AI for real-world network operation

WP5 – Dissemination, communication, and exploitation of results

D5.3 – Communication and dissemination monitoring phase 1

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DISCLAIMER

EXECUTIVE SUMMARY

The present document represents the third deliverable to be submitted within the scope of the AI4REALNET project work package 5 (WP5): "Communication and dissemination monitoring phase 1".

The project's WP5 is structured in four tasks, which will be developed and implemented during the whole project, resulting in a total of nine deliverables [1]:

- Task 5.1 - Dissemination and communication plan
- Task 5.2 - Dissemination boosters
- Task 5.3 - Cooperation and synergies with regional and European initiatives/stakeholders
- Task 5.4 - Exploitation strategy and Plan

This deliverable, "Communication and dissemination monitoring phase 1", intends to provide an overview of the work developed so far in terms of communication and dissemination activities of the project, determined in the deliverable "Communication and Dissemination Plan". Therefore, this report is divided into two main analysing parts: the communication and the dissemination plans.

The dissemination plan will be first presented since it is focused on a macro strategy, with the presentation of the KPIs achieved within the communication actions carried out.

The communication part monitors the results of the integrated marketing approach based on several communication initiatives.

All results revealed will be detailed further in the document. Nevertheless, a brief overview is described hereinafter.

The measurable WP5 achievements about dissemination and communication include the project's visual identity and respective supports; 1 website fully operational; 3 social media channels (682 followers on LinkedIn, 79 followers on X and 20 subscribers on YouTube); 22 videos produced, including 12 interviews, summing a total of >900 views on YouTube; 6 infographics; 1 brochure; 4 newsletters, reaching a total of 373 subscribers, and all editions with an opening rate over 50%; 3 press releases, which resulted in 11 news published on the media; and 26 news pieces and 1 article published on other online platforms.

The dissemination included a total of 19 events that have happened since the beginning of the project, 8 organised by the consortium, and 11 in which the partners participated. The events organised included 4 webinars (Industry-driven use cases; Distributed and Hierarchical Reinforcement Learning;

Knowledge-Assisted AI Applications for Real-World Network Infrastructure; Towards transparent, Safe, and Trustworthy AI: Enhancing Human-AI Collaboration in Critical Infrastructures), a workshop at AMLD EPFL 2024 and a track at AMLD EPFL 2025. Also, a poster presentation at HFES Europe Chapter Lü beck and a working session on the AIoD and Adra-e event "Future Ready: On Demand Solutions with AI, Data, and Robotics" were delivered.

The project's partners also presented in a mFUND Workshop and participated in the Horizon Europe AI, Data & Robotics Launch Event 2024 at IEEE PES ISGT Europe 2024, the PERKS webinar on Human-centred and trustworthy AI, and the CIGRE WG C2.42 regarding AI-day for Power System Operations.

The creation of the project Advisory Board was formally concluded, with the aggregation of 20 expert members, and a first meeting already took place.

AI4REALNET disclosed a GitHub repository created for disseminating the project's results in public and free access, as well as released information through the AI-on-demand platform (AIoD). A page in the Zenodo repository was created alongside.

A data set containing structured training, validation, and test data was released in October 2024, publicly available on all the project's platforms.

17 scientific publications have been produced, 9 published and available in open-access and 7 still under review; 4 publications have been submitted and presented in the ECML 2024 Machine Learning for Sustainable Power Systems (ML4SPS) workshop, and 3 in the Annual Conference on Neural Information Processing Systems (NeurIPS 2024).

A collaboration between projects from the HORIZON-CL4-2022-HUMAN-02-01 call is ongoing, and that includes TANGO, THEMIS 5.0, PEER, and HumAIne projects. This synergy resulted in a joint news piece disseminated through all project's channels, as well as the organisation of a joint workshop that took place in the ADR Forum 2024 – "AI, Data and Robotics Forum".

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ABBREVIATIONS AND ACRONYMS

AAV	Automatic Advertising Value
AB	Advisory Board
AI	Artificial Intelligence
AIoD	AI on Demand
ATM	Air Traffic Management
CRM	Customer Relationship Management
D	Deliverable
EC	European Commission
EU	European Union
GDPR	General Data Protection Regulation
IMC	Integrated Marketing Communication
IMS	Integrated Marketing Strategy
KoM	Kick-off Meeting
KPI	Key Performance Indicator
M	Month
MUAC	Maastricht Upper Area Control Centre
n/a	Not available
PR	Press Release
SME	Small and Medium-sized Enterprise
TEF	Testing and Experimentation Facility
UC	Use Case
WP	Work Package

1. INTRODUCTION

The WP5 "Dissemination, communication, and exploitation of results" of the AI4REALNET project has the following objectives:

- Deliver communication, dissemination, engagement, and cooperation strategies.
- Deliver relevant input to scientific communities.
- Promote open science activities.
- Ensure collaboration with AI4Europe and Adra-e projects.
- Benchmark and engage the AI community along the project and get contributions (e.g., participation in open innovation with the AI4REALNET digital environments).
- Promote the exploitation of the AI4REALNET results and of the technologies.

The first deliverable - D5.1 – Communication and dissemination plan [2] – set up a dissemination and communication plan, following an Integrated Marketing Strategy approach (IMS), to reach certain outcomes from the beginning until the end of the project. It was submitted three months after the beginning of the project, approaching the first task of the WP: Task 5.1: Dissemination and communication plan.

As follows, this "Communication and dissemination monitoring phase 1" intends to analyse the work developed within the WP, providing an overview of the outcomes achieved in the first 18 months of the project and delivering some insights regarding the next steps. It presents as the project's WP5 third deliverable.

The project dissemination chapter will present the outcomes divided by communication tool. The communication tools presented in this report are the same as the ones presented in deliverable D5.1. This chapter ends with a summary of the KPIs achieved so far.

The project communication chapter will present the results achieved in the first and second communication campaigns, as well as an outline of the next steps.

2. PROJECT DISSEMINATION

The AI4REALNET project dissemination plan (D5.1) presented strategic and targeted actions for promoting the project and its results to a series of different audiences, as well as measuring instruments and indicators to assess the impact of each action. This report presents the results achieved so far for each of the actions developed according to that plan.

2.1 DISSEMINATION IMPACT ASSESSMENT (MONTH 1-18)

According to the categorisation of the communication tools in deliverable D5.1, the results achieved so far for each of the actions developed will be presented in seven subsections: Advertising, Digital marketing, Direct marketing, Public Relations, Advisory Board, Open Science and Cooperation with stakeholders.

Before presenting in detail the outcomes achieved, a general overview of the communication outcomes is presented in Figure 1. The indicators have been recorded by the uOneConnect platform, the project's management tool that consists of a web-based application that addresses all the work developed throughout the project (more information about this platform can be found in deliverable D6.1, "Project management guide – procedures handbook" [3]). The details about each outcome are presented in the report subsections.

The main outcomes per category in absolute results are the following:

- Press Releases: 3
- News pieces published on the media: 11
- News pieces published on other platforms: 26
- Social media channels: 232
- Newsletters: 4
- Events: 19
- Scientific Publications issued: 9
- Scientific Publications in review: 6
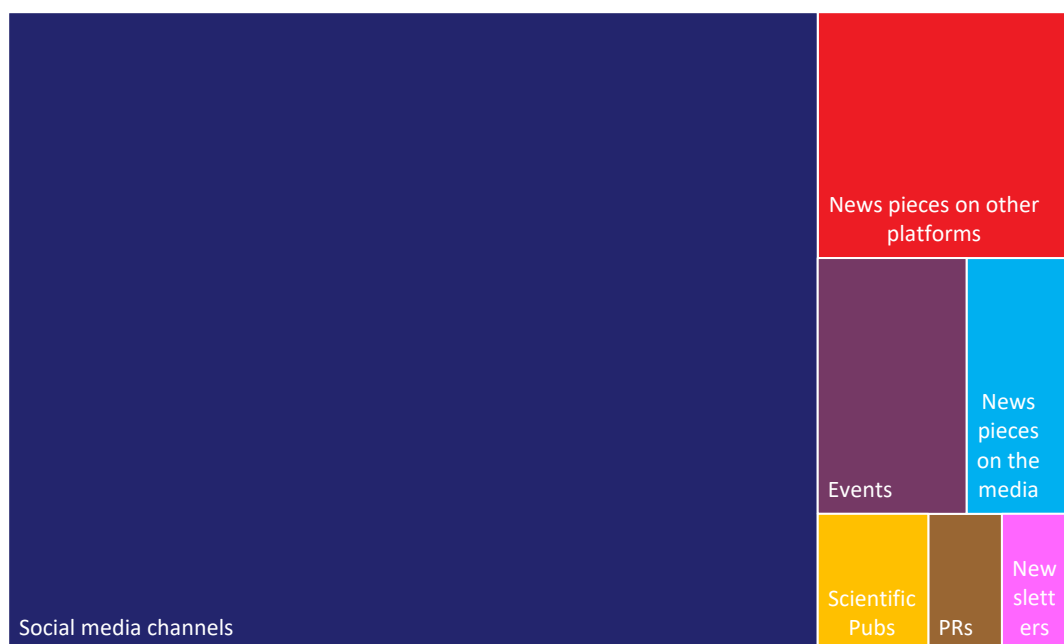
FIGURE 1 - MAIN OUTCOMES PER CATEGORY OF THE PROJECT

Several actions have been implemented during the project's first 18 months to determine the dissemination impact assessment. Considering the categories referred to in the above outcomes, Figure 2 presents the type of actions developed and its share among the whole communication activity. As can be observed, the activity developed within the social media networks is the most considerable one, resulting in the channel with the most relevance among the project's target groups so far. The next activities to show impact are the news pieces and the events, both important communication instruments to reach the audiences of interest.
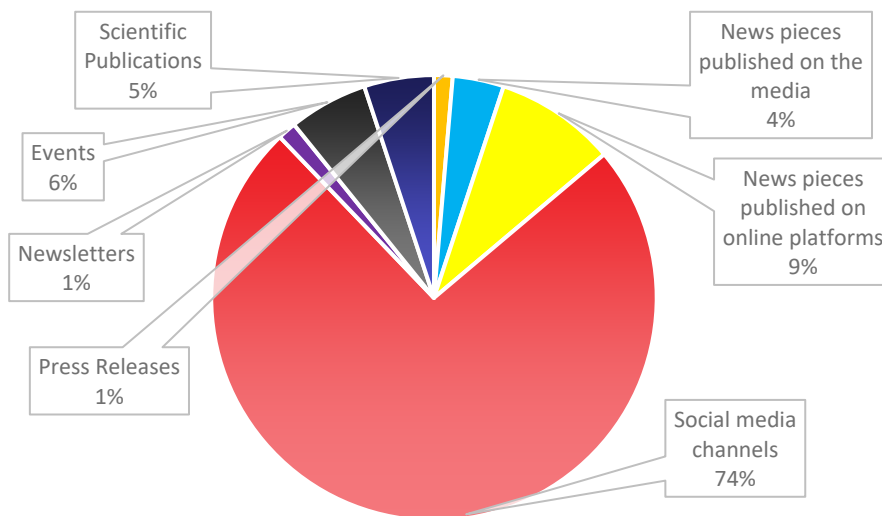
FIGURE 2 - COMMUNICATION OUTCOMES

2.1.1 ADVERTISING

Within the marketing strategy picked for this project (Integrated Marketing Communication approach), several marketing communication tools were selected to be part of the communication process, each one playing a specific role. All these tools are expected to contribute to reaching the project's target audiences and achieving the project's objectives.

The project identity, including the identity presentation and logos, the project presentation and an x-banner, has been developed, shared among all the partners of the consortium and published on the project's website. A slide deck was also created so that the researchers could rely on an institutional tool to help them construct their own presentations around the project's assignments.

Since all these tools were already developed and presented at the time of the deliverable D5.1 - Communication and dissemination plan, this report will not go into detail, whereas more information about this course of work can be found in that report.

The next subsections will focus on the work regarding the advertising strategy that was not developed at the time of deliverable D5.1, especially brochures, videos and infographics.

2.1.1.1 BROCHURES

During the reporting period, two brochures were planned and one executed (ANNEX 1). From this one, 50 printed copies were produced and delivered, as well as published on the project's website. Two

digital versions of this document were made available to the entire consortium, one for digital use only and the other specially for printing.

2.1.1.2 VIDEOS

The initial communication plan included the production of three videos targeting diverse project audiences. Currently, 22 videos have already been produced, including 12 interviews, a project video presentation and the recording and editing of four webinars. Also, two additional videos have been published regarding the work developed within D1.2. All videos are available on the project's YouTube page. One of the videos produced is unlisted (available through a targeted link) because it served as a project presentation for an online event. Table 2 presents an overview of all the videos and respective views, registered on March 27, 2025.

