Distributed Artificial Intelligence-driven open and programmable architecture for 6G networks

D6.2 Dissemination, communication, standardization, exploitation, IPR, clustering – Initial

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Glossary of terms and abbreviations

Abbreviation / Term	Description
GA	Grant Agreement
D&C	Dissemination & Communication
KPIs	Key Performance Indicators
SDO	Standards Development Organizations (SDOs)
PoCs	Proof of Concepts
WG	Working Groups

Executive Summary

The present Deliverable 6.2, is a public document of the Distributed Artificial Intelligence-driven open and programmable architecture for 6G networks (ADROIT6G) project, prepared as part of the Work Package (WP) 6 “Impact maximization and outreach” and addresses the following Tasks:

- Task 6.1 “Dissemination, communication, and capacity building”,
- Task 6.2 “Exploitation and sustainability”, and
- Task 6.3 “Standardisation and clustering activities”
- Task 6.4 “Innovation, data management and IPR activities”

The deliverable "Dissemination, Communication, Standardisation, Exploitation, IPR, Clustering" is a comprehensive document outlining the strategic framework and planned activities for effectively managing key aspects within the ADROIT6G project. Firstly, the document elaborates on the dissemination and communication strategy, detailing how project findings, outputs, and achievements will be shared with relevant stakeholders and the public. Also, dissemination channels and activities such as conferences, workshops, publications, and participation in events and exhibitions are presented, ensuring a broad visibility and accessibility of project outcomes. In terms of communication, the deliverable emphasizes the importance of both internal and external communication channels. Project visual identity such as logos, templates and website, as well as various communication tools, are outlined to facilitate effective communication among project partners, team members, and stakeholders.

Furthermore, D6.2 provides a detailed overview of the project's approach to maximizing the impact and longevity of its outcomes through an exploitation strategy plan. The document details the project's key exploitable results, highlighting the tangible outputs or innovations that hold potential for exploitation. A comprehensive initial exploitation map is provided, illustrating the projected pathways for exploiting these results and achieving desired outcomes. It details planned exploitation activities, key exploitable results, an initial exploitation map, and reporting tools for monitoring progress. Together, these elements form a cohesive plan to ensure the long-term effectiveness and utilization of the project's outputs.

The sections concerning "Standardization Plan" and "IPR Management Strategy" delineate crucial frameworks essential for both aligning project processes with industry standards and safeguarding intellectual property rights. In the Standardization Plan, a detailed roadmap is laid out, delineating standardization activities aimed at ensuring interoperability and quality. This includes the participation to working groups and clustering activities, fostering collaboration and knowledge exchange, as well as the identified SDO’s. Additionally, the incorporation of reporting tools is presented which enables meticulous tracking and evaluation of standardization progress. Lastly, IPR Management Strategy underscores the significance of safeguarding intellectual property throughout the project's lifecycle. It outlines measures for IPR management during project execution, including policies and procedures for identifying, protecting, and managing intellectual property. Specifically, strategies for IP protection through patents are elucidated, emphasizing the importance of securing legal rights to project innovations. Through these comprehensive frameworks, the project endeavours to ensure both adherence to industry standards and the protection of valuable intellectual property assets.

Overall, the present deliverable is the initial Deliverable on “Dissemination, communication, standardization, exploitation, IPR, clustering”, providing a comprehensive roadmap for effectively managing and optimizing dissemination and communication activities, standardization and exploitation roadmaps, as well as IPR Management strategy, and clustering activities within the ADROIT6G project, aiming to enhance its impact and sustainability.

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1 Introduction

The Deliverable D6.2 "Dissemination, communication, standardisation, exploitation, IPR, clustering-Initial" addresses Tasks 6.1 "Dissemination, communication, and capacity building", 6.2 "Exploitation and sustainability", and 6.3 "Standardization and clustering activities".

