: Noor Ul Ain (HHI): Distributed MIMO in Line-of_sight Environments: Bridging Optimal Processing and Practical Limitations

Pillar 2 : Standardization Collaboration

The Standardization Collaboration pillar (Pillar 2) focuses on aligning standardization-relevant research activities between the EU and Japanese partners, facilitating information exchange on ongoing 3GPP contributions and identifying opportunities for coordinated future standardization work, as a means of influencing global standards.

Past exchanges under pillar 2:

- March 4, 2026: Presentations by KDDI, Kyocera, University of Tokyo (HARMONY) and Ericsson, Telefonica, Apple (6G-MIRAI) launched the discussion on the targeted project results which are relevant for 3GPP RAN1, RAN2, SA2, the AI-RAN alliance and XGMF.
- September 1, 2026: Presentations by KDDI, Kyocera (HARMONY) and Ericsson, Apple (6G-MIRAI). A discussion was also held during this workshop with concrete action points on mapping the standardization items of both projects to the overall picture of RAN-CN harmonization view and defining any alignments and possibilities of joint contributions.

Overall, the standardization exchanges have enabled both projects to initiate mapping of the ongoing activities in 3GPP RAN1, RAN2, SA2, AI-RAN Alliance and XGMF and discuss areas where coordinated contributions are possible.

Pillar 3 – Demonstration / PoC Collaboration

The objective of the Demonstration / PoC Collaboration pillar (Pillar 3) is to jointly explore how research outcomes from both 6G-MIRAI and HARMONY can be validated in realistic experimental environments, including testbeds, datasets and PoC platforms.

The joint discussions under Pillar 3 were initiated on August 4, 2026 through a dedicated EU-Japan workshop on validation and demonstration activities. During the session, the Japanese partners presented their plans for evaluating research outcomes in the University of Tokyo campus testbed while the European partners presented the ongoing activities of WP3, including scenarios, benchmarking methodologies, datasets, validation frameworks and available testbed capabilities. The workshop served as a first exchange on experimental and validation activities of the two projects. While the difficulty of finding ideas that could be carried out jointly was highlighted, both projects agreed to continue the exchanges through follow-up sessions dedicated to brainstorming and defining possible collaboration activities under Pillar 3.

Coordination meetings EU-JP:

There have been 2 coordination meeting between 6G MIRAI and HARMONY during the first term of the project:

- January 15, 2026 – 6G MIRAI-HARMONY general coordination meeting (online)
- June 1, 2026 – 6G MIRAI-HARMONY EU-Japan Collaboration Meeting (face to face in Malaga, Spain)

Finally, there have been several dissemination activities focused on EU-JP collaboration:

- March 5, 2025: 6G-MIRAI-HARMONY was presented on Japan-EU Digital Partnership Stakeholder Consultation Roundtable
- April 2025: 6G MIRAI activities were presented at EU-Japan Digital Week 2025 (Tokyo)
- April 28, 2026: Publication on *AI/ML-based CSI-RS overhead reduction* in XGMF Beyond 5G whitepaper (6G Radio Technology Project “AI/ML and Digital Twin Technologies”)
- June 1, 2026: 6G-MIRAI-HARMONY collaboration roadmap presented during XGMF meeting held in Malaga, Spain.
- June 2, 2026: Joint workshop organized in EuCNC, Malaga on International Cooperation for AI-Native RAN for 6G.

- June 6, 2026: EuCNC 2026: Special session on Research collaborations beyond Europe towards 6G

4 Standardization and Regulatory Framework

4.1 Standardization

4.1.1 Approach

The standardization approach of the project combines direct participation in standards development organisations with pre-standardization activities. The project focuses primarily on 3GPP RAN activities where ongoing 6G study work has already started and is being discussed across RAN working groups. The table below summarizes the standardization bodies in which the consortium's partners take part:

Table 6 Partner interests wrt. SDOs for 6G-MIRAI-HARMONY

SDO	1 Fraunhofer	2 Ericsson France	3 Telefonica	4 ISRD	5 SEQ	6 APPLE	7 KU Leuven	8 CNIT/ UNPI	Contributions
3GPP RAN 1	✓	✓	✓		✓				Discussion papers, workshop contributions, specification, documents.
3GPP RAN 2		✓			✓	✓			
3GPP RAN 3		✓		✓					
3GPP RAN 4		✓			✓	✓			
ORAN Alliance	✓	✓		✓			✓		Whitepaper ORAN nGRG AI/ML, technical contributions to WG2.
ETSI ISG THz	✓		✓				✓	✓	Discussion papers, workshop, specification, documents.

4.1.2 Standards impact

During the reporting period, the project actively contributed to relevant standardization activities and pre-standardization discussions. The following table provides an overview of the standards contributions produced by the consortium.