Title	Date	Views
AI4REALNET Happy Holidays	December 21, 2023	-
Interview with Mouadh Yagoubi | IRT SystemX	January 22, 2024	25
Interview with Ricardo Bessa | INESC TEC	January 22, 2024	19
Interview with Marcel Wasserer | EnliteAI	January 26, 2024	19
Interview with Jan Viebahn | TenneT	February 1, 2024	27
Horizon Europe AI, Data & Robotics - Launch Event 2024 | AI4REALNET Project presentation *(private)*	February 2, 2024	-
Interview with Irene Sturm | DB	February 16, 2024	11
Interview with Clark Borst | TU Delft	February 16, 2024	30
Interview with Adrian Egli | SBB CFF FFS	February 23, 2024	41
Interview with Daniel Boos | SBB CFF FFS	February 28, 2024	6
Interview with Manuel Schneider | Flatland Association	March 5, 2024	16
Interview with Cristina Felix | NAV Portugal	March 12, 2024	15
Interview with Antoine Marot | RTE	March 19, 2024	15
Interview with Marcello Restelli | POLIMI	March 21, 2024	107
AI4REALNET Project Presentation	April 4, 2024	109
Webinar | Industry-driven Use Cases	April 4, 2024	158
Webinar | Distributed and Hierarchical Reinforcement Learning	April 24, 2024	141
Webinar | Knowledge-Assisted AI Applications for Real-World Network Infrastructure	November 29, 2024	67
AI4REALNET Seasons Greetings	December 17, 2024	-

Title	Date	Views
Webinar | Towards Transparent, Safe and Trustworthy AI for critical infrastructures	February 14, 2025	111
Restricted sectors and sectorization based on sector occupancy	March 24, 2025	4
Available environments in BlueSky-Gym	March 24, 2025	3

TABLE 1 - LIST OF THE VIDEOS PRODUCED BY THE PROJECT

2.1.1.3 INFOGRAPHICS

An infographic is a visual representation of data with the purpose of simplifying information storytelling. Within the work developed by the AI4REALNET project, there was the need to create a series of six infographics that could straightforwardly explain the use cases (ANNEX 2), the baseline that will validate the project's framework [4]. These documents were made available on the website and disseminated across social media.

2.1.2 DIGITAL MARKETING

The outcomes obtained in the first 18 months of the project regarding the website and social media channels are presented in this subsection.

2.1.2.1 WEBSITE

The AI4REALNET project website was launched at the end of January 2024, with a related measuring tool in operation since March 2024, namely the Google Analytics platform. Therefore, the results presented in this section will for now consider this tool. However, due to the EU General Data Protection Regulation (GDPR), the next deliverables will present data using the Matomo platform. This alternative analytics tool can result in some discrepancies within the reporting indicators in the future.

So, until March 27, 2025, the website had 812 visits and summed 6,400 views. Figure 3 shows the five most visited pages of the website – highlights for the homepage with a great distance from other individual pages, followed by the use cases page – and Figure 4 the top 5 of the visitor's origin countries – with Portuguese visitors leading the table, followed by Switzerland, France, Italy and Germany, numbers that are quite expected, taking into consideration the composition of the consortium.

Regarding the website's documents download, the Google Analytics platform can´t provide precise indicators of how many times specific information was consulted and/or downloaded. However, we

can state that, until March 27, 2025, 620 downloads were made of all the documents available on the website.

	Total	6,400 100% of total
1	AI4REALNET – AI FOR REAL-WORLD NETWORK OPERATION	1,521 (23.77%)
2	Use Cases – AI4REALNET	558 (8.72%)
3	Project – AI4REALNET	527 (8.23%)
4	Deliverables – AI4REALNET	357 (5.58%)
5	Events – AI4REALNET	252 (3.94%)

FIGURE 3 - TOP 5 PAGES VISITED ON THE PROJECT WEBSITE

	Total	812 100% of total
1	Portugal	137 (16.87%)
2	Switzerland	113 (13.92%)
3	France	65 (8%)
4	Italy	61 (7.51%)
5	Germany	60 (7.39%)

FIGURE 4 - TOP 5 COUNTRIES OF ORIGIN

2.1.2.2   SOCIAL MEDIA

Since the beginning of the project and until March 27, 2025, 232 posts were made on all the project's social media channels of the project – LinkedIn, X (former Twitter) and YouTube.

Figure 5 presents the percentage of posts done on each of the project's social media channels. The absolute numbers are:

- X: 91 posts

- LinkedIn: 120 posts

- YouTube: 21 posts
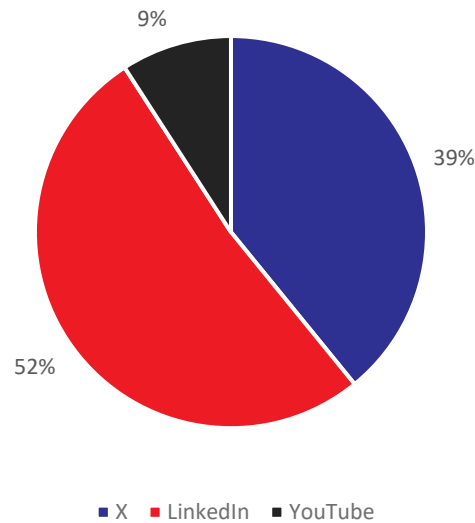
FIGURE 5 - PERCENTAGE OF POSTS DONE ON EACH OF THE SOCIAL MEDIA CHANNELS

The algorithm that decides to whom the content is delivered is different in each social media platform. Presenting a summary of the activity on social media, there are a few notes to consider.

In what concerns LinkedIn, we can share that the AI4REALNET profile has gathered 682 followers, had 62,896 organic impressions (meaning the number of times the content has naturally appeared on someone's page) and 1,472 reactions to our posts, 21 comments, and 30 reposts. This specific social network only allows for the collection of information from page activity from the last civil year. So, we do not have information regarding the activity that took place in November and December 2023, even though the profile was created right at the beginning of the project.

Regarding the X's profile of the project, the results have been more challenging to achieve since it has attracted only 79 followers. Thus, 91 posts and 9 reposts resulted in:

- 7,811 views
- 226 likes
- 8 comments
- 66 reposts

One of the reasons for this outcome can be related to the recent changes in the platform's algorithm concerning the social media structure itself. It will be difficult to counteract these results since X's algorithm is increasingly being fed by polemics and controversies, which is not the goal when

communicating an R&D project. However, another type of content will be tested to try to overcome these difficulties.

The YouTube page has hosted 22 videos so far (one is unlisted), including partner interviews, webinar recordings and a project presentation video, with 924 views and 20 subscribers. The individual impact of each of these videos was already presented in Chapter 2.1.1.2 Videos. Until March 27, 2025, a total of 13,018 impressions were registered (the number of times the video's thumbnails were shown to viewers). Since all the videos available on YouTube are also shared on other social media channels, this effect might explain the low reach of this social media channel when compared to the other.

2.1.3 DIRECT MARKETING

Communicating through direct marketing consists of using tools to engage directly with a target audience. In this project, we enhance the usage of newsletters, as described below.

2.1.3.1   NEWSLETTERS

Since the beginning of the project, four newsletters have been launched by e-mail and published on the project's website (ANNEX 3).

The mailing has been implemented through a CRM (Customer Relationship Management) platform, namely Mailchimp, from which it is possible to monitor the reach of each posting.

Audiences are challenged to subscribe to the newsletter through the website, and calls to action for that subscription are regularly published on social media channels. In addition, all consortium partners were directly contacted to subscribe and disseminate the information through their contacts. Until this date, 188 contacts were part of the project's newsletter dedicated audience.

All project newsletters can be consulted here:

Title	Date	Recipients	Opening rate
AI4REALNET Newsletter #1	January 31, 2024	31	58.1%
AI4REALNET Newsletter #2	April 30, 2024	74	55.4%
AI4REALNET Newsletter #3	September 30, 2024	93	61.5%
AI4REALNET Newsletter #4	January 31, 2025	175	50.9%

TABLE 2 - AI4REALNET PROJECT'S LAUNCHED NEWSLETTERS

The low opening rate of the first newsletter can be attributed to its initial distribution to a recipient list that required a subscription, meaning a dedicated audience had not yet been established. However, through ongoing dissemination efforts and regular engagement, the contact list nearly tripled after the first edition.

2.1.4 PUBLIC RELATIONS

The outcomes of four actions will be considered in this subsection: press releases, news pieces published on the media, news pieces published on other platforms and events.

2.1.4.1 PRESS RELEASES

Three press releases have been developed since the beginning of the project. As responsible for the project's communication with the media, INESC TEC produced a general press release in English (ANNEX 4) and distributed it among all the partners of the consortium so that they could adapt and disseminate it in their country-of-origin media community. This was then carried out by INESC TEC and Politecnico di Milano (POLIMI), resulting in two releases to the media in Portugal and Italy, respectively. INESC TEC launched the PR to the Portuguese media (ANNEX 5) on November 14, 2023, and made it available on the project's website. The release of this resulted in the publication of two new pieces, as detailed on the next subject.

Table 4 presents the details regarding the press releases that have been disseminated, namely the title, date, country and responsible partner.

Title	Date	Country	Partner
Artificial Intelligence and humans collaborate to increase safety of critical infrastructures	November 2023	All	INESC TEC
Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas	November 14, 2023	Portugal	INESC TEC
Improving the sustainability and security of critical infrastructure through Artificial Intelligence	December 14, 2023	Italy	POLIMI

TABLE 3 - PRESS RELEASES LAUNCHED SINCE THE BEGINNING OF THE PROJECT

2.1.4.2 NEWS PIECES PUBLISHED ON THE MEDIA

A total of 11 news pieces have been published in six different countries – Portugal, the United Kingdom, Italy, the United States of America, the Netherlands and Germany. The distribution of these publications by country can be observed in the following figure:
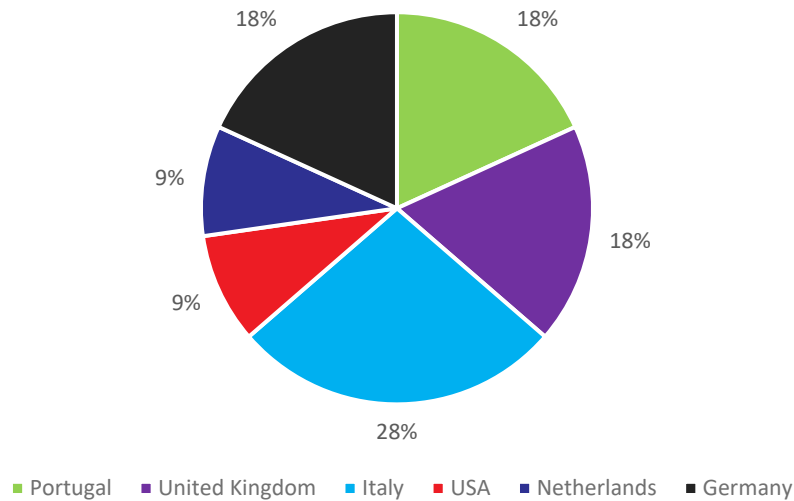
FIGURE 6 - PERCENTAGE OF NEWS PIECES PUBLISHED BY COUNTRY

The release of a press release to the Portuguese media resulted in the publication of two new pieces, with an Automatic Advertising Value (AAV)[1] obtained of about 322k€.

The following table shows the list of news pieces published in the media by country, considering that some were a direct consequence of the press releases launched.

Title	Date	Media	Country
Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas	November 11, 2023	e-newvation	Portugal
Inteligência artificial pode aumentar segurança de infraestruturas críticas	November 17, 2023	Mais Tecnologia	Portugal
AI and humans collaborate to increase safety of critical infrastructures	November 16, 2023	The Voice of Renewables	UK

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[1] AAV corresponds to the advertising value equivalent to the space occupied by the news calculated automatically from the cost of an even colourless page in the press, one second on television or radio and CPM (cost per thousand contacts) in online media.

Title	Date	Media	Country
Improving the sustainability and security of critical infrastructure through Artificial Intelligence	December 14, 2023	Eureka Alert	USA
Infrastrutture critiche, più sostenibilità e sicurezza con l'Intelligenza Artificiale	December 14, 2023	Build News	Italy
Migliorare la sostenibilità e la sicurezza delle infrastrutture critiche grazie all'Intelligenza Artificiale	December 14, 2023	Gazzetta di Milano	Italy
AI improves sustainability and security of critical infrastructure	December 15, 2023	Rocking Robots	Netherlands
Il Politecnico di Milano tra i partner del progetto europeo AI4REALNET	December 22, 2023	Informatore	Italy
European researchers explore use of AI in critical infrastructure	January 10, 2024	Build in Digital	UK
ZHAW und FHNW werden Teil von europäischem KI-Projekt	February 14, 2024	Inside IT	Germany
Verbesserung der Vertrauenswürdigkeit kritischer Systeme mit KI: ZHAW und FHNW sind Teil des EU-HORIZON-Projekts AI4REALNET	February 14, 2024	myscience	Germany

TABLE 4 - NEWS PIECES PUBLISHED IN THE MEDIA

Regarding the project's international dissemination, identifying the exact source of information can be challenging, as content creators – whether from official media or other channels – may receive details directly or indirectly through various sources. Nonetheless, the results from the first 18 months are considered positive.

2.1.4.3   NEWS PIECES PUBLISHED ON OTHER PLATFORMS

26 news pieces have been published on other online platforms – 11 on institutional websites, 4 on institutional newsletters, 8 on the project's websites, 1 on EC platforms, and 2 on other online networks – since the beginning of the project, as detailed below.