The deliverable is of a significant importance as it outlines all the communication and dissemination activities of ADROIT6G project, as well as presenting a strategic roadmap for managing key aspects within the ADROIT6G project. It outlines dissemination and communication strategies, including channels like conferences and publications. The document also details exploitation plans, focusing on maximizing project impact and longevity through key exploitable results and an exploitation roadmap. Additionally, it highlights frameworks for aligning with industry standards and protecting intellectual property rights through standardization and IPR management strategies. Together, these components aim to enhance the project's impact and sustainability by effectively managing dissemination, communication, standardization, exploitation, IPR, and clustering activities. Table 1 shows the relationships between WPs and summarized the future deliverables related to deliverable 6.2.

Based on the objectives and work carried out under the relevant tasks, the document starts with an executive summary followed by an Introduction in Chapter 1. Chapter 2 presents Dissemination and Communication plan, including the objectives and the target audiences, while in Chapter 3 the D&C activities performed are detailed along with their KPI's. Chapter 4, Chapter 5, and Chapter 6 refer to the Exploitation and Sustainability Strategy Plan, the Standardization Plan, and the IPR Management Strategy, respectively. In briefly:

- Chapter 1: Executive Summary
- Chapter 2: Introduction
- Chapter 3: Dissemination and Communication Plan
- Chapter 4: Dissemination and Communication Activities Performed
- Chapter 5: Exploitation and sustainability Strategy and plan
- Chapter 6: Standardization Plan
- Chapter 7: IPR Management Strategy
- Chapter 8: Conclusions

Table 1. Links to other Project's Outputs/ Work

WP #	Task #	Deliverable No related	Content
WP6	T6.1	D6.1	Development of the website and Social Media Channels were detailed in previous deliverable related to this Task, D6.1 that was submitted on M1. D6.1 "Project website and social media presence"
WP6	T6.1	D6.3	The project results and WP6 outputs are closely connected. Updated Dissemination, Communication activities can be presented in future deliverables related to this Task, more specifically in D6.3 that will be submitted on M36. D6.3 "Dissemination, communication, standardization, exploitation, clustering – Final"
WP6	T6.2	D6.3	Updated Exploitation and Sustainability activities can be presented in D6.3 that will be submitted on M36. D6.3 "Dissemination, communication, standardization, exploitation, clustering – Final"
WP6	T6.3	D6.3	Updated Standardisation and clustering activities can be presented in D6.3 that will be submitted on M36. D6.3 "Dissemination, communication, standardization, exploitation, clustering – Final"
WP6	T6.4	D6.3	Updated IPR activities can be included in D6.3that will be submitted on M36. D6.3 "Dissemination, communication, standardisation, exploitation, clustering – Final"

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1.1 Target Audience

The intended audience for this deliverable includes scientific peers, industrial partners, consortium members, professional organizations, policymakers, and stakeholders both within and beyond the ADROIT6G project community. It also aims to inform the general public and media who are interested in learning about the ADROIT6G project.

1.2 Mapping ADROIT6G Outputs

This section presents the ADROIT6G 's Grand Agreement (GA) commitments, as extracted from the formal deliverable and task description, in respect to their outputs and work to be performed (Table 2, Table 3).

Table 2. Adherence to ADROIT6G's GA Deliverable

ADROIT6G GA Component Title	ADROIT6G GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D6.2 Dissemination, communication, standardisation, exploitation, IPR, clustering-Initial	Plan for the exploitation and dissemination of results including communication activities updated by M18, and reports containing the dissemination, communication, trainings, standardisation, exploitation, and clustering activities with communities/associations. Moreover, the report will contain innovation and IPR management matters.	3-Dissemination and Communication Plan 4- Dissemination and Communication Activities Performed 5- Exploitation and sustainability Strategy and plan 6-Standardisation Plan 7- IPR Management Strategy	The present deliverable details the dissemination and communication plan, while it reports all the dissemination and communication activities performed by M18. It outlines the exploitation and standardization map, while innovation and IPR management is also being reported.