Table 7 6G-MIRAI-HARMONY 3GPP contributions (6G Radio Study Item)

6G-MIRAI partner	Partner contacts	Contribution title	Link to contribution	WG	Meeting
Ericsson	Tanguy Kerdoncuff, Apostolos Destounis, Adrian Garcia Rodriguez	TDoc R1-2505180: AI/ML Use Cases for 6GR Air Interface	https://www.3gpp.org/ftp/tsg_ran/wg1_rl1/TSGR1_122/Docs/R1-2505180.zip	TSG-RAN WG1	Meeting #122 (Bengaluru, India)
Ericsson	Tanguy Kerdoncuff, Apostolos Destounis, Adrian Garcia Rodriguez	TDoc R1-2506762: AI/ML Use Cases for 6GR Air Interface	https://www.3gpp.org/ftp/tsg_ran/wg1_rl1/TSGR1_122b/Docs/R1-2506762.zip	TSG-RAN WG1	Meeting #122bis (Prague, Czech Republic)
Ericsson	Tanguy Kerdoncuff, Apostolos Destounis, Adrian Garcia Rodriguez	TDoc R1-2508365: AI/ML Use Cases for 6GR Air Interface	https://www.3gpp.org/ftp/tsg_ran/wg1_rl1/TSGR1_123/Docs/R1-2508365.zip	TSG-RAN WG1	Meeting #123 (Dallas, USA)
Ericsson	Tanguy Kerdoncuff, Adrian Garcia Rodriguez	TDoc R1-2601038: Views on aspects of downlink-based CSI Acquisition	https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_124/Docs/R1-2601038.zip	TSG-RAN WG1	Meeting #124 (Gothenburg, Sweden)
Ericsson	Tanguy Kerdoncuff, Adrian Garcia Rodriguez	TDoc R1-2603259: Views on aspects of downlink-based CSI Acquisition	https://www.3gpp.org/ftp/meetings_3gpp_sync/RAN1/Docs/R1-2603259.zip	TSG-RAN WG1	Meeting #124bis (Malta)
Apple	Nil Zaev, Jian Song, Henning Sanneck	R2-2600461 Views on 6G AIME use cases	https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_133/Docs/R2-2600461.zip	TSG-RAN WG2	Meeting #133 (Gothenburg, Sweden)
Apple	Nil Zaev, Jian Song, Henning Sanneck	R2-2603733 Views on 6G spectrum aggregation_v1	https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_134/Docs/R2-2603733.zip	TSG-RAN WG2	Meeting #134 (Dalian, China)

EU-Japan standardization collaboration forms one of the pillars of the broader 6G-MIRAI-HARMONY cooperation framework. Through regular workshops partners share information on ongoing standardization developments, identifying topics of common interest and explore opportunities for aligned future contributions. This collaboration complements the direct standardization activities reported in this section. A more detailed description of the EU-Japan collaboration framework and its standardization pillar is provided in Section 3.4.

4.2 Regulation

4.2.1 GDPR

The General Data Protection Regulation [GDPR] is the EU's comprehensive legal framework for data privacy, designed to safeguard the personal data of individuals and strengthen their fundamental privacy rights. It establishes clear and enforceable rules governing how organisations collect, process, store, and protect personal information, while granting individuals meaningful control over how their data is used. Notably, the GDPR applies not only to organisations based within the EU, but to any organisation anywhere in the world that handles the personal data of EU residents.

The GDPR's reach is intentionally broad. It applies to any organisation — regardless of size, sector, or geographic location — that processes the personal data of individuals within the EU. Personal data, in this context, covers any information that can directly or indirectly identify a person. This includes obvious identifiers such as names, addresses, and phone numbers, but also extends to online identifiers, behavioural data, and other digital traces that can be linked to a specific individual.

Organisations subject to the GDPR must handle personal data in accordance with a set of core principles. Data must be collected and processed lawfully, transparently, and for a clearly defined purpose. It should be limited to what is strictly necessary, kept accurate and up to date, and retained only for as long as required to fulfil the stated purpose. These principles collectively ensure that data use remains proportionate, purposeful, and respectful of individual rights.

One of the GDPR's most significant contributions is the set of rights it confers upon individuals. People have the right to access the personal data held about them, to have inaccuracies corrected, and to request the erasure of their data under certain conditions. They may also object to specific forms of data processing and, in some cases, request that their data be transferred to another service provider. These rights place individuals firmly in control of their own information.

In the event of a personal data breach, organisations are required to act swiftly. Where a breach poses a risk to the rights and freedoms of affected individuals, the relevant supervisory authority must be notified within 72 hours of the organisation becoming aware of it. In more serious cases, affected individuals must also be informed directly. This obligation promotes accountability and enables timely action to mitigate harm.

The GDPR places a strong emphasis on demonstrable accountability. Organisations must maintain appropriate documentation of their data processing activities and be able to show, at any time, that they are operating in compliance with the regulation. Where data processing activities are carried out at large scale or involve sensitive categories of data, organisations are required to appoint a Data Protection Officer (DPO) — an independent role responsible for overseeing compliance and acting as a point of contact for supervisory authorities.

The consequences of failing to comply with the GDPR are substantial. Depending on the nature and severity of the violation, fines can reach up to €20 million or 4% of the organisation's total global annual turnover — whichever figure is higher. These penalties reflect the seriousness with which the EU regards the protection of personal data and serve as a strong incentive for organisations to embed compliance into their operations.