Title	Date	Platform
Projeto AI4REALNET	October 2023	INESC TEC Institutional website

Title	Date	Platform
AI4REALNET Project	October 2023	INESC TEC Institutional website
Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas	November 14, 2023	BIP INESC TEC Magazine
Artificial Intelligence and humans collaborate to increase safety of critical infrastructures	November 14, 2023	BIP INESC TEC Magazine
INESC TEC contribui para discussão sobre posicionamento da Europa em Inteligência Artificial, Dados e Robótica	November 28, 2024	BIP INESC TEC Magazine
INESC TEC contributed to the discussion on Europe's positioning in Artificial Intelligence, Data and Robotics	November 28, 2024	BIP INESC TEC Magazine
Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas	November 14, 2023	INESC TEC Institutional website
Artificial Intelligence and humans collaborate to increase safety of critical infrastructures	November 14, 2023	INESC TEC Institutional website
Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas	November 14, 2023	INESC TEC Institutional website [press archive]
Artificial Intelligence and humans collaborate to increase safety of critical infrastructures	November 14, 2023	INESC TEC Institutional website [press archive]
Improving sustainability and safety of critical infrastructures with the AI	December 14, 2023	POLIMI Institutional website
Improving the sustainability and security of critical infrastructure through Artificial Intelligence	December 14, 2023	POLIMI Institutional website [press archive]
Improving the trustworthiness of critical systems with AI: CAI and IDP are part of the EU HORIZON project AI4REALNET	September 18, 2023	ZHAW Institutional website
AI for REAL-world NETwork operation (AI4REALNET)	October 2023	ZHAW Institutional website
Con AI4REALNET infrastrutture critiche più sostenibili e sicure grazie all'AI	January 10, 2024	Regione Lombardia
Con AI4REALNET infrastrutture critiche più sostenibili e sicure grazie all AI	January 10, 2024	ESGData
New project on using AI to support human operators to control critical infrastructure	November 27, 2023	UvA Institutional website
Artificial Intelligence and humans collaborate to increase safety of critical infrastructures	November 29, 2023	AI4REALNET website

Title	Date	Platform
AI4REALNET Consortium Holds Second Meeting	June 20, 2024	AI4REALNET website
AI4REALNET and Leading EU Projects Announce Partnership for Ethical AI Development and Human-Centric Collaboration	September 27, 2024	AI4REALNET website
AI4REALNET Consortium Lays Groundwork for Ethical AI in Critical Infrastructure	October 3, 2024	AI4REALNET website
AI4REALNET Workshop Explores Human-Centric AI and Trustworthy Design	November 11, 2024	AI4REALNET website
AI4REALNET project coordinator contributed to the roadmap on Artificial Intelligence applied to power systems operation	December 10, 2024	AI4REALNET website
Pioneering Railway Innovation: Highlights from the Flatland Workshop & Symposium 2024	January 1, 2025	AI4REALNET website
AI4REALNET project	November 30, 2024	ADR-e website
Five EU Projects unite to advance ethical and trustworthy Human-AI collaboration	September 26, 2024	HumAIne Institutional website

TABLE 5 - NEWS PIECES PUBLISHED ON OTHER ONLINE PLATFORMS

In this section, we highlight a joint news piece (ANNEX 6), developed by the collaboration engaged in 2024 that united five projects focused on "AI for human empowerment": AI4REALNET, TANGO, THEMIS 5.0, PEER, and HumAIne. This activity will be explained in detail further in topic 2.1.7.3. This piece dissemination was led by HumAIne and distributed through all the project's involved social media channels, as well as published on the HumAIne institutional website.

On a different dimension, in the first 18 months of the project, one opinion article was published in an institutional communication science magazine, namely INESC TEC Science & Society Magazine, addressing the work developed in the AI4REALNET project. Table 7 lists the detailed article information.

Title	Date	Venue	Type	Author(s)
A tale of two transitions: sustainable energy and Artificial Intelligence	January 21, 2025	INESC TEC Science & Society Magazine	Article	Ricardo Bessa [INESC TEC]

TABLE 6 - ARTICLE PUBLISHED IN THE SCOPE OF THE PROJECT

2.1.4.4 EVENTS

Two types of events can occur within the AI4REALNET project: organised by the consortium (total of 8) or organised by other entities or institutions (conferences, EU events, workshops, etc.) in which the project's partners participate (total of 11). The percentage of those events can be observed in Figure 7.

■ Organisation ■ Participation
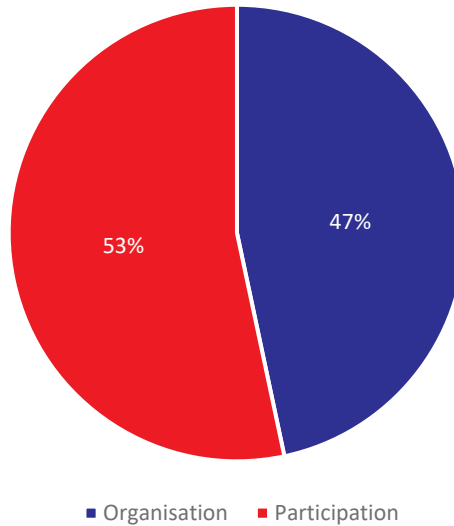
FIGURE 7- PERCENTAGE OF EVENTS REGARDING THE PROJECT'S CONSORTIUM

Regarding the events organised by the consortium, 8 events happened within the first 18 months of the project, namely 4 webinars and 4 workshops, with a total of 479 participants.

Title	Date	Partners	Participants
Industry-driven use cases for AI webinar	April 3, 2024	INESC TEC, POLIMI	146
Distributed and Hierarchical Reinforcement Learning webinar	April 24, 2024	INESC TEC, POLIMI	66
Knowledge-Assisted AI Applications for Real-World Network Infrastructure webinar	November 29, 2024	INESC TEC, POLIMI	34
Bridging the Gap: Solving Real World Problems with Open Research (Workshop at AMLD EPFL 2024)	March 26, 2024	RTE, DB, SBB, ZHAW, FLATLAND	60
From Algorithms to Assurance: Designing Human-Centric AI to enhance Collaboration, Trust, and Acceptance (Workshop at ADRF 2024)	November 5, 2024	INESC TEC	32

Title	Date	Partners	Participants
Flatland Symposium and workshop	November 19, 2024	FLATLAND (organiser), RTE, DB, ENLITEAI	66
AI and Simulation: Solving complex real-world challenges (Track at AMLD EPFL 2025)	February 11, 2025	FLATLAND (organiser), ENLITEAI	45
Towards transparent, Safe, and Trustworthy AI: Enhancing Human-AI Collaboration in Critical Infrastructures webinar	February 14, 2025	INESC TEC, POLIMI, Fraunhofer	30

TABLE 7 - EVENTS ORGANISED BY THE PROJECT'S CONSORTIUM

In addition to these events, one can also count the organisation of three internal events that aimed only the consortium partners, with a total of 102 participants. Those events were:

- AI4REALNET KoM | October 11-12, 2023 [46 participants]
- uONEConnect Platform Workshop | January 22, 2024 [24 participants]
- AI4REALNET Second Consortium Meeting | June 12-13, 2024 [32 participants]

Together with the events organised by the consortium, 11 events were attended by some of the project's partners. Figure 8 shows the percentage of events by type attended by the project's Consortium, as Table 9 presents a detailed list of those events.
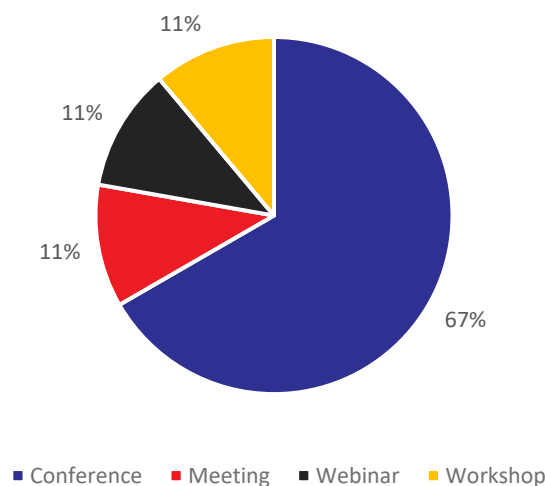

FIGURE 8 - PERCENTAGE OF EVENTS BY TYPE ATTENDED BY THE PROJECT'S CONSORTIUM

Title	Date	Participation	Partners	Audience
Launch Event: showcasing the future of innovation in AI, Data, and Robotics *[online]*	February 22, 2024	Project pitch	INESC TEC	451 views on YouTube
Transport Research Arena Conference 2024	April 15, 2024	Project presentation	FLATLAND	Over 3,000 participants
HFES Europe Chapter Lübeck 2024	April 17, 2024	Poster presentation	FHNW	Over 850 attendees
"Driven by Data Workshop No 10: Benefits and challenges of Artificial Intelligence use for mobility" - The mFUND Workshop Series about Mobility Innovation.	September 24, 2024	Invited talk in a meeting with policymakers (Federal Ministry for Digital and Transport)	DB	30 participants
Human-AI frameworks and knowledge representation for AI in control room tasks (ISGT2024)	October 3, 2024	Invited talk	INESC TEC	n/a
PERKS webinar on Human-centred and trustworthy AI	October 24, 2024	Invited talk	INESC TEC	n/a
AI-day for Power System Operations (CIGRE)	November 18, 2024	Invited talk	INESC TEC, RTE, IRTSX	11,215 participants
The Flatland Framework: Enabling Machine Learning Research for Railway Rescheduling and Beyond (FOSDEM 2025)	February 2, 2025	Invited talk	FLATLAND	100 attendees
3rd In-Person Workshop: Foundation Models for the Electric Grid	February 11, 2025	Invited talk	INESC TEC	70 attendees
Future Ready: On Demand Solutions with AI, Data, and Robotics	February 18-19, 2025	Working session	INESC TEC	205 attendees (in-person & online)
Workshop: Human-Centred Machine Learning: Bridging Design, Development, and Social Impact	March 6-7, 2025	Project Presentation	ZHAW	

TABLE 8 - EVENTS ATTENDED BY THE PROJECT'S CONSORTIUM

The organisation of and participation in events is an extremely relevant tool for presenting the project's activity to a group of different audiences. Therefore, this action is supposed to happen regularly throughout the course of the project, having an impact on the project's objectives. Brief feedback on some of the main events attended by the project can be analysed in ANNEX 7.

2.1.5 ADVISORY BOARD

Facing the objective of raising awareness of the target groups with specific actions, the establishment of an Advisory Board (AB) was planned for Month 7 of the project. This consists of a group of experts covering geographical and industrial experience, in which the interim results and deliverables are discussed to give feedback to the consortium so that the broad relevance of the project results is ensured.

Its overall goal is to guarantee that solutions, approaches, and methods developed by AI4REALNET will have sustained relevance and incorporate current developments at the European level. The list of 20 confirmed members is presented in more detail in Table 10.

Entity	Type	Sector	Country
ENTSO-E	Association	Energy	*[Europe]*
JRC	Non-profit	AI	Spain
EPRI Europe	Non-profit	Energy	Ireland
Intel	Industry	Other	Germany
LF ENERGY	Association	Other	USA
SSENSEI Advisory	AI Consultancy	AI	Canada
Rebase Energy	Start-up	Energy	Sweden
DFKI	Academic	AI	Germany
Eurocontrol	Association	ATM	Netherlands
IEEE Standards Association	Association	Other	Austria
TU Dresden	Academic	AI	Germany
SNCF	Industry	Railway	France
University of Bamberg	Academic	AI	Germany
Federal Office of Transport	Other	Railway	Switzerland
Eurocontrol	Association	ATM	Netherlands
House of Energy	Association	Energy	Germany
University of Zurich	Academic	AI	Switzerland
DIGI Mind Sphere	Start-up	AI	Italy

Entity	Type	Sector	Country
Artelys	SME	AI	France
ÖBB-Infrastruktur AG	Industry	Railway	Austria

TABLE 9 - MEMBERS OF THE ADVISORY BOARD

Following the recommendation from the first periodic review, a smaller group of advisers from the AB was selected (on a volunteer basis) to follow and advise more frequently on the project's developments. Table 11 shows the short list of members that will follow regularly the work progress.

Entity	Type	Sector	Country
Intel	Industry	Other	Germany
DIGI Mind Sphere	Start-up	AI	Italy
TU Dresden	Academic	AI	Germany
ÖBB-Infrastruktur AG	Industry	Railway	Austria
Artelys	SME	AI	France

TABLE 10 - MEMBERS OF THE ADVISORY BOARD SUBGROUP FOR FREQUENT ADVISORING

Throughout the project at least three AB meetings are supposed to be held. Until the date of this deliverable, the AB panel has been created, and the first meeting took place on December 12, 2024 (see ANNEX 8 for a summary of the meeting outcomes).

2.1.6 OPEN SCIENCE

The dissemination of scientific publications in conferences and peer-reviewed journals will also be used as a communication tool. In line with Horizon Europe rules, peer-reviewed publications and research data developed within the scope of the AI4REALNET project should be made available through open access, meaning they are free of charge to the end-user, selecting open access publishing and making research results available via an open repository, such as Zenodo (where the project created its own page, available here), and by publishing results on the project website for public, quick, and free access.
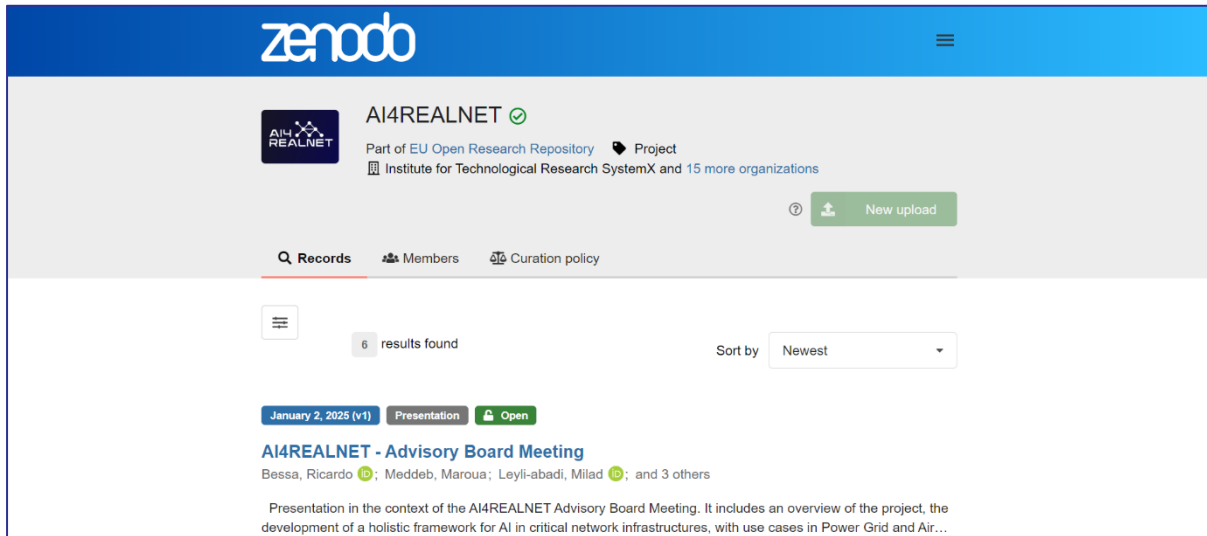
FIGURE 9 - AI4REALNET ZENODO PAGE

All project's key exploitable results will be published under an open-source licence and made available through a GitHub repository. This will enable the evolution and progress of the AI4REALNET concept, mainly beyond the end of the project. Therefore, a GitHub repository was already created for the AI4REALNET project: https://github.com/AI4REALNET.