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Table 3. Adherence to ADROIT6G's GA Deliverable & Tasks Descriptions

ADROIT6G GA Component Title	ADROIT6G GA Component Outline	Respective Document Chapter(s)	Justification
TASKS			
Task 6.1 Dissemination, communication, and capacity building	This task will implement the dissemination and communication of the project goals, software elements and AI models, reports, results, achievements, and other outputs. The process of communication and dissemination of the results will be executed in a systematized way through the elaboration of a plan according to the article 17 of the Model Grant Agreement of HEU. The dissemination and communication channels and actions as defined in Section 2.2 will serve as a baseline to achieve the impact maximisation goals in this task. As far as dissemination is concerned, all research and academic consortium partners will be involved in the preparation and publication of articles in scientific journals and conferences. The project's intermediate results will also be presented in the form of white papers, presentations and online demos in various conferences and industrial exhibitions. Technical and PoC workshops will be organized by ATH, CYENS, CAFA, SIEMENS, ORO and NXW (see Section 2.2.1), which will be open to academic, research and industrial communities, to present the intermediate and the final project results and achievements, which will be collocated with important conferences. ORO and EURE will undertake the training sessions (online training tutorials and summer schools). CNIT, EURE, OULU, and ORO, will organise training events to PhD schools, as means of knowledge transfer, capacity building, wider outreach, and sustainability. ORO and NOVA will	4-Dissemination and Communication Activities Performed	In this Chapter the Dissemination and Communication Strategy is presented, the Dissemination and Communication Activities performed between M01 and M18, and the status of the KPIs. Website, social media, ADROIT6G visual identity, and templates are also detailed in this chapter.

	organise the webinars. As far as communication is concerned, this task will ensure the creation and constant update of all web-based communication means, including ADROIT6G website and social media channels (from M01 developed by EBOS). Participants will ensure visibility of the project activities through several traditional and electronic dissemination materials sent out to a large pool of stakeholders (Table 2.1) on a quarterly basis. (Output: D6.1, D6.2, D6.3)		
Task 6.2 Exploitation and sustainability	This task will conduct a continuous technology and research watch, led by the Exploitation Manager (ORO) supported by all technological partners on the technologies and elements they will conduct their research and development work in ADROIT6G, to identify and verify that ADROIT6G advancements are indeed the most relevant ones having the highest exploitation interest and potential for 6G targeted vertical industries. A technological survey assessment will be undertaken to understand the sectoral needs and opportunities for ADROIT6G, with an initial focus on the vertical industry segments covered by consortium partners, including deep involvement from the MNOs (ORO and NOVA). An analysis will then follow, which will seek to understand how ADROIT6G outcomes compare against existing beyond 5G as well as other 6G architectural technological solutions being developed. This will be used as input to the exploitation plan, to define a market position and unique value propositions for the ADROIT6G solution. Then, the focus will be on analysing the initially identified ADROIT6G key exploitable results and then enhance the exploitation strategy presented in Section 2.2.3 by creating specific business models and plans tailored to the constituent parts of the 6G	6- Exploitation and sustainability Strategy and plan	In this task, the exploitation plans and activities are presented, activities performed by M18 and achievements. Relevant exploitation plans are presented, with support of Exploitation Questionnaires, Market Analysis Questionnaire and Outcomes Registers, as completed by partners.