4.2.2 Data Act

The European Data Act [DATA_ACT] establishes a comprehensive legal framework aimed at promoting fairness, interoperability, and innovation across Europe's data economy. It applies to data generated by connected products and related services — including IoT devices, industrial machinery, and smart systems — and complements the Data Governance Act as part of the EU's broader strategy to build a competitive, secure, and trustworthy digital ecosystem.

The Act's primary goals are to broaden access to and sharing of data, ensure fair contractual relationships — particularly for Small and Medium Enterprises (SMEs) — enable seamless switching between cloud and edge providers free from vendor lock-in, and establish interoperability requirements for data spaces and cloud services. It also introduces

provisions allowing public-sector bodies to access privately held data under exceptional circumstances, such as natural disasters or major public emergencies.

A central pillar of the regulation is the obligation placed on manufacturers and service providers to ensure that users can access data generated by the products or services they own or use. Such access must be easy, secure, and, where applicable, available in real time. Users may additionally share this data with third-party service providers of their choosing, fostering a more open and competitive market for digital and data-driven services.

The Act regulates business-to-business data sharing by requiring data holders to make data available on fair, transparent, and non-discriminatory terms. It explicitly prohibits unfair contractual clauses imposed on SMEs and provides model contractual terms to support balanced agreements. In business-to-government contexts, public bodies may request access to privately held data only under strictly defined conditions of exceptional need, subject to appropriate safeguards and proportionate compensation rules.

To address cloud lock-in, the Data Act introduces rules requiring cloud and edge service providers to support data and application portability, functional equivalence following a provider switch, reduced switching charges during a defined transition period, and the eventual elimination of exit fees. Providers are also required to support cross-system interoperability, including adherence to standards for data formats, Application Programming Interfaces (APIs), metadata, and smart contracts — all of which contribute to the development of harmonised European data spaces and enhanced cross-domain data sharing.

Compliance obligations encompass implementing user data access mechanisms, supporting secure data exchange with authorised third parties, enabling cloud switching, and maintaining alignment with GDPR, NIS2, and applicable cybersecurity standards. Each Member State will designate a competent authority to oversee compliance, operating within a coordinated EU-level governance structure.

The European Data Act represents a foundational regulation for Europe's data economy. It expands data availability, strengthens user rights, enhances interoperability, and reduces

both the technical and commercial barriers to innovative digital services. It is of particular relevance to projects involving IoT, artificial intelligence, data spaces, interoperability frameworks, distributed computing, and data-driven service development.

4.2.3 AI Act

The European AI Act [AI ACT], formally adopted in 2024, is the world's first comprehensive regulatory framework governing the development, deployment, and use of artificial intelligence. Its central objective is to ensure that AI systems placed on the EU market — or used anywhere within the EU — are safe, transparent, trustworthy, and respectful of fundamental rights, while at the same time supporting innovation and competitiveness. To achieve this balance, the Act adopts a risk-based approach, calibrating obligations to the potential societal impact of each AI system.

At the heart of the Act is a four-tier classification system that determines the level of regulatory scrutiny applied to any given AI system:

- **Unacceptable risk:** These systems are prohibited outright. Examples include AI used for social scoring or for manipulating human behaviour in harmful ways.
- **High risk:** These systems are subject to strict compliance requirements, reflecting their significant potential impact on individuals and society.
- **Limited risk:** These systems must meet targeted transparency obligations, such as disclosing when users are interacting with AI-generated content.
- **Minimal risk:** These systems may be deployed freely, without any additional regulatory constraints.

High-risk AI systems — those deployed in areas such as critical infrastructure, healthcare, education, law enforcement, employment, and essential public services — are subject to a comprehensive set of mandatory requirements. Providers must implement robust risk management processes, use high-quality training data, ensure meaningful human oversight, and maintain detailed technical documentation. Cybersecurity measures, transparency, and ongoing performance monitoring are required. In addition, providers must conduct

conformity assessments prior to market placement and sustain post-market monitoring throughout the system's lifecycle.

The Act also establishes a dedicated framework for General-Purpose AI (GPAI) models and foundation models — particularly those capable of generating content or powering a wide range of downstream applications. All GPAI developers must provide adequate technical documentation, ensure training data transparency, and implement appropriate risk mitigation measures. Developers of high-impact foundation models, such as large generative AI systems, face an additional layer of requirements covering cybersecurity resilience, systemic risk management, and energy consumption reporting.

Where AI systems engage directly with people, the Act mandates clear and explicit disclosure. Users must be informed when they are consuming AI-generated content, when they are communicating with an AI bot rather than a human, and when biometric categorisation or emotion recognition technologies are being applied. These obligations are designed to protect user autonomy and uphold the principle of informed consent.

Recognising the importance of responsible experimentation, the Act establishes regulatory sandboxes — structured environments in which companies, research institutions, and startups can test and validate AI systems under the supervision of national authorities, prior to broader deployment. This mechanism is intended to lower barriers to entry for innovators while maintaining appropriate oversight.