FIGURE 10 - AI4REALNET GITHUB PAGE

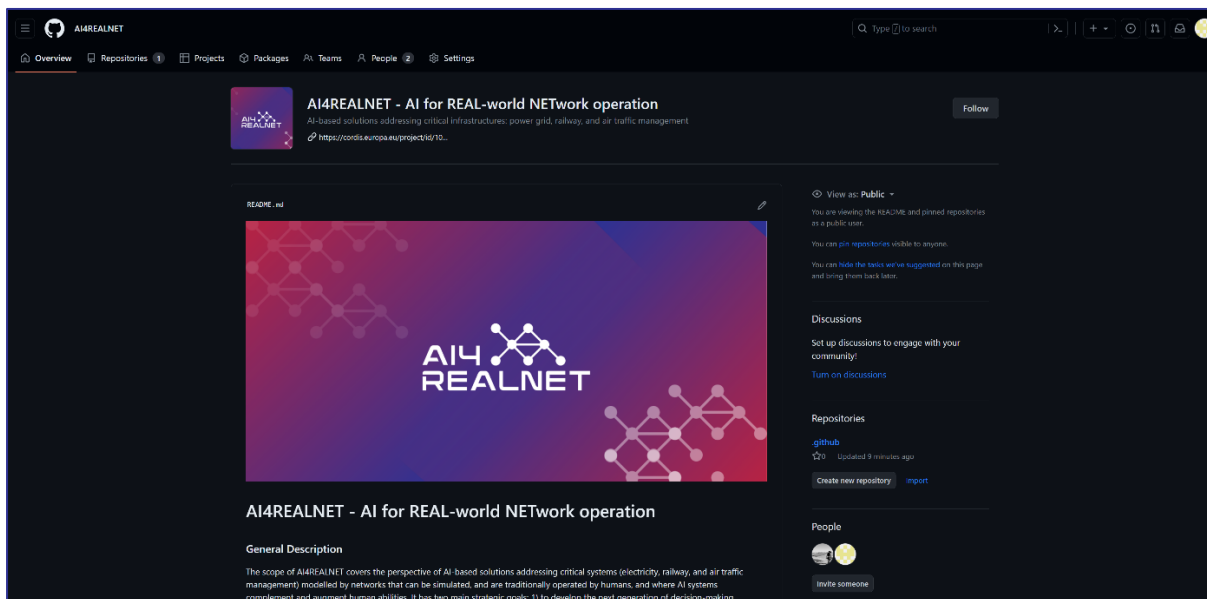A key outcome of the project is the development of its first dataset, presented at the Workshop on Machine Learning for Sustainable Power Systems (ML4SPS) as part of ECML PKDD 2024. This dataset includes structured training, validation, and test data, capturing both failure and survival events from transmission power grid simulations. It has been used to train, validate, and test machine learning

models for predicting grid agent failures in topology optimization tasks. The dataset is openly available on the project's Zenodo page.

Table 12 presents a detailed list of all the work published within the scope of the AI4REALNET project, and all available currently in open access.

Title	Date	Venue	Type	Partner(s)
Structured Power Grid Simulation Dataset for Machine Learning: Failure and Survival Events in Grid2Op's L2RPN WCCI 2022 Environment	October 17, 2024	ECML 2024 Workshop	Dataset	Fraunhofer UKASSEL
Pioneering roadmap for ML-driven algorithmic advancements in electrical networks	October 24, 2024	IEEE ISGT Europe 2024	Conference paper	INESC TEC TUD RTE
Fault Detection for Agents in Power Grid Topology Optimization: A Comprehensive Analysis	August 1, 2024	ECML 2024 Workshop	Conference paper	Fraunhofer UKASSEL
Graph Reinforcement Learning for Power Grids: A Comprehensive Survey	August 1, 2024	ACM Computing Surveys	Journal paper	Fraunhofer UKASSEL
Imitation Learning for Intra-Day Power Grid Operation through Topology Actions	August 18, 2024	ECML 2024 Workshop	Conference paper	TENNET
State and Action Factorization in Power Grids	September 3, 2024	ECML 2024 Workshop	Conference paper	POLIMI
Sub-optimal Experts mitigate Ambiguity in Inverse Reinforcement Learning	December 10, 2024	NeurIPS	Conference paper	POLIMI
How does Inverse RL Scale to Large State Spaces? A Provably Efficient Approach	December 10, 2024	NeurIPS	Conference paper	POLIMI
Last-Iterate Global Convergence of Policy Gradients for Constrained Reinforcement Learning	December 10, 2024	NeurIPS	Conference paper	POLIMI

TABLE 11 - LIST OF THE PROJECT'S SCIENTIFIC PUBLICATIONS ISSUED

On the other hand, Table 13 presents a list of all the work submitted until the date of this deliverable (i.e., under review), but no information on applicable publications has yet been available.

Title	Date of submission	Venue	Type	Partner(s)
Generalizable Graph Neural Networks for Robust Power Grid Topology Control	January 3, 2025	Applied Energy	Journal Paper	TENNET
Multi-Objective Reinforcement Learning for Power Grid Topology Control	January 27, 2025	IEEE Power Tech 2025 *[29 June-3 July]*	Conference paper	TENNET
The Supportive AI Framework: From recommending to supporting	February 6, 2025	HCI International 2025 *[22-27 June]*	Conference paper	TENNET
Generation of Power Network Operating Scenarios for an AI-friendly Digital Environment	February 14, 2025	IEEE Power Tech 2025 *[29 June-3 July]*	Conference paper	INESC TEC, RTE
On the Definition of Robustness and Resilience of AI Agents for Real-time Congestion Management	February 14, 2025	IEEE Power Tech 2025 *[29 June-3 July]*	Conference paper	INESC TEC
Learning Topology Actions for Power Grid Control: A Graph-Based Soft-Label Imitation Learning Approach	March 19, 2025	ECML PKDD 2025 *[September 15-19]*	Conference paper	FRAUNHOFER, UKASSEL, TENNET

TABLE 12 - LIST OF THE PROJECT'S SCIENTIFIC PUBLICATIONS SUBMITTED (UNDER REVIEW)

2.1.7 COOPERATION WITH STAKEHOLDERS

Cooperation and synergies with other initiatives are key activities throughout the project timeline, considering the expected results and their dissemination during and after the project. The following subsections summarise the main cooperation initiatives until M18.

2.1.7.1 AI-ON-DEMAND PLATFORM

The community of the AI-on-Demand (AIoD) platform brings together Europe's diverse AI communities and organisations interested in contributing to or benefiting from AI capabilities. In that sense, the participation of the AI4REALNET project is inevitable since it covers the perspective of AI-based solutions addressing critical systems, aiming to contribute to the development of open-source

environments that can be capable of playing a role, in the long term, in facing the challenges of energy transition and digitalisation.

The software assets presented in deliverables D1.2 – "Digital environment – Version 1" [5] and D2.2 – "AI fundamental blocks – beta release" [6], and available in the project GitHub, will be integrated into the AIoD platform until M20. This includes the new versions of the digital environments (Grid2Op, Bluesky, and Flatland) with the project's use cases and data generation assets, replicating real-world operating scenarios involving human operators to apply innovative AI-based methods.

2.1.7.2   ADRA-E

The Adra-e project intends to create the conditions for an ecosystem that can boost Europe's research and innovation in AI, Data and Robotics towards developing the best technologies and applications. The following actions from the consortium took place in the first 18 months of the project:

- Participation in the event "Future-Ready: On Demand Solutions with AI, Data, and Robotics" | February 18-19, 2025, with the following activities:
  - Joint "Birds of a Feather" session with the cluster projects titled "The Human Factor in AI: Bridging Technology and Trust" – this presentation is available on the project's Zenodo page (link here). The main outcomes from this session are presented in ANNEX 7.
  - The project coordinator (Ricardo Bessa) chaired a Topics Group session with "Inspection and maintenance & Energy", where the focus was to discuss the research challenges in terms of the deployment of AI to manage critical infrastructures.
- Organization of a workshop at the ADRF 2024 event, entitled "From Algorithms to assurance: designing human-centric AI to enhance collaboration, trust, and acceptance" | November 5, 2024 (the main conclusions from this workshop are presented in ANNEX 7), that counted with around 32 participants; the presentation from AI4REALNET is available in Zenodo (link here).
- Submission of two abstracts for book chapters to the Adra-e open-access book "Artificial Intelligence, Data and Robotics: Foundations, Transformations, and Future Directions":
  - First chapter title: "Toward a Holistic Framework for Human-AI Collaboration in Safety-Critical Systems"
  - Second chapter title: "Human-AI Interaction and Visualization Perspectives on ADR"

Furthermore, the Adra-e platform, called ADR Awareness Centre, works as an open repository of ADR educational resources and materials. For this platform, the AI4REALNET project has published 7 relevant resources, detailed in Table 14.

Title	Resource
Industry-driven use cases for AI	Webinar
Distributed and Hierarchical Reinforcement Learning	Webinar
Structured Power Grid Simulation Dataset for Machine Learning: Failure and Survival Events in Grid2Op's L2RPN WCCI 2022 Environment	Data set
Knowledge-Assisted AI Applications for Real-World Network Infrastructure	Webinar
Holistic framework for AI in critical network infrastructures	Paper
Position paper on AI for the operation of critical energy and mobility network infrastructures	Paper
Towards Transparent, Safe and Trustworthy AI for critical infrastructures	Webinar

TABLE 13 - AI4REALNET PUBLICATIONS ON ADR AWARENESS CENTRE

2.1.7.3   CLUSTER PROJECTS

In Month 8 of the project, we established strategic connections with four complementary projects funded under the HORIZON-CL4-2022-HUMAN-02-01 call, focusing on "AI for human empowerment". The cluster includes the following projects:

- TANGO: Advancing trustworthy AI solutions for manufacturing environments
- THEMIS 5.0: Developing frameworks for human-centric AI implementation in industry
- PEER: Enhancing human-AI collaboration through adaptive systems
- HumAIne: Researching emotional intelligence integration in AI applications

Our collaboration framework consists of regular monthly coordination meetings where we align our communication and dissemination strategies to maximise impact and reach. These coordination efforts have resulted in:

- Systematic cross-promotion of project milestones and events across social media platforms
- Integration of project updates in respective newsletters
- Dedicated sections on project websites highlighting cluster activities
- Shared dissemination of research findings and best practices
- Joint participation in relevant conferences and workshops

A significant milestone in our cluster formation was achieved in September 2024 with the publication of a joint news piece formalising the cluster (ANNEX 6), coordinated by the HumAIne project. This formal announcement consolidated our collaboration and established a foundation for future joint initiatives advancing human-centric AI development.

The effectiveness of this cluster collaboration was demonstrated at the Algorithmic Decision-Making Research Forum (ADRF 2024) in Eindhoven in November 2024. The conference, themed "From Algorithms to Assurance: Designing Human-Centric AI to Enhance Collaboration, Trust, and Acceptance", featured participation from THEMIS 5.0, PEER, and HumAIne. This joint presence enabled us to showcase complementary approaches to human-centric AI development and foster meaningful discussions about the future of AI technology in human empowerment.

Project	Technical expertise	Human-centred expertise	Domain expertise
TANGO	AI foundation; Decision support systems; Interface development.	Cognitive psychology; Human decision-making; Trust assessment	Healthcare systems; Legal systems; Public administration
HumAIne	Operating systems; Active & swarm learning; Neural networks; Symbolic reasoning; System integration	Training development; Community management; User experience	Industrial processes; Cross-sector implementation; System deployment
THEMIS 5.0	Cloud computing; Conversational AI; Natural language processing	Ethics & moral values; Trustworthiness assessment; Human-AI dialogue	Socio-technical systems; Business requirements; Compliance & governance
PEER	AI system development; Process automation; Optimization algorithms	User-centered design; Human-AI interaction; Trust & transparency	Business processes; Economic assessment; Sustainable development

TABLE 14 - CLUSTER PROJECTS AREAS OF EXPERTISE

Even though this synergy has already included the five projects evolved in the referring call, contacts have been made to embrace other European projects that somehow work on subjects of interest for the expected outcomes. Besides sharing meaningful practices, this also promotes the project's visibility at a European level.

2.1.7.4 DOMAIN-SPECIFIC STAKEHOLDERS

The project has actively engaged with domain-specific stakeholders to enhance the impact and relevance of its outcomes. These interactions serve a dual purpose: maximizing the dissemination and reach of the results while also gathering valuable feedback and insights to inform and refine the research and validation activities. By collaborating closely with industry experts, academic researchers, and other key stakeholders, the project ensures that its developments align with real-world needs and challenges, fostering stronger applicability and adoption of the solutions being developed.

Until M18, AI4REALNET contributed to the CIGRE (*Conseil International des Grands Réseaux Electriques*) Working Group C2.42 "The impact of the growing use of AI/ML for power system operations from an operational perspective", where the convenor is Antoine Marot (RTE) and the secretary is Ricardo Bessa (INESC TEC), both part of the project, and the project contributed with use cases, requirements for ethics and risk assessment, and contributed to a roadmap for innovation in AI for power grid operations. This roadmap was also developed in cooperation with a testing and experimentation facility (TEF) for the energy sector, the AI-EFFECT project (GA no 101172952). Furthermore, AI4REALNET was presented in a full-day event organised by this CIGRE WG in Paris, entitled "AI-day for Power Systems Operations", which took place on November 18, 2024. A summary of the main conclusions from this collaboration with the WG is available in ANNEX 7.