The AI Act does not operate in isolation. It is designed to work in conjunction with existing EU legislation, including the GDPR, the Data Act, and the Cyber Resilience Act, as well as a range of sector-specific rules. Together, these instruments form a coherent and mutually reinforcing regulatory ecosystem for digital technologies across the EU.

Compliance with the Act will be supervised by national authorities in each Member State, working alongside the newly established European AI Office. The Office is responsible for coordinating enforcement activity, monitoring systemic and emerging risks, and ensuring consistent application of the rules across the EU. Non-compliance carries substantial

financial penalties, with fines scaled to the severity of the violation and potentially reaching several percent of a company's global annual turnover.

The European AI Act represents a foundational step in building a trustworthy AI ecosystem for Europe. By establishing clear obligations for developers and deployers alike, it ensures that AI is developed and used in ways that are safe, ethical, transparent, and aligned with fundamental rights. At the same time, through sandboxes and harmonised market rules, it actively supports innovation rather than stifling it. The Act is of direct relevance to any project involving AI-enabled products, automated decision-making, data-driven services, or the development of foundation models.

5 Exploitation

5.1 Introduction

Deliverable D4.1 [D 4.1] established the initial exploitation strategy of 6G-MIRAI-HARMONY, defining the main exploitation pathways, industrialization roadmap, and individual and joint exploitation plans of the consortium partners. This section provides an update on the exploitation activities performed since D4.1, highlighting the progress achieved, the evolution of exploitation priorities, and the current status of the industrial and academic exploitation roadmap.

Overall, the exploitation objectives defined in D4.1 remain valid and no major deviations from the original plans have been identified. Exploitation activities primarily concentrate on the identification of Key Exploitable Results (KERs), technology maturation, alignment of technical developments with partner business objectives, and preparation for future industrial uptake, standardization, and open innovation activities.

5.1.1 Industrial Exploitation Roadmap Status

Since the beginning of the project, the industrial partners have been progressing according to the exploitation roadmap defined in Deliverable D4.1. During the first half of the project (M1–M18), the activities focused on identifying high-value use cases, aligning technical developments with partner business objectives, and establishing foundations for future exploitation. Special attention has been given to the identification of early exploitation opportunities and the assessment of industrial relevance of project outcomes.

Table 8 Overview of the industrialization roadmap for exploitation from D4.1 [D 4.1]

Roadmap Phase	Planned activity (D4.1)	Status	Assessment
M1-M10	Identify high-value use cases	Completed	Finished
M11-M18	Update exploitation plans	Ongoing	On track

M18-M24	Prepare exploitation activities	Pending	Pending
M24-M36	Exploitation activities begin	Pending	Pending

Table 8 summarizes the current status of the industrial exploitation roadmap. As shown in the table, the initial phase dedicated to use-case identification has been successfully completed, while the project is currently progressing through the phase focused on updating exploitation plans and assessing the potential impact of emerging technical results. The next phases will concentrate on consolidating exploitable outcomes, preparing intellectual property and standardization activities where appropriate. Updates from the industrial partners can be found in Section 5.4.

5.1.2 Academic Exploitation Roadmap Status

Academic exploitation is progressing according to plan and already constitutes one of the strongest impact vectors of the project. Several partners have produced scientific publications, public datasets, contributions to international conferences, tutorials, and workshops [D 3.2]. In addition, project activities have been integrated into ongoing PhD and MSc research programs, creating opportunities to train the next generation of researchers in AI-native wireless systems. Specific updates from the academic partners can be found in Section 5.4.

5.2 Joint Exploitation Activities

In the first half of the project (i.e., M1-M18), the consortium has actively pursued joint exploitation activities aimed at increasing the visibility and impact of the project results. These activities focused on fostering collaboration across partners, promoting joint dissemination efforts, and identifying opportunities for future industrial and research exploitation. In addition, multiple joint initiatives were discussed and launched, including the preparation of joint publications. In addition, the consortium contributed to international events and collaborative activities with the SNS-JU and EU-JP communities,

including workshops, tutorials, and technical exchanges (see Section 3 and Section 4 for more details). During the next months, the consortium is planning to explore the preparation of workshops at major conferences, such as IEEE Globecom and IEEE INFOCOM, as well as the preparation of additional joint publications and technical contributions.

5.3 Early Exploitation Results

The project has started to generate concrete exploitation-relevant outcomes. Notably, the consortium reported two key achievements to the SNS JU Innovation Radar process. The first achievement concerns the impact of the project on 3GPP studies related to AI/ML-assisted CSI acquisition for 6G air interfaces, including contributions that influenced discussions and agreements within 3GPP RAN1. The second achievement concerns the development of a generative AI framework for site-specific wireless channel modeling, enabling the creation of realistic synthetic channel datasets with applications in network planning, digital twins, and AI model training. Table 9 provides a more detailed description of the two achievements.