The project also contributed to the EERA (European Educational Research Association) Joint Programme on Digitalisation for Energy (DfE) "EERA Position Paper on AI", with the project's conceptual framework and research directions from the position paper (deliverable D2.1).

AI4REALNET also presented its use cases and conceptual framework in a US-EU working group about foundation models for power grids[2], in the "3rd In-Person Workshop: Foundation Models for the Electric Grid", Chicago, U.S., February 11-13, 2025. The presentation is available in Zenodo (link here). The collaboration with this working group is important to understand the application of general-purpose AI to the project use cases and define lines for future research (beyond the project duration) and attract other researchers to use the digital environments developed in the project to test foundation models. Brief conclusions are presented on ANNEX 7.

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[2] Hamann, H. F., Gjorgiev, B., Brunschwiler, T., Martins, L. S., Puech, A., Varbella, A., et al. (2024). Foundation models for the electric power grid. Joule, 8(12), 3245-3258. https://arxiv.org/abs/2407.09434

In what concerns the railway domain, a collaborative problem-solving initiative organised by FLATLAND allowed the arrangement of an advanced platform to explore simulations and human-AI interaction through their own framework. This happened in the [Flatland Symposium & Workshop](#), which took place on November 19-21, 2024, an event that brought together researchers, developers, and industry professionals, working in teams to address complex challenges, such as graph representations of railway infrastructure and designing intuitive interfaces for real-time control (brief conclusions are presented on [ANNEX 7](#)).

For the air traffic management domain, a consultation was initiated with Maastricht Upper Area Control Centre (MUAC), an air traffic control centre managing the upper airspace of Belgium, the Netherlands, Luxembourg and north-west Germany. MUAC operates in an environment with similar operational conditions to NAV Portugal, facing the same challenges of aviation growth. Representatives from MUAC take part in the AB of AI4REALNET, having an interest in AI applications for the use cases proposed for the air traffic management domain.

The consultation was conducted on November 26, 2024, and involved discussions both with employees on the operational side (air traffic controllers and flow management positions) and with researchers involved in the development of support tools for air traffic controllers. The discussion conducted with operators focused on the task of sectorization, specifically around the needs of flow management position in relation to the design of an automation support tool. The issue primarily identified by the flow management position, responsible for issuing sector openings, is the lack of integrated information on the complexity of the flights. This results in considerable efforts in combining the available information for predicting the workload experienced by controllers operating each sector. A second point of discussion was the current workflow around the creation of routing and sector opening plans, and the information available for each subsequent refinement of these plans. Similarly to what is proposed in AI4REALNET, MUAC agrees that AI is most effective in the planning stages of air traffic management. Researchers at MUAC envision the use of learning-based methods for the integration and processing of the information useful to generate accurate and robust plans.

The consultation confirmed the direction that the research undertaken by AI4REALNET is conducting on the side of air traffic management and opened the door for further feedback on the AI tools developed by AI4REALNET in the upcoming period.

2.2 KEY PERFORMANCE INDICATORS SUMMARY

It is only possible to measure the success of each communication action by using Key Performance Indicators (KPIs). These indicators, as defined at the time of the proposal, are crucial to evaluating the course of action. Table 16 presents the KPIs associated with the actions considered within the communication and dissemination plan.

Activity	Schedule	KPI	1-18M	% achieved
Website	M3-M42	> 1500/year unique visitors	812 visitors	54%
Social media	M1-M42	> 100 followers (LinkedIn) > 100 followers (X) > 100 views (YouTube)	682 followers (LinkedIn) 79 followers (X) 924 views (YouTube)	100% 80% 100%
Brochures	M5-42	≥ 5	1	20%
Project Slide-deck	M5	1	1	100%
Videos	M6-M42	≥ 3	22	100%
Infographics	M5	≥ 8	6	75%
Articles	M1-M42	≥ 5	1	20%
Newsletters	M4-M42	≥ 9	4	45%
Press Relations	M2-M42	≥ 3 PRs ≥ 10 news pieces	3 11	100% 100%
Invited talks	M1-M42	On invite	6	n/a
Booklet	M42	1	0	0
Final event	M42	≥ 100 attendees	0	0

TABLE 15 - AI4REALNET COMMUNICATION KPIS

Table 17 presents a summary of achievements over the past 18 months for the remaining KPIs. As publications in highly ranked international journals, we have two papers that were submitted and approved. Still, there are more publications already under consideration by the editorial teams of the journals (to see the full list, recall chapter 2.1.6). In the same line, under the AI4REALNET project, the partners contributed and participated with five research papers and one dataset at international conferences, namely at ECML PKDD 2024, IEEE ISGT Europe 2024, and NeurIPS 2024. Thematic

workshops are a valuable way to knowledge exchange, networking, stakeholder engagement and dissemination, and showcase. During this period, we proposed a workshop at the ADRF 2024 event, entitled "From Algorithms to assurance: designing human-centric AI to enhance collaboration, trust, and acceptance". It was accepted, and in collaboration with partners for projects from the HORIZON-CL4-2022-HUMAN-02, we were in-person at the event. We are currently starting the organisation of our second in-person workshop (Spring 2025: "Ethics and regulation", co-organised with CLAIRE) and start the conceptualisation of the third workshop. This workshop will be online during Fall 2025 and under the topic "Social-technical evaluation of AI-based decision systems". As for other engagement activities, we had a project pitch in a meeting with policymakers (Federal Ministry for Digital and Transport) at the mFUND Workshop Series about Mobility Innovation. Lastly, the project will organise at least three AI open innovation competitions (Railway in Fall 2025, Power Grid in Spring 2026, and Air Traffic Management in Fall 2026). The organisation of these AI open competitions will take around 6 to 9 months to complete from the preparation to the end of the challenge. So, for the period of M1 to M18, we planned to start with the Railway competition. Accordingly, this started in M17 with the kick-off and discussion of the general concepts; then we will have the definition of the problem, set a detailed timeline, scenario evaluation and challenge set up (M19-M23) and give two months for the challenge (start of the challenge M24 and end of the challenge M25).

Activity	KPI	1-18M	% achieved
AI open innovation competitions (including tutorials)	≥ 3	0	0
Publication in highly ranked international journals	≥ 8	2	25%
Thematic workshops organisation	≥ 5 (2 in person + 3 online)	1	20%
Contributions to international conferences	≥ 20	6	30%
Cluster of European projects and other initiatives	≥ 8	3	37.5%
Targeted meetings with policymakers	≥ 4	1	25%

TABLE 16 - AI4REALNET DISSEMINATION KPIS

3. PROJECT COMMUNICATION

The communication plan presented in D5.1 was structured into four different campaigns to accomplish the general WP objectives better, each aligned with specific goals, targets, and instruments.

In this sense, this topic aims to present the communication results within the planned campaigns that go through until Month 18 of the project.

3.1 FIRST CAMPAIGN RESULTS

The first communication campaign started at the beginning of the project (October 2023) and went on until April 2024. A summary of the first communication campaign – goal, stakeholders, timeline and communication tools – is presented in the next figure:

Objective: deliver strategies to create awareness of the project's activities
Audiences: general audiences | scientific communities
Timeline: October 2023 - April 2024

Advertising	Digital Marketing	Public Relations	Direct Marketing
Graphic identity	Social Media	KoM	Newsletter #1 and #2
X-banner	Website	Press-releases	
Interview videos		Communication workshop	
Presentation video		Webinar	
Brochure #1			

FIGURE 11 - SUMMARY OF THE FIRST COMMUNICATION CAMPAIGN

The first communication campaign was successful, and all planned actions were executed, as the results are in the Table 18. For example, the KPIs established until the end of the project for the videos featured the production of three videos until M48, but in the first 18 months of the project, 19 videos have already been concluded.

Another relevant outcome refers to the social media profile on LinkedIn, where the KPIs proposed for the entire project have already tripled. Regarding the powerful results within these posts, one can conclude that this platform is the best working social media channel for the project. On the contrary, X has shown some poor interaction results, where the number of followers grows slowly. This

challenge will remain until the end of the project, but the conclusion is that this social media does not work as well as it did in the past, mostly because of the structural changes it faced. The fact is that, by the time of the project proposal, this reality was not still in course, so our efforts go on to alleviate this impact.

Activity	Results
Identity	Institutional logo; 1 identity presentation; 1 x-banner; 1 project presentation; 1 slide deck
Website	152 visits
LinkedIn	35 posts; 18 082 impressions; 443 reactions; 4 comments; 19 reposts
X	60 posts; 3 reposts; 5 816 views; 49 publications reposts; 3 comments; 145 likes
YouTube	17 videos; 623 views
Newsletters	2 editions; 105 recipients
Brochures	1 edition; 50 printouts
Kick-off meeting	46 participants
Webinars	2 events; 212 participants
Press Releases	3 press releases
News pieces published on the media	11 news pieces published
News pieces published on other platforms	14 news pieces published

TABLE 17 - COMMUNICATION RESULTS OF THE FIRST COMMUNICATION CAMPAIGN

Following all the results obtained from the first communication campaign, the website is the communication instrument that requires more attention. The fact that we can only measure its activity from March 2024 on and considering that the moment of release (January 2024) is always the most impactful one, one can assume that a great part of these indicators, unfortunately, was not registered. Even though the traffic on the website is evidently increasing. However, to mitigate thin growth, a series of actions are planned, especially in social media, to lead viewers to the website. Also, the increase of several distinct outputs as the project develops will contribute to the digital content creation we need to improve the website's performance.

Considering the remain results obtained at this first stage, we can conclude that the communication and dissemination efforts are on the right track. The goal is to continue the work developed so far and comply with the activities proposed so that the results can keep evolving positively.

3.2 SECOND CAMPAIGN RESULTS

The second communication phase started in May 2024 and ends in March 2025. At this point, the work of the communication plan relied on promoting the activities developed by the project's partners, delivering relevant input to scientific communities, engaging with AI communities, and preparing further collaboration with other projects in the same areas.

The results of this campaign are presented below. A summary is shown in Figure 12, and the detailed results are in the following table.
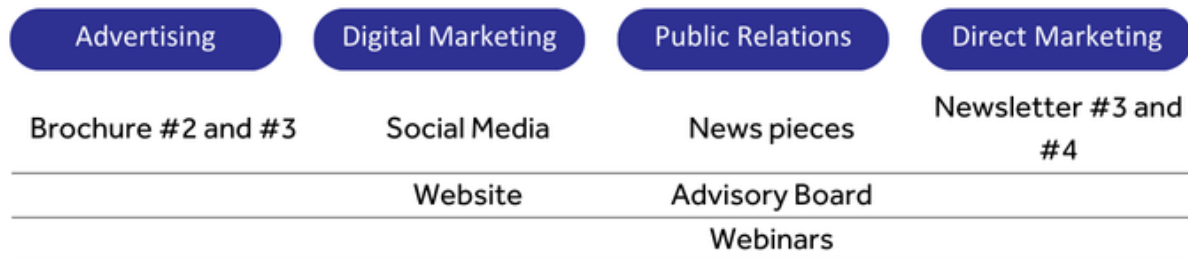
FIGURE 12 - SUMMARY OF THE SECOND COMMUNICATION CAMPAIGN

Activity	Results
Website	660 visits
LinkedIn	85 posts; 44 814 impressions; 1 029 reactions; 17 comments; 11 reposts
X	31 posts; 6 reposts; 1 995 views; 17 publications reposts; 5 comments; 81 likes
YouTube	3 videos; 301 views
Newsletters	2 editions; 268 recipients
Second consortium meeting	32 participants
Webinars	2 events; 64 participants
Workshops	5 events; 203 participants
Advisory Board Meeting	13 participants
News pieces published on other platforms	12 news pieces published

TABLE 18 - COMMUNICATION RESULTS OF THE SECOND COMMUNICATION CAMPAIGN

The fact is that, even though the second campaign lasted 11 months, and the first only seven, the launch of a project normally gathers more attention and interest that gradually fades out as the project progresses, only to hopefully rise again when actual results are presented.

The communication tool that is more relevant during this campaign is the event's organisation and/or participation. As the project unfolds, subjects to present and discuss emerge more rapidly, helping to create awareness among the stakeholders. Therefore, a total of 8 events allowed the consortium to reach out to different audiences.

Following the relevance accelerated by presenting the AI4REALNET in several events, the establishment of cooperation between the so-called "Cluster Projects" stressed out a key activity throughout the project timeline. This relation resulted in a joint news piece disseminated across the project's channels.

In addition, at this stage, we highlight also the creation and introduction of the Advisory Board. Gathering 20 participants in all three project areas of intervention, this important instrument allows the project to generate more impactful results at the same time it acts within the AI communities.

Still regarding this campaign, a note to the lack of development of the second and third editions of the project's brochure. This communication tool suffered a delay, which was justified by the timing of the publications, as well as other work progresses that overpassed them. Initially, a plan was made without information about the outputs of the project, and during these months, we realised that it was better to postpone the editions a few months later. Either way, this just means that the brochures will be edited with a small lag.

3.3 NEXT STEPS

Two more campaigns are planned until the end of the project. The third communication campaign, starting in April 2025 and lasting until April 2026, intends to reinforce the message of the technological solutions being developed within the project's scope, enhancing the project's results and best practices. The strategies to be developed and implemented now will also rely on the WPs 1-4 outcomes. The main groups that need to be targeted in this phase are network operators, AI service providers, regulators and policymakers, and all the communication content will steadily be aligned

with these audiences. Nevertheless, some core communications actions continue to be part of the project's strategy to disseminate the work it is developing.

The project is planning to organise one in-person workshop designed in the Description of Action, in particular:

- A workshop proposal titled "AI for Safety-Critical Infrastructures (AI-SCI)" was submitted and accepted to the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases 2025 (ECML PKDD 2025), September 15-19, 2025, in Porto, Portugal.

Whereas the dissemination boosters, a group of actions that intend to engage the target groups with specific actions, aiming to raise awareness, enhance their engagement, and disseminate the final project results, are expected to start happening during this third campaign. These actions include awareness boosters, with the preparation of webinars, as well as engagement boosters, with the organisation of workshops and open competitions, both occurring during the project's duration. An AB board meeting is planned for June 2025, to discuss the main outcomes from WP1 and WP2, in particular the digital environments and AI building blocks.

The first planned workshop is called "Ethics and regulation", and it is co-organised with CLAIRE. The project partner leading this work is ZHAW, and this activity is scheduled to happen in 2025, on a date yet to be determined. Until the end of this third campaign, two more workshops are expected to happen, one regarding "Social-technical evaluation of AI-based decision systems" in September 2025 and the other on "AI challenges for energy and mobility networks" in March 2026.

In addition, the project will host at least three AI open innovation competitions using the digital environments (Grid2Op, Bluesky, and Flatland), in the three domains, to enrich and speed up new concepts and solutions developments, strengthen solution-seeking and AI developers' collaborations and partnerships, involving developers from around the globe. The first competition to be organised will happen by the end of 2025, and it will consider the railway domain, with the purpose of encouraging AI and domain specialists to compete and collaborate to develop AI-based agents (or digital assistants) to plan, monitor and control critical network infrastructures. Led by the project's partner Flatland, at the date of this submission, the planning is already in place, and the challenge is expected to start in September 2025.

4. CONCLUSIONS

This deliverable aimed to report the main outcomes achieved in terms of dissemination, communication, and exploitation in the first 18 months of the project.

304 dissemination outcomes were achieved in the first 18 months of the project, divided between:

- Press Releases: 3

- News pieces published on the media: 11

- News pieces published on online platforms: 26

- Social media channels: 232

- Newsletters: 4

- Infographics: 6

- Brochure: 1

- Events: 19

- Articles: 1

- Scientific Publications issued: 9

- Scientific Publications in review: 6

The first communication campaign, implemented between October 2023 and April 2024, with the goal to inform the project stakeholders about the existence of the project, was implemented with successful results, regarding three press releases launched and the publication of a total of 25 news pieces. Together with the posts on social media, this campaign runs actively in eight different countries: Portugal, the United Kingdom, Italy, the United States of America, the Netherlands, Switzerland, France, and Germany.

In turn, the second communication campaign, implemented from May 2024 until March 2025, aiming to promote the activities developed by the project's partners, also presented positive results, with the organisations and/or participation in a total of 19 events and the implementation of an external Advisory Board, that gathered 20 experts within the AI community and related to the three core networks approached by the AI4REALNET project: electricity, railway and air traffic.

So, two more integrated communication campaigns have been defined until the end of the project, with the third one starting right after the submission of this deliverable in April 2025.

Evidence of all the dissemination activities referred to in the deliverable is available in the annexe section of this document.

REFERENCES

[1] AI4REALNET Grant Agreement number 101119527

[2] D5.1 – "Communication and dissemination plan"

[3] D6.1 – "Project management guide – procedures handbook"

[4] D1.1 – "AI4REALNET Framework and Use Cases"

[5] D1.2 – "Digital environment – Version 1"

[6] D2.2 – "AI fundamental blocks – beta release"

ANNEX 1 – BROCHURE #1

INESCTEC

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AI4 REALNET
AI FOR REAL-WORLD NETWORK OPERATION

TUDelft · Digitale Schiene Deutschland · enliteAI · UNIVERSITY OF AMSTERDAM · n|w University of Applied Sciences and Arts Northwestern Switzerland School of Applied Psychology · POLITECNICO MILANO 1863 · Fraunhofer · Red La Rel de Transport d'Electricité · zhaw · Liu LINKÖPING UNIVERSITY · NAV PORTUGAL · SBB CFF FFS · UNIKASSEL VERSITÄT · Intelligent Embedded Systems · SystemX · TenneT

PURPOSE

The Project AI4REALNET covers the perspective of AI-based solutions addressing critical systems (electricity, railway, and air traffic management) modelled by networks that can be simulated, and are traditionally operated by humans, and where AI systems complement and augment human abilities.

These networks operated by humans, often combining human expertise with control and supervision software and different levels of automation, will face challenges in handling increasing uncertainty (e.g., from weather, assets aging, demand), combinatorial and sequential decisions to exploit network flexibility (and defer network reinforcements), and in human overseeing the increasing automation and intervene when required. In the AI4REALNET vision, high levels of human control and AI-based automation coexist with "optimal" balance. They are divided into a) full human control (AI-assisted), b) co-learning between AI and humans, including adjustable autonomy, and c) trustworthy (human-certified) full AI-based control.

GENERAL OBJECTIVES

It aims to achieve the following two strategic high-level objectives:

1) To develop the next generation of decision-making methods powered by supervised and reinforcement learning, which aim at trustworthiness in AI-assisted human control with augmented cognition, hybrid human-AI co-learning, and autonomous AI, with the resilience, safety, and security of critical infrastructures as core requirements, and

2) To boost the development and validation of novel AI algorithms by the consortium and AI community through existing open-source AI-friendly digital environments capable of emulating realistic scenarios of physical systems operation and human decision-making, enabling a direct assessment of AI-based decision quality.

SOCIETAL IMPACTS

- reduce the workload of human operators
- promote awareness of the benefits of AI systems
- facilitate continuing growth of air traffic demand while maintaining a high level of safety
- provide more flexibility and operational reliability to maximize the capacity of the current infrastructures
- support energy transition & increase resilience to natural and man-made hazards

SPECIFIC OBJETIVES

1. Develop an AI framework within the formalism of sequential decision-making
2. Design human-assistance and co-learning strategies
4. Create autonomous AI agents with safety and robustness
5. Validate the increase awareness of AI potential

EXPECTED OUTCOMES

- Journal and conference publications
- Open-source software
- New supervised and reinforcement learning algorithms
- New versions of AI-friendly digital environments
- Human-AI solutions to increase trustworthiness
- Validated AI-human interactions
- AI ecosystem around the digital environments
- Recommendations for policymakers in critical infrastructures and AI

General Indicators

- **17** Partners
- **8** Countries
- **6** Use Cases
- **6M** Budget
- **42** Months

In the AI4REALNET vision, high levels of human control and AI-based automation coexist with "optimal" balance.

ANNEX 2 – INFOGRAPHICS

ANNEX 3 – NEWSLETTER #2

ANNEX 4 – GENERAL PRESS RELEASE MADE AVAILABLE TO ALL PARTNERS

Artificial Intelligence and humans collaborate to increase safety of critical infrastructures

The European project AI4REALNET will support electricity, rail, and air traffic system operators to implement human-intelligence interactions and increase safety and efficiency in decision-making, considering the challenges of energy transition and digitalisation.

What if Artificial Intelligence (AI) were to be used to support decision-making, and increase efficiency and safety in the operation of critical infrastructures (typically run by humans) in the energy (power grid) and transport (railway and air traffic management) sectors? This is the goal of the Horizon Europe European project AI4REALNET – AI for REAL-World network operation.

It presents itself as a challenging and ambitious project that relies on a collaboration between humans and AI to support decisions made by human operators, creating conditions for the decarbonisation of these sectors, improving the quality of service and efficiency, while solving potential congestion issues in these infrastructures and contributing to increase the efficiency of investments in sectors critical to society.

The goal is not to replace humans by AI, but to ensure that AI emerges as a way to support faster decision-making, and even operationalising specific tasks autonomously. In sectors where human intervention is still predominant, the integration of new AI-centric technologies is an opportunity to reduce the workload of operators, addressing the challenges and needs of the sectors and designing solutions with adequate responses, in order to support people and societal challenges like resilience of critical infrastructures.

To apply and demonstrate AI-based decision systems in industry use cases, revealing tangible additional value, AI4REALNET developments will be validated in six use cases led by industry partners from the three domains.

The project aims at improving the safety and resilience of critical infrastructures, which are becoming more challenging, not only due to the increase in the volume of information, but also due to the changes imposed by decarbonisation. The AI4REALNET consortium hopes that AI can increase the capacity to operate more effectively and with less margin of error.

With the involvement of industry, the project will promote awareness of the benefits of reinforcement learning and explainable machine learning.

The project will also resort to current open-source AI-friendly digital environments, e.g., Grid2Op, Flatland, and BlueSky to foster and advance a global AI community.

The project is led by INESC TEC – a Portuguese research institute dedicated to scientific research and technological developments - and, in addition to Portugal, it brings together organisations

from France, Germany, Italy, the Netherlands, Switzerland, Sweden and Austria. The consortium is composed of 17 partners.

The project received close to €4M from the European Union, through the Horizon Europe programme, and €2M from the State Secretariat for Education, Research and Innovation (SERI) of Switzerland.

About INESC TEC

INESC TEC is a private non-profit research association, with Public Interest status, dedicated to scientific research and technological development, technology transfer, advanced consulting and training, and pre-incubation of new technology-based companies.

Present in six sites in the cities of Porto (headquarters), Braga and Vila Real, and with more than 800 researchers, INESC TEC acts from knowledge generation to science-based innovation, and performs collaboratively in search for a more sustainable, responsible, and improved world.

The primary goal of INESC TEC is to exceed performance in research, while considering its social, environmental, and economic impact, with a commitment to the scientific and technological contribution to foster pervasive intelligence. As so, INESC TEC endeavours to be a relevant international player in Science and Technology in eight scientific domains, Artificial Intelligence, Bioengineering, Communications, Computer Science and Engineering, Photonics, Power and Energy Systems, Robotics and Systems Engineering and Management. Being an institution that operates at the interface between the academic and business worlds, bringing academia, companies, public administration, and society closer together, INESC TEC generates new knowledge as part of its research, and leverages that knowledge in technology transfer projects, seeking impact through both value creation and social relevance.

November XX, 2023

ANNEX 5 – PRESS RELEASE SENT TO MEDIA IN PORTUGAL (PT VERSION)

Inteligência artificial e humanos colaboram para aumentar segurança de infraestruturas críticas

Projeto europeu AI4REALNET ajudará os operadores do sistema elétrico, da ferrovia e de tráfego aéreo, a implementar interações humanos-inteligência artificial para aumentar a segurança e eficiência na tomada de decisões, considerando os desafios da transição energética e digitalização.

E se a Inteligência Artificial (IA) passasse a ser usada como forma de apoiar a tomada de decisão, o aumento da eficácia e segurança na operação de infraestruturas críticas (tipicamente operadas por humanos) nos setores energéticos (rede elétrica) e transportes (ferrovia e tráfego) aéreo? Este é o objetivo do projeto europeu AI4REALNET – AI for REAL-World NETwork operation - liderado pelo Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência (INESC TEC).

Apresenta-se como um projeto desafiante e ambicioso que assenta numa colaboração entre humanos e a IA com vista a apoiar decisões operacionais tomadas por operadores humanos que criem condições para a descarbonização destes sectores, melhoria na qualidade de serviço e eficiência, resolvendo, por exemplo, possíveis congestionamentos nestas infraestruturas e contribuindo para aumentar a eficiência dos investimentos em setores críticos para a sociedade. Centrado nas áreas da rede elétrica, ferrovia e controlo de tráfego aéreo, o AI4REALNET irá "ajudar os operadores de infraestruturas críticas a implementar interações humanos-IA, promover alterações organizacionais no contexto de integração de IA nos processos de negócio, e melhorar a inteligência operacional e de planeamento", explica Ricardo Bessa, investigador sénior do INESC TEC responsável pelo projeto e coordenador do Centro de Sistemas de Energia (CPES).

Apostando em diferentes formas de interação entre humanos e a IA, o projeto foca-se numa aprendizagem conjunta. "O que se pretende não é substituir um pelo outro, mas garantir que a IA surge como um apoio à tomada de decisão mais rápida, operacionalizando, até, de forma autónoma, determinadas tarefas", adianta.

Em setores onde a intervenção humana é ainda predominante, a integração de novas tecnologias centradas em IA surge como uma oportunidade para reduzir o volume de trabalho dos operadores, respondendo aos desafios e necessidades dos setores e desenhando soluções com respostas adequadas, de forma a apoiar as pessoas.

Para aplicar e demonstrar sistemas de decisão com base em IA em casos de uso na indústria, revelando um valor adicional tangível, os desenvolvimentos do AI4REALNET serão validados em seis casos de uso liderados pelos parceiros industriais dos três domínios.

"Queremos melhorar a segurança e a resiliência das infraestruturas críticas, que estão a tornar-se mais desafiantes, não só pelo aumento do volume de informação, mas também pelas mudanças impostas pela descarbonização e é nesse sentido que esperamos que a AI possa

aumentar a capacidade de operar de forma mais eficaz e com menor margem de erro", adianta Ricardo Bessa.

Contando com o envolvimento dos setores, o projeto irá, também, promover a consciencialização sobre os benefícios da aprendizagem reforçada (reinforcement learning - RL) e da aprendizagem automática (machine learning - ML) explicável. "É importante que os gestores estejam cientes do que esperar de um sistema de IA, e que os trabalhadores percebam que, em certas condições, um sistema pode falhar, ser tendencioso e tomar decisões erradas ou propor sugestões erradas. Isto representará uma mudança cultural na forma como os humanos veem e interagem com sistemas digitais", reforça.

Para atrair e construir uma comunidade global de IA, serão utilizados ambientes digitais já existentes e amigáveis à IA de código aberto, nomeadamente Grid2Op, Flatland e BlueSky.