Table 9 Early exploitation results

ID	Result / Component	Description	Contribution to future exploitation
R1	AI-based CSI acquisition and prediction	AI/ML techniques for reducing CSI-RS overhead and improving scalability of CSI acquisition in large antenna systems	Enables scalable and efficient PHY layer operation and contributes to 3GPP standardization activities
R2	Generative AI for site-specific	Generative models for producing realistic MIMO channel datasets based on limited data and environmental information	Enables digital twins, network planning, and data-driven optimization for future 6G systems

	channel modeling		
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The identified results will be continuously refined, extended, and consolidated during the second half of the project. These efforts will culminate in a set of KERs where the exploitation pathways, market relevance, and IPR aspects will be detailed.

5.4 Individual Exploitation Plans

In this section, we detail the individual exploitation plans from the 6G-MIRAI-HARMONY partners:

Table 10 Per partner exploitation plans

Partner	Exploitation plans	Updates to plan
ISRD	As a SME partner in 6G-MIRAI-HARMONY, ISRD aims to disseminate and exploit its scientific contributions in international events through participating in several conferences, workshops, symposiums, and scientific journals. The output of 6G-MIRAI-HARMONY will enrich the portfolio of the company on a global level, by developing innovative algorithms for radio resource management with particular focus on URLLC/TSN networks by power control and	As WP2 leader in 6G-MIRAI-HARMONY, ISRD will exploit the project results to strengthen its R&I capabilities in AI/ML-enabled 6G RAN and O-RAN-based cell-free massive MIMO. The main focus is on ML-based uplink power control for improving spectral efficiency and reliability, as well as ML-assisted beamforming and coordination mechanisms considering the D2 interface. ISRD also contributes to the 6G-MIRAI architecture blueprint by providing WP2 algorithmic and system-level inputs, and supports WP3 through

	dynamic resource scheduling mechanisms for cell-free mMIMO network with distributed ML algorithm. Furthermore, ISRD will also design and develop flexible fronthaul solution by predicted the traffic based on ML algorithm. The developed solutions and its integration our product. Consequently, 6G-MIRAI-HARMONY results will allow ISRD to further enhance the product, helping to initiate new customers (e.g., commercial MNOs, research institutes, etc.) to use it as an experimenter platform.	the provision of relevant datasets and technical inputs. The developed concepts will be assessed for possible integration into future ISRD RAN solutions and experimentation platforms. In parallel, ISRD participates in the SNS JU 6G Architecture Working Group and the Reliable Software Networks Working Group, supporting alignment with broader 6G architecture and reliability discussions. The project outcomes will further contribute to scientific dissemination, internal knowledge development, and potential reuse in future R&I and product evolution activities.
Ericsson France	Analysis of standardization impact of proposed AI/ML-based solutions relevant to 3GPP RAN1, RAN2, and RAN4 groups. At least two publications, one of them jointly with Telefonica, of 6G-MIRAI-HARMONY results at tier-1 international conferences and journals (e.g., IEEE Communications Magazine or IEEE Globecom/ ICC). Additionally, Ericsson France will also organize of at least two tutorials and/or workshops focused	Ericsson has actively contributed to the dissemination and standardization of AI/ML technologies for future radio access networks through several 3GPP RAN1 contributions. Ericsson also <ol style="list-style-type: none"> 1. co-organized a tutorial on AI/ML standardization for the 6G air interface at EUCNC 2026 together with other 6G-MIRAI partners, 2. presented a keynote at the 2026 IEICE-CS conference in Japan, and

	on AI/ML for air interface and where the project-related results will be highlighted.	<p>3. published a white paper within the Japanese XG Mobile Forum outlining Ericsson's vision for a key 6G use case.</p> <p>Looking ahead, Ericsson plans to further strengthen its impact through additional tutorials and workshops, continued contributions to 3GPP standardization, and the publication of research results in at least two leading journals or international conferences.</p>
SEQ	<p>SEQ will utilize the project's results to strengthen its awareness and proficiency in AI/ML optimization schemes, bolster internal communication and training on this research area, inform product definition to strategize transition from 5G to 6G, and guide internal development for SEQ forthcoming device platforms. Fundamentally, SEQ will strive to leverage the project's outcomes to facilitate the integration of innovative 6G technologies into our next generation products. Moreover, the insights obtained from SEQ technical work in AI-aided wireless communications will propel scientific publications,</p>	<p>Sequans is using the progress in WP1 and WP2 to increase expertise in the AI/ML space. We specifically take advantage of our WP1 technical work on CSI estimation and prediction for cell-free massive MIMO, to expand our understanding on aspects of different neural network-based models, advantages of different architectures for employing intelligence, and use of own and public datasets for ML model training. The results developing within WP1 are planned to feed at least one scientific paper submission in the near future.</p> <p>In parallel, the project (through WP3/WP4) gives us the opportunity to monitor meaningful use cases and</p>