"Esperamos ter novos algoritmos e novas abordagens para que possamos inspirar outros grupos de investigação, outros operadores de infraestruturas críticas (por exemplo distribuição de água, telecomunicações) e contribuir para colocar a Europa na liderança da Inteligência artificial", conclui o responsável. Todos os resultados serão disponibilizados em código aberto.

O projeto é liderado pelo INESC TEC e, para além de Portugal, conta com a participação de organizações de França, Alemanha, Itália, Países Baixos, Suíça, Suécia e Áustria. No total, o consórcio reúne 17 parceiros.

O Projeto é financiado em cerca de quatro milhões de euros pela União Europeia, através do programa Horizonte Europa, e dois milhões de euros pelo governo da Suíça.

Porto, XX de Novembro de 2023

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ANNEX 6 – JOINT NEWS PIECE RELEASED BETWEEN CLUSTER PROJECTS

Press Release

For immediate release

Brussels, Belgium,
27/09/2024

Five EU Projects unite to advance ethical and trustworthy Human-AI collaboration

In a landmark initiative, five pioneering European projects funded under the Horizon Europe HORIZON-CL4-2022-HUMAN-02-01 Cluster are coming together to drive forward the future of ethical and trustworthy Artificial Intelligence. The collaborative effort, featuring the projects AI4REALNET, HumAIne, PEER AI, TANGO, and THEMIS 5.0, aims to enhance Human-AI collaboration across various domains through innovative, focused expertise.

AI4REALNET

AI for REAL-world NETwork operation

AI4REALNET is transforming critical systems like electricity, railway, and air traffic management with advanced AI solutions, enhancing human capabilities. By integrating cutting-edge AI algorithms and human-in-the-loop decision making, AI4REALNET ensures transparency, safety, and resilience in network operations.

HumAIne

Hybrid Human-AI Decision Support for Enhanced Human Empowerment in Dynamic Situations

is a pioneering initiative dedicated to the research, development, validation, and promotion of an innovative Operating System (OS) for Human-AI collaboration. At its core, the HumAIne OS aims to empower AI solution integrators by providing a platform that enhances decision-making capabilities in dynamic and unstructured environments across diverse industrial sectors. The HumAIne OS integrates four key components: Active Learning (AL), Neuro-Symbolic Learning, Swarm Learning (SL), and eXplainable AI (XAI). By surpassing traditional AI systems and human capabilities in isolation, this platform is set to transform decision-making processes. HumAIne will also offer training resources and foster a vibrant community to maximize the impact and adoption of its groundbreaking results.

Press Release

For immediate release

PEER AI

The Hyper Expert Collaborative AI Assistant

The vision of PEER is to revolutionize the current AI systems' design processes. PEER project will address the barriers to accepting AI in sequential decision-making problems by systematically putting the user at the center of the entire AI design, development, deployment, and evaluation pipeline prioritizing user preferences in AI-enabled decision-making scenarios. PEER is developing AI solutions designed to benefit both individuals and industries, with uses case in smart cities and manufacturing. That's the future PEER is working towards.

TANGO

It takes Two to TANGO: A Synergistic Approach to Human-Machine Decision Making

TANGO is a €7M EU-funded Horizon Europe project that aims to develop the theoretical foundations and the computational framework for synergistic human-machine decision making. The goal is to fully develop the enormous potential that AI holds in terms of positive impact on individuals, society and economy by establishing a symbiosis between humans and machines, and pave the way for the next generation of human-centric AI systems. The potential impact on individuals and society of the TANGO framework will be evaluated on a pool of real-world use cases of extremely high social impact, in healthcare, finance, and social welfare. The success of these case studies will foster the adoption of TANGO as the framework of reference for developing a new generation of synergistic AI systems and will strengthen the leadership of Europe in human-centric AI.

THEMIS 5.0

Human-centered Trustworthiness Optimisation in Hybrid Decision Support

THEMIS 5.0 is simplifying AI decision-making by making the process more understandable. This EU-project is promoting a shift towards more trusted AI services by helping users clarify the 'black box' of AI algorithms. This involves revealing the data used and explaining how decisions are made, allowing users to influence improvements. With a risk-based approach, THEMIS 5.0's framework for AI trustworthiness and its intelligent coaching tools create an environment where AI-driven decisions align with the needs and values of individual users. The project is being co-created, developed, and tested in three key areas: healthcare, port logistics, and journalism.

The collaboration of these projects marks a significant step towards a future where AI systems are not only more advanced but also more aligned with human values and ethical considerations. It promises to redefine the landscape of Human-AI interaction and set new standards for the development and application of AI technologies.

Press Release

For immediate release

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COMMUNICATION AND DISSEMINATION MONITORING PHASE 1

ANNEX 7 – MAIN CONCLUSIONS FROM STAKEHOLDERS INTERACTIONS

PARTICIPATION IN CIGRE WG C2.42: THE IMPACT OF THE GROWING USE OF MACHINE LEARNING/ARTIFICIAL INTELLIGENCE IN THE OPERATION AND CONTROL OF POWER NETWORKS FROM AN OPERATIONAL PERSPECTIVE | NOVEMBER 18, 2024

Participants from AI4REALNET: Antoine Marot (RTE), Ricardo Bessa (INESC TEC), Mouadh Yagoubi (IRTSX). This section presents a summary of the main conclusions withing this working group.

The congestion management use case, which is also being considered in AI4REALNET, was selected as a use case to illustrate the integration of AI in control rooms. The following challenges and risks were identified for this use case:

- Mix of discrete and continuous remedial actions that define a practically infinite solution space. Additionally, it is a multi-objective problem in which KPIs related to switching complexity, costs, and loadings must be weighed against each other.
- Developing an advanced digital environment for simulating and playing realistic scenarios is very important.
- The larger the network, the larger the action and solution space. Thus, there may be cases where the entire size of the action space or solution space may not be traversable, thus resulting in solutions that may not be global optima.
- Risk of deskilling if operators simply accept recommendations without thinking. Risk of over-reliance if no confidence measure is provided when making recommendations.
- Risk of non-adoption if recommendations do not match operator preferences, do not seem valid, or can hardly be explained. This risk can be mitigated by involving the operators in the development phase and by explaining the actions proposed by the decision support tool so that the operators can justify why they make certain decisions with the help of the decision support tool.

The following lessons were extracted:

- Involving the users (operators) from the very start contributes to adopting the tool. This is extremely relevant as operators might also misinterpret the tool as threatening their position. Besides, other important stakeholders from the business should be taken along from the start.
- Starting small, with a simplified version of the tool to incrementally add functionality and complexity, is preferred over a big leap into a full AI assistant tool. This is preferred from both a development and user perspective. A simplified algorithm can also function as a benchmark for more advanced algorithms.
- Start with preparing digital environment foundations and benchmarks for thoroughly developing and testing solutions.
- Define baselines and compare the performance to more simulation-based or rule-based solutions.

In terms of a roadmap for AI innovation, whether an organization is at a very early stage of exploring the applicability of AI/ML, as most system operation organizations are, or already at the stage of deploying AI, there are several paths that an organization can follow to embark on or continue in its AI Journey. Some use cases might be more suitable for starting and earning key lessons for practical implementations. Business needs may drive the need for AI, as technology is not an end by itself. Yet, AI/ML is a transversal technology that best works upon shared data sources and technical resources, which is a challenge. Thus, an AI strategy should eventually be implemented from the top of a company to unlock this agility.

Data management, thorough benchmark environments, and scalable, robust, reproducible experimentation capability are key to developing AI/ML and mitigating risks. Open-source developments can also be a catalyst for accelerating AI/ML developments. In the end, new capabilities, skills, and roles are required compared to more standard project and application developments. Users also become active in the software performance through their annotations, preferences, and feedback, which AI/ML can leverage. Human involvement is key to working best, and AI/ML should be developed through a human-centred approach. Having one lighthouse project with AI as a primary driver can unlock an organisation's AI capability more systematically. Ultimately, it prioritises the most valuable use cases to apply AI concerning the required investment and complexity.

The successful deployment of AI/ML technologies in power systems control rooms requires addressing several risks:

- Interpretability and trustworthiness. Human operators should be able to interpret AI predictions or recommendations, while trustworthiness ensures compliance with required specifications and grid codes.
- Cybersecurity. Data security and protection against unauthorised data access are crucial to prevent compromised system operations.
- Human expertise. Relying too heavily on AI could erode human expertise. Operators must be able to critically assess AI outputs and take control when necessary, like pilots with autopilot systems.

A regulatory framework is essential to balance the advancement of AI/ML tools with safety and reliability. It should promote explainability, certification, and human oversight to realise AI benefits responsibly and ethically.

AI4REALNET co-publication with CIGRE WG and the AI-EFFECT TEF: J.L. Cremer, A. Kelly, R.J. Bessa, M. Subasic, P.N. Papadopoulos, S. Young, A. Sagar, A. Marot, "Pioneering roadmap for ML-driven algorithmic advancements in electrical networks," IEEE ISGT Europe 2024, Dubrovnik, Croatia, 14-17 Oct. 2024

FROM ALGORITHMS TO ASSURANCE: DESIGNING HUMAN-CENTRIC AI TO ENHANCE COLLABORATION, TRUST, AND ACCEPTANCE (WORKSHOP AT ADRF 2024) | NOVEMBER 5, 2024

The session was organized by AI4REALNET (INESC TEC), involved four "cluster" projects of AI4REALNET, and focused on advancing the state of human-AI collaboration and trustworthiness in decision-making systems. The agenda was structured into three main parts: presentations on state-

of-the-art developments (with a questionnaire in Menti interactive presentation software), a roundtable discussion on designing human-centric AI solutions, and a concluding session.

The first presentation presented the PEER project, which aims to develop explainable sequential decision-making systems applicable in smart cities and manufacturing. The methodology involves simplifying agent models to improve human understanding, explaining reward structures to enhance transparency, and assessing long-term outcomes of decisions. These approaches are implemented in use cases such as personalized shopping assistants, optimization of product placement, city accessibility improvements, and autonomous systems that integrate human feedback.

The second presentation was from the AI4REALNET project, which focuses on developing AI frameworks for critical infrastructure operated by humans. The project combines supervised and reinforcement learning to create systems that facilitate human-AI co-learning, autonomous AI, and decision-making support. A key feature is using open-source environments to simulate and validate scenarios, bridging the gap between simulation and real-world applications. Practical applications include congestion management, train re-dispatching, and airspace flow optimization. The project also emphasizes scalability, robustness, and the explainability of AI behaviors to ensure reliability and human trust.

Another presentation centered on THEMIS 5.0 project addresses the challenge of optimizing trust in hybrid AI-human decision-making systems. This project implements a layered approach where one AI tool generates recommendations, another assesses their trustworthiness, and a third communicates these findings to human users. It highlights the importance of legal frameworks, particularly under the European AI Act, which mandates meaningful human oversight for high-risk AI systems. The project examines critical questions about what aspects of AI systems require oversight, who should oversee them, and when intervention is necessary.

Finally, the HumAIne project was presented, focusing on human-AI collaboration in decision-making. It explores the design of systems that integrate evaluative and co-creative methods to enhance trust and cooperation. The project adopts a trustworthiness framework based on international standards, considering transparency, reliability, safety, and robustness dimensions. The overarching goal is to build systems where human and AI agents can work together seamlessly while ensuring accountability and trust.

The following common points were identified for all projects:

- The explainability of sequential decision-making processes remains a significant challenge, with the need for new methods that can provide insights into the rationale behind decisions made over time (e.g., when impacts occur much later), particularly in dynamic environments and with complex reward functions.

- The user is at the center of the development. Thus, different and complementary approaches can be followed, a) co-creation workshops with users, integrating risk assessment before and afterward, b) formal writing of use cases following a standardized template (e.g., adapting the IEC 62559-2 template), c) simulate what an AI tool can do before developing it (Wizard-of-Oz prototyping, and d) construction of AI-friendly digital environments for development and AI testing.

- The first generation of AI-based decision systems primarily consists of AI assistants designed to recommend actions to humans. However, future generations are expected to evolve

toward systems that enable collaborative learning between humans and AI, ultimately progressing to autonomous AI systems that operate while maintaining human oversight and agency.

- Human oversight is fundamental. It needs authority to overrule and/or support knowledge to challenge the AI decision. It is important to define how we can empower the human.

- Human oversight is essential in AI decision-making, ensuring ethical and accountable outcomes. It requires the authority to overrule AI decisions when necessary and the knowledge to critically evaluate and challenge the AI's reasoning. Empowering humans in this role involves providing adequate education and training to understand AI's capabilities and limitations, ensuring systems are transparent and interpretable.

- Uncertainty quantification and modeling are core in AI-based systems, and they should consider the operating context. This highlights the need for a stronger university education in statistics and stochastic systems.

- Designing optimal socio-technical systems requires an interdisciplinary approach integrating expertise from diverse fields, such as engineering, computer science, social sciences, and ethics. This will foster a holistic understanding of complex challenges, enabling the development of systems that effectively balance technical performance with societal/human needs and impacts.

The following results were obtained with in the Menti interactive questions:

What level of decision-making autonomy would you prefer in an AI assistant for daily tasks?

0	12	8	0
Full autonomy – The AI makes decisions independently without needing approval.	Partial autonomy – The AI suggests options and makes minor decisions but requires approval for major actions.	Minimal autonomy – The AI only provides recommendations, leaving all decisions to the user.	No autonomy – The AI strictly follows direct instructions without making any decisions independently.

4   20

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Mentimeter

What factors would most increase your trust in AI systems used in critical infrastructures?

Explainability	Interpretability	Reliability	regulatory compliance	Human oversight	Robustness	AI self-awareness	Scalability
3	5	2	1	6	2	3	0

5   22

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What are the legal requirements for meaningful human oversight in AI?