	<p>whitepapers, and an educated activity to 3GPP groups for helping the development of novel RAN schemes and efficient, practical standards specifications.</p>	<p>developments on AI/ML front in 3GPP standardization.</p> <p>The overall gained expertise is already supporting internal training regarding the use of AI/ML in cellular systems, as relevant communication and mentoring have started among our technology, strategy and business teams.</p>
APPLE	<p>The project objectives of 6G-MIRAI-HARMONY are very relevant to Apple's interests regarding AI/ML in (cellular) networks. The research results on future cell-free architecture and AI-nativeness obtained in the project will be leveraged internally in the development process for 6G user-centric network technologies. Apple plans to deliver at least 3 publications of research results at conferences as well as international and joint EU-JP industry events. The collaborative investigation and evaluation of the AI/ML algorithms and AI/ML-centric 6G architecture (incl. working on ML datasets) together with other members of the consortium will help Apple select and design AI-based solutions in its diverse product and associated</p>	<p>Apple has published the baseline for its WP2 work in 6G-MIRAI-HARMONY together with initial results in a paper at EuCNC 2026.</p> <p>Apple has submitted 2 contributions to 3GPP RAN2 which elaborate on critical protocol stack components of that baseline. Apple has taken the role of monitoring RAN2 for further developments relevant to 6G-MIRAI-HARMONY. Finally, ongoing internal alignment of 6G positions as well as concept creation is taking the work in 6G-MIRAI-HARMONY into account.</p>

	<p>service offerings enjoyed by many millions of consumer end users around the world. In addition, Apple will benefit from the pre-standards collaborative work to further develop its 6G standardization position, thereby enabling efficient and pre-aligned standards contributions to the 3GPP Rel. 20 & 21 study phases by Apple.</p>	
Telefónica	<p>As a network operator, Telefonica will focus on incorporating the research results in 6G-MIRAI-HARMONY with their business and operation units by: (i) improving or developing new radio access optimization methods and algorithms for future 6G networks, (ii) deriving innovative products or services innovations based on the interaction with 6G-MIRAI-HARMONY, and (iii) submitting patents to license and protect new radio modelling tools or optimization methods. The solutions Telefonica will develop in 6G-MIRAI-HARMONY will be exploited as part of its internal innovation process. The results will</p>	<p>During the first part of the project, Telefónica has been advancing with the exploitation of 6G-MIRAI-HARMONY results. Specifically, Telefónica has contributed to a joint tutorial to EuCNC 2026, increasing the visibility of the project outcomes. In addition, Telefónica published and submitted multiple scientific publications related to the efforts in WP1 and WP3. Currently, Telefónica is exploring the submission of a patent application that covers key innovations related to generative AI models for realistic wireless channel generation. In the second part of the project, Telefónica will continue to align the research outcomes of 6G-MIRAI-HARMONY with its innovation and business objectives. To be specific,</p>

	<p>be used in the design of future own products and solutions for the commercial mobile operator brands of the Telefónica group, such as Movistar Spain, O2 UK, O2 Germany, or Vivo Brazil. For example, generative AI Models of the radio propagation, originated from a marriage of simulated and measured data, will allow to evaluate “what if” scenarios, e.g., to infer the coverage and capacity resulting when a certain subset of cells is upgraded with additional carriers in new frequency bands, or when some carriers are switched off for energy saving purposes. Furthermore, the outcomes of 6G-MIRAI-HARMONY will contribute to the team’s scientific production and visibility with top-tier IEEE publications and invited lectures.</p>	<p>Telefónica will further develop AI-enabled radio optimization and channel modeling solutions, will explore potential scientific publications and IPR opportunities, and will contribute to collaborative activities to increase the visibility of the project results.</p>
KU Leuven	<p>The 6G-MIRAI-HARMONY project will have a significant scientific impact for KU Leuven. It will help KU Leuven to further deepen its expertise in hybrid deep learning models, previously mainly focused on localization for cell-free and Massive</p>	<p>So far, we have submitted papers for publication regarding AI-based fronthaul reduction, PA modelling, and digital pre-distortion compensation. We have also published a dataset about non-linear PA behavior. In the future, we will extend our work on AI-based</p>

	<p>MIMO towards MIMO processing blocks for the 6G baseband. In addition, KU Leuven will make public more and diverse datasets for Massive MIMO and cell-free MIMO communication in this project, which will help visibility of the team to the AI-based 6G community. KU Leuven will mainly valorize this project as a breeding ground towards new scientific ideas, such as decentralized or continual learning, for follow-up projects. KU Leuven will enrich its scientific knowledge through scientific publications and datasets, broadening the existing knowledge and capacity.</p>	<p>fronthaul and use our PA dataset to implement PA-distortion-aware precoding. This will lead to several more publications and increased visibility to the community at the intersection between AI and wireless communications.</p>
CNIT	<p>Aims to exploit the results of its participation in 6G-MIRAI-HARMONY in several ways:</p> <ul style="list-style-type: none"> • Strengthening industrial competence: CNIT will provide industrial partners with enhanced expertise and will disseminate project results beyond the consortium boundaries. By leveraging existing relationships with key 	<p>During the first half of the project, CNIT co-organized, together with other project partners, a tutorial at EuCNC 2026 on AI/ML standardization for future 6G networks. CNIT also delivered an online tutorial to the Japanese HARMONY partners, supporting knowledge exchange across the two sides of the project. Furthermore, a PhD student from the HARMONY project will visit CNIT to work on MIMO technologies,</p>

	<p>industry players, CNIT will help these companies realize the full potential of 5G/6G technologies, thereby influencing their strategic initiatives.</p> <ul style="list-style-type: none"> • Empowering Telecom Operators: By working closely with TIM and other telecom operators in Italy, CNIT will enhance their competence in deploying advanced telecom technologies, facilitating the adoption of 5G/6G solutions. • Supporting SMEs: CNIT will provide specialized knowledge to small and medium-sized enterprises (SMEs) venturing into AI-native communications, helping them to capitalize on the emerging opportunities in this field. • Professional development: Leveraging the expertise acquired through the Academies, CNIT will provide training to professionals from large industries, further enhancing their competencies. • Research output: CNIT aims to increase its contributions to 	<p>further strengthening collaboration with the Japanese partners. In terms of industrial engagement, CNIT has initiated discussions with Ericsson and Telefónica to identify possible areas for future collaboration. Furthermore, CNIT delivered a tutorial within Pillar 1 of 6G-MIRAI-HARMONY on the evolution of MIMO technologies towards 6G, together with other 6G-MIRAI-HARMONY partners, to the EuCNC 2026 tutorial on AI/ML for 6G MIMO.</p>
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	<p>scientific journals and conferences, and to disseminate project results and findings to the wider academic community.</p>	
UniPi	<p>Aims to exploit the results of its participation in 6G-MIRAI-HARMONY in several ways:</p> <ul style="list-style-type: none"> • Dissemination of Results: As an academic partner and member of local and national valorisation clusters, UNIPI will actively disseminate project results through publications in scientific journals and presentations at conferences, ensuring broad visibility within the academic community. • Curriculum integration: The knowledge and methods developed in the project will be integrated into academic courses at PhD level at the Department of Information Engineering of UNIPI, enriching the educational experience of students at both the 	<p>During the first half of the project, UNIPI has made substantial progress in the academic exploitation of 6G-MIRAI-HARMONY results through scientific dissemination, advanced education, and postgraduate training. Research activities related to the project have already generated a significant stream of scientific outputs, including peer-reviewed journal and conference publications as well as several journal submissions currently under review. These works address key topics relevant to 6G-MIRAI-HARMONY, including AI/ML-assisted power optimization, scalable resource allocation and user-centric clustering in cell-free massive MIMO networks, and learning-based approaches for energy-efficient network operation.</p> <p>The project has also contributed directly to the training of young researchers. In particular, PhD student Heng Zhao has</p>

	<p>undergraduate and postgraduate levels.</p> <ul style="list-style-type: none"> • Industry Collaboration: UNIPi will collaborate with industry stakeholders to translate research findings into practical applications, fostering innovation and contributing to industrial advancement in relevant sectors. • Sustainability through research continuity: As a non-profit organization, UNIPi does not seek direct commercial exploitation of project results. Instead, it uses the results to apply for follow-up projects at national and international levels, thus ensuring the long-term continuity of the Institute's research efforts in the respective field. • Professional development: UNIPi will workshops, seminars, or training sessions to enhance the skills and competencies of professionals in industries related to the project's focus areas. • Technology Transfer: Efforts will 	<p>submitted the paper "Load-Coupling-Enabled Base Station Sleep Mode Optimization Using Deep Reinforcement Learning", currently under review. The research leading to this work has contributed to her doctoral training and to the development of expertise at the intersection of wireless network optimization and machine learning. Postgraduate education has further benefited from a Master's thesis carried out in collaboration with Fraunhofer HHI on the acceleration of power-control algorithms using AI/ML techniques.</p> <p>Beyond research activities, project-generated knowledge has been transferred into teaching. Relevant concepts and methodologies have been incorporated into the second-year course "Intelligent Wireless Technologies" of the Master's Degree in Telecommunications Engineering at the University of Pisa, particularly in relation to optimization algorithms for wireless communication systems. UNIPi has also contributed to broader knowledge dissemination through educational and scientific activities, including the EuCNC 2026 tutorial on "AI/ML for 6G MIMO: From fundamentals to industrialization".</p>
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	<p>be made to facilitate the transfer of technology and know-how from academia to industry, promoting the adoption of cutting-edge technologies and solutions developed during the project.</p>	<p>During the second half of the project, UNIPi will continue to pursue scientific dissemination, MSc and PhD research activities, collaboration with industrial and research partners, technology and know-how transfer, and opportunities for follow-up national and European research initiatives, thereby supporting the further development and long-term exploitation of the knowledge generated within the project.</p>
Fraunhofer HHI	<p>Fraunhofer HHI will contribute to transferring the results of 6G-MIRAI-HARMONY to the German and European industrial ecosystem. These findings will be disseminated in Fraunhofer's startup incubator program, and flagship IEEE conferences and journals, forming the basis for future industry-commissioned projects aimed at developing new products or processes, as well as projects funded by EU and German agencies. As the coordinator of 6G-RIC (follow-up project is xG-RIC), one of Germany's largest 6G research hubs with established cooperation with Japanese industry and academia, Fraunhofer HHI will leverage 6G-MIRAI-HARMONY outcomes to strengthen ongoing initiatives.</p>	<p>Fraunhofer has contributed to several scientific publications covering the analysis of cell-free performance under imperfect line-of-sight (LoS) estimation, scheduling in cell-free massive MIMO, utility region analysis for cellular and cell-less wireless networks, the development of a proof-of-concept uplink multi-user MIMO testbed, and estimation techniques for MIMO systems. The estimation techniques involve carrier frequency offset and delay estimation for TDD operation, and angular power spectrum estimation. These activities have also established the basis for ongoing research and further scientific publications, including possible work on topics such as AI/ML-aided scheduling for cell-free MIMO,</p>