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Improved trust arising from Human-AI collaboration contributes to the following categories of performance/aims:
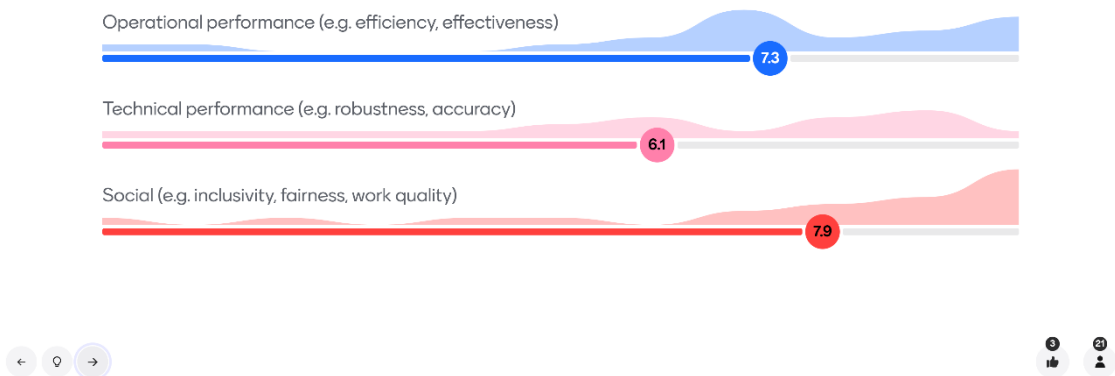
FLATLAND SYMPOSIUM AND WORKSHOP | NOVEMBER 19-21, 2024

The workshop was conducted using the open space method. This method allowed us to focus on topics that the participants had their expertise in, were relevant to their work and were of interest to the specific workshop group. The high participation rate of AI4REALNET partners (about 2/3 of the participants were from AI4REALNET partners) facilitated the direct exchange on specific tasks the partners work on together in AI4REALNET. In addition, the mix of participants (AI4REALNET and others) presented a unique opportunity to bring new perspectives and ideas to topics relevant to the AI4REALNET project.

Two workshop topics were particularly interesting for AI4REALNET. First, the workshop fostered discussions around graph observations. These observations represent a class of state-of-the-art observations for multi-agent reinforcement learning (MARL) for railway dispatching, a major focus of the AI4REALNET project. The workshop sessions resulted in specifications for improved support of graph-observations in the Flatland digital environment.

A second outcome was the conceptualisation and prototyping of an interactive human-computer interface (HMI) for railway dispatchers working with AI assistants. The work done during the workshop will serve as input for work on human-in-the-loop in railway use cases later in the AI4REALNET project.

The participants working on these two topics could also benefit from the input of the Flatland Symposium between the two workshop days and featured talks on MARL and HMI for AI-assisted railway dispatching. Further, work was done on how to generalise the Flatland environment to support resource allocation problems of other domains as well as on real-world infrastructure representations for Flatland.

All outcomes of the workshop are published on the workshop GitHub repository: https://github.com/flatland-association/flatland-workshop-2024.

THE FLATLAND FRAMEWORK: ENABLING MACHINE LEARNING RESEARCH FOR RAILWAY RESCHEDULING AND BEYOND @ FOSDEM 2025 | FEBRUARY 2, 2025

The discussions around the talk underscored the impact of open-source digital environments for transportation research and innovation as well as other work done by the AI4REALNET project like the enabling of human-AI-interaction and trustworthiness/explainability research. The target audience were railway and mobility experts and enthusiasts with technical background. Around 100 people attended the presentation.

AI AND SIMULATION: SOLVING COMPLEX REAL-WORLD CHALLENGES @ APPLIED MACHINE LEARNING DAYS (AMLD) EPFL 2025 | FEBRUARY 11, 2025

At the Applied Machine Learning Days (AMLD) at the École Polytechnique Fédérale de Lausanne (EPFL), Flatland organized a track with the title "AI & Simulation: Solving complex real-world challenges". Five speakers talked about various topics in AI, two of them from the AI4REALNET consortium (Flatland and EnliteAI). The presentations and the subsequent panel discussion focused on technical topics such as agent-based modeling and reinforcement learning for power grid operations, railway network planning, and railway dispatching as well as using machine learning to control heat pump settings. Furthermore, the human factor both in the development of technological solutions and in their applications were discussed.

The main takeaways for the AI4REALNET project are the importance of human involvement in the whole process from development to application of AI solutions, especially co-learning aspects in operating human-AI-systems. Further, choosing the right key performance indicators (KPI) was identified as a major factor to successfully solving relevant business problems. Finally, discussions with participants indicated that we should continue our research, as there is significant interest in simulations and reinforcement learning in general and in the Grid2Op and Flatland frameworks

specifically. Target audience were people with working with or interested in how to use simulations and machine learning to address real-world problems. Around 45 people participated in the track

3RD IN-PERSON WORKSHOP: FOUNDATION MODELS FOR THE ELECTRIC GRID | FEBRUARY 11-13, 2025

Location: Argonne National Laboratory

This event gathered over 70 international stakeholders from academia, industry, and government agencies to drive forward the development and application of AI and machine learning foundation model technologies for critical challenges in electric grid systems. The main goals were:

- Explore the transformative potential of foundation models (FMs) for electric grid systems.
- Address key challenges and opportunities identified in the positional paper, "A Perspective on Foundation Models for the Electric Power Grid", recently published in Joule.
- Foster collaboration among leading researchers, practitioners, and policymakers to advance the state of the art in electric grid technologies.

Participation in the AI4REALNET project

The project focused on presenting the conceptual architecture of AI-driven systems, particularly emphasizing the socio-technical design and the critical role of human operators in the power grid. A key part of the discussion revolved around the common decision-making features identified in the project's use cases across three domains. These highlighted the potential of the FM to be applied in tasks such as train re-dispatch.

Three major highlights of the project were emphasized:

- The need to predict potential failures of AI agents and proactively inform human operators was identified as a crucial requirement. This capability is vital for building trust in AI-driven decision systems. Equally important is the ability to quantify the uncertainty associated with AI decisions, ensuring transparency and reliability.
- The findings from AI4REALNET for distributed reinforcement learning can be used to build FMs for sub-areas of a large power grid. These results pave the way for scalable and efficient AI applications in complex systems.
- The project highlighted the importance of bi-directional information exchange between human operators and AI systems, i.e., interactive AI with hypervision that is being developed in WP1. Future FMs must be capable of co-learning with human operators to ensure safe and effective implementation. This approach underscores the need for collaboration between humans and AI to achieve optimal outcomes and human acceptance in real-world scenarios. An important question is how humans can communicate with AI? This may require ontologies for human-AI communication.

About the GridFM project (focused on a foundation model for power flow calculations)

- Benefit from previous background in geospatial FM. For instance: https://huggingface.co/ibm-nasa-geospatial
- The use of a physics-informed loss function resulted in high improvement
- Pre-trained models converge faster in terms of model tunning

- The current version outperforms direct current (DC) power flow in terms of accuracy and computational time. Outperforms alternating current (AC) power flow in computational time.
- The current model has 6 million parameters, but can go up to 50 million. For reference, the FM for weather has 2.3 billion parameters and Chronos has 70 million.
- Potential evolutions and use cases are state estimation, contingency analysis, cascading events analysis, advisor for human operators, and optimal power flow. It can also be used to accelerate power system simulations.
- Rely on synthetic power grid data for pre-training, e.g., PowerGraph. Synthetic data also has challenges, such as being too "clean" (noise-free) when compared to real data or highly correlated across time.

"BIRDS OF A FEATHER" SESSION WITH THE CLUSTER PROJECTS TITLED "THE HUMAN FACTOR IN AI: BRIDGING TECHNOLOGY AND TRUST" (EVENT "FUTURE-READY: ON DEMAND SOLUTIONS WITH AI, DATA, AND ROBOTICS") | FEBRUARY 18, 2025

The goal of this session was to present the work of each project in terms of human-centric and what we are expected to produce was:

Identify 3 remarkable results/insights that you wish to emphasize or share with the community and the European Commission.

The following results/insights were identified:

- Development of an impact assessment methodology for AI prior to deployment. The TANGO project is developing this, but in the future, the ideas could be common to all AI projects and ensure that a common methodology is used for the assessment. The basic idea is to integrate the economics part into the ELSA methodology[3].
- The integration of AI in high-risk applications should not be just about the AI component or software, but it should consider the full social-technical system where the AI solution is being integrated. The five projects follow this approach and require an interdisciplinary approach involving disciplines like philosophy or cognitive engineering. The goal is to go from individual decision-making to shared human-AI decision-making.
- Explainability in sequential decision-making problems is fundamental in different applications (e.g., reinforcement learning). This is also being covered by the projects at different levels, such as neurosymbolic models, or the development of a prediction mechanism for reinforcement learning failures.

Identify 3 research/innovation challenges (or gaps) following the results of your projects that the EC should invest in the next period.

The following challenges were identified:

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[3] van Hilten, M., Ryan, M., Blok, V., & de Roo, N. (2025). Ethical, Legal and Social Aspects (ELSA) for AI: An assessment tool for Agri-food. Smart Agricultural Technology, 10, 100710. https://doi.org/10.1016/j.atech.2024.100710

- Development of a standardized AI impact assessment methodology to enable cross-project comparisons of benefits and costs for the same use cases. This requires defining a common set of key performance indicators (KPIs) that encompass multiple dimensions, including social, environmental, and economic factors.

- Integrating AI for decision explainability to humans, even when decisions are derived from model-driven or mathematical approaches. This is particularly crucial in scenarios with multiple, conflicting objectives and diverse stakeholders, each with varying preferences and risk profiles.

- Advancing general-purpose AI systems could accelerate commercial deployment. However, achieving this remains challenging due to the heterogeneity of use cases and data. Nonetheless, ensuring the replicability of certain algorithmic solutions across different applications should be a key priority.

ANNEX 8 – ADVISORY BOARD MEETING

List of Attendees from the Advisory Board, December 12, 2024

Entity	Type	Sector	Representative name
ENTSO-E	Association	Energy	Ilaria Federici
JRC	Non-profit	AI	João Vinagre
Intel	Industry	Other	Valerio Frascolla
AI Redefined	Start-up	AI	Yves Lostanlen
Philipp Slusallek	Academic	AI	Philipp Slusallek
Eurocontrol	Association	ATM	Adam B. Tisza
TU Dresden	Academic	AI	Nikola Bešinović
Eurocontrol	Association	ATM	Dirk Schaefer
House of Energy	Association	Energy	Maike Buddensiek
University of Zurich	Academic	AI	Felix Gille
DIGI Mind Sphere	Start-up	AI	Viktor Miloshevski
Artelys	SME	AI	Nicolas Lair
ÖBB-Infrastruktur AG	Industry	Railway	Gerald Schinagl

Agenda

Time	Topic
11:00-11:05	Welcome
11:05-11:25	Overview of the AI4REALNET project
11:25-11:55	AI4REALNET use cases
11:55-12:35	AI4REALNET conceptual framework
12:35-13:00	AI4REALNET position paper on AI building blocks

Meeting minutes

Overview of the Project

- **Valerio Frascolla**: Highlighted that for a project at TRL 4-5, a go-to-market strategy may not be fully applicable. Instead, the focus should be on strategies that increase the maturity of the solutions.

- **Viktor Miloshevski**: Emphasized that open-source is not always free but can be monetized, for instance, through consultancy services.

- **Nicolas Lair**: Noted that open-source solutions can be effective if shared by users, as this fosters growth in the user base.

Presentation of the Use Cases

- **Valerio Frascolla**: Asked about scenarios where the AI does not provide recommendations and emphasized the need for a bidirectional feedback loop, allowing the AI to both assist the user and learn from user actions.

- **Dirk Schaefer**: Inquired about varying levels of automation across domains. Automation levels are currently low for the power grid, and human operators primarily perform manual actions. He referenced RTE's use of the Joint Control Framework for assessing automation levels.

- **Yves Lostanlen**: Asked if the project incorporates both simulation environments and real-world testing with operators. He suggested leveraging simulations to train young operators to use AI assistants.

- **Philipp Slusallek**: Questioned whether the AI has global grid knowledge or operates as a multi-agent distributed system. The consortium confirmed that distributed and hierarchical learning is being employed for scalability. He also asked about training methods and guarantees of confidence, with the consortium citing ongoing work on epistemic uncertainty estimation.

- **Nikola Bešinović**: Highlighted the importance of assessing decision quality, particularly under stress. The consortium mentioned using KPIs to measure cognitive load and assess system effectiveness. He also referenced the ATI trust index developed in the SHAPE project (reference: https://skybrary.aero/bookshelf/guidelines-trust-future-atm-systems-measures-0).

- **Valerio Frascolla**: Suggested extracting 2-3 key research questions from each use case, focusing on full automation and co-learning (human-AI interaction).

- **João Vinagre**: Asked about risk assessment methodologies. The consortium confirmed the development of a framework aligned with ISO standards, incorporating models from natural disaster management into WP4.

- **Yves Lostanlen**: Suggested linking technological breakthroughs with scenarios and levels of autonomy. He noted potential applications beyond networks, such as energy assets and manufacturing, and mentioned the relevance of the confiance.ai project.

- **Nikola Bešinović**: Asked about evolving Flatland to more realistic test cases and improving its link to use cases. The consortium confirmed ongoing enhancements, including the integration of an HMI.

Conceptual Framework

- **Valerio Frascolla**: Stressed the need for adaptability, making the framework applicable across various use cases.

- The Advisory Board noted that the framework appears generic and could benefit from greater specificity.

Presentation of the Position Paper

- **Dirk Schaefer**: Highlighted the importance of certification for AI systems, referencing EASA's work in aviation (reference: https://www.easa.europa.eu/en/domains/research-innovation/ai).

- **Yves Lostanlen**: Discussed incorporating human values into AI, referencing a Harvard Business Review article (reference: https://hbr.org/2024/03/bring-human-values-to-ai). He suggested dividing AI systems into subsystems and functions to align with systems-of-systems approaches.