	<p>Close collaboration with the Technical University of Berlin will also ensure the integration of results into student education through courses and PhD/M.Sc. theses.</p>	<p>AI/ML-based network planning, and synchronization aspects, as well as the potential exploitation of the developed multi-user MIMO testbed. Furthermore, Fraunhofer HHI has delivered a tutorial within Pillar 1 of 6G-MIRAI-HARMONY on resource allocation in wireless networks and contributed to the EuCNC 2026 tutorial on AI/ML for 6G MIMO, together with other 6G-MIRAI-HARMONY partners. In addition, Fraunhofer has supervised two master's theses, one in collaboration with TU Berlin on utility region analysis in cellular and cell-less networks, and another in collaboration with 6G-MIRAI-HARMONY partner UniPi on accelerating power control algorithms using AI/ML. The knowledge and results generated through these activities are also being leveraged in other 6G and beyond initiatives, particularly xG-RIC. Furthermore, several of these research activities have been carried out within the framework of ongoing PhD projects at Fraunhofer HHI and TU Berlin.</p>
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5.5 Intellectual Property

This paragraph shows the perspective on Intellectual Property gained through 6G-MIRAI-HARMONY for some of the project partners:

- **Telefónica:** As part of the project's exploitation activities, Telefónica is actively evaluating the protection and commercialization potential of its research outcomes in the area of generative AI-based site-specific wireless channel modeling. Building on the generative model that is being developed in WP1, Telefónica is planning the preparation of a patent application covering novel aspects of the developed methodology. This step reflects the intention to translate the obtained research results into protected intellectual property and to support future industrial exploitation within the 6G ecosystem.
- **Ericsson:** Within the project, Ericsson has investigated AI-based solutions for CSI-RS overhead reduction and AI-assisted SRS channel estimation, both of which are relevant to ongoing 3GPP standardization 6G activities. To date, no intellectual property protection has been filed based on these activities within the context of 6G-MIRAI. Ericsson will continue to assess the outcomes of this work and evaluate whether any future innovations warrant intellectual property protection.
- **Apple:** Raising attention to collaborative project research results in general, but also specifically for 6G-MIRAI-HARMONY, is a continuous activity ongoing at Apple. Apple is participating in WP2 with its first deliverable due in December 2026; more details on exploitation specifics can be shared after this delivery.
- **Sequans:** Our technical research work in WP1 on CSI estimation and prediction methods for cell-free massive MIMO is currently ongoing with promising initial results. Sequans is actively evaluating the protection and commercialization potential of the outcomes from this research and once a patentable solution is identified, we will plan to prepare a respective patent application.

6 Conclusions

This deliverable has presented an updated account of the cooperation, dissemination, and impact activities carried out within 6G-MIRAI-HARMONY during the first 18 months of the project. The evidence gathered across all four pillars of activity confirms that the project is on track, and in several areas ahead, of the objectives set out in the initial plan (D4.1).

On Open Science, the consortium has established robust, FAIR-aligned procedures for documents, datasets, and software, anchored by a dedicated Zenodo community linked to the EU Open Research Repository, ensuring that project outputs remain findable, accessible, and reusable well beyond the project's lifetime. In communication and dissemination, the project has built a strong and recognisable identity, reflected in a well-performing website, an actively growing LinkedIn presence, and high-visibility participation in flagship events, most notably the co-organised EuCNC 2026 workshop on International Cooperation for AI-native RAN and the tutorial on AI/ML for 6G MIMO. The EU-JP collaboration with the HARMONY consortium has matured into a structured three-pillar framework spanning research exchange, standardization alignment, and PoC/dataset cooperation, generating a steady cadence of joint activities and visible outputs.

In standardization and regulation, the consortium has delivered concrete 3GPP contributions relevant to AI/ML-based physical layer design and network coordination, while maintaining awareness of the evolving GDPR, Data Act, and AI Act landscape relevant to its technical work. On exploitation, early results, including AI-based CSI acquisition and generative channel modelling, have already been reported to the SNS JU Innovation Radar, and individual partners report tangible progress across publications, datasets, patent evaluation, and industrial and academic uptake.

Overall, no major deviations from the original dissemination, communication and exploitation strategy have been identified. For the remainder of the project, the consortium will focus on consolidating results into Key Exploitable Results, deepening EU-JP cooperation across all three pillars, and pursuing further high-impact dissemination opportunities (including a follow-up international workshop and renewed tutorial

submissions) thereby continuing to maximise the visibility, uptake, and long-term impact of 6G-MIRAI-HARMONY's results.

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