	architecture that consortium partners will either jointly or individually pursue after the end of the project. The task will also support partners in further developing their individual business plans and goals. To ensure sustainability and accelerate the penetration of ADROIT6G to the industry, free community versions of several ADROIT6G components will be published and promoted, some of them as open source (see Table 2.6). In addition, this task will conduct: an exploitation methodology, a detailed SWOT analysis of the ADROIT6G proposal; an alignment with the market and the competitive landscape; revenue and cost projections for different business models of ADROIT6G addressing specific sectors and customer needs; funding strategies for further R&I; a risk analysis for commercial sustainability for up to 5 years beyond the end of the project, quantifying opportunities as an advantage market opportunity, business aware and sustainable business model plan, etc. All partners of this task will synergize on the set of defined tasks. (Output: D6.2, D6.3)		
Task 6.3 Standardisation and clustering activities	ADROIT6G consortium partners will use standardisation to exploit the impacts of the project key results and to invest the public funding of this project most efficiently. Firstly, it will ensure that the R&D results produced by the project will be aligned with existing and emerging standards from the relevant standardisation bodies (e.g., 3GPP, ETSI, ITU, etc). Secondly, through 5G-PPP pre-standardisation WG and contributing to the next phase of 6G standardisation efforts ADROIT6G will analyse the standardisation gaps with respect to the 6G SNS JU vision, so that such gaps can be adequately addressed. Consortium partners ATH, IQU, ORO, NXW, SIEMENS	7-Standardisation Plan	The Chapter details the Standardization Road Map as well as it outlines the relevant SDO's and other standardization activities of ADROIT6G.

	will join efforts to contribute to the standardisation process by providing experiences, lessons learned, and research results, relevant to the outcomes of the project, as indicatively listed in Table 2.4 in Section 2.2.1. The following standardisation planning activities are foreseen: • A dedicated standardisation plan, identifying relevant standardisation and regulatory bodies. • A roadmap of relevant standardisation and regulatory bodies (3GPP, ETSI, ITU, etc.) and topics for 6G and extreme use cases, including evaluating existing roadmaps at international level; influencing pre-standardisation on 6G and related R&D, recommending which outcomes should be standardised. • Setting up the standardisation activity roadmap by month M12 and continue the updating of this roadmap based on the project's work progress and in conjunction with the SDOs progress. • Coordinating the project and standardisation groups through constant monitoring of activities and regular conference calls with targeted standardisation community. • Seizing opportunities to push technology contributions into ongoing specifications. • Coordinating with standardisation experts to draft and defend contributions in related SDOs meetings. • Joint actions with other SNS JU projects to promote opportunities for shared standardisation contributions and transfer of knowledge across the 5G-PPP pre-standardisation WG. ADROIT6G will maximize its impact by leveraging on, engaging with, and contributing to communities, networks, clusters, DIH and associations (see Table 2.4). In particular, the clustering plan with associated activities will be defined		

	and prepared in this task, aiming to advance ADROIT6G vision, to promote the exchange of results, to share knowledge, experience, and best practices for the emerging future looking services supported by ADROIT6G system over different relevant verticals. ADROIT6G commitment to such communities and sustainability strategy relies on the strong positioning and motivation of ADROIT6G consortium partners covering the full value chain, the sustained availability of ADROIT6G open-source software, and its open access to research results policy. Also, most of the partners are actively involved in existing European communities, DIHs, clusters and associations (see Table 2.4) and ongoing 5GPPP and other relevant H2020 and HEU projects; thus, they will raise awareness, ensure knowledge transfer, adoption, and joint activities. (Output: D6.2, D6.3)		
Task 6.4 Innovation, data management and <u>IPR activities</u> <u>Subtask:</u> Innovation management and IPR activities	Identify and manage innovation from the project, advising the Project Coordinator and consortium partners on the scope and potential of the innovations arising and paying attention to discerning IPR at regular checkpoints. The work also includes identifying, assisting, and overseeing the filing of at least 3 strategic patent filings. All IP produced will be monitored and the potential IPR attached to them (e.g., copyright, patent) will be also verified and cleared for the project's smooth execution. Further activities include: (a) Design the IPR protection strategy to promote the sustainability of project results, building on existing assets, considering aspects defined in Section 2.2.2. (b) Establish IPR management procedures and associated activities. (c) Conduct a search on the prior art for potential inventions, trademarks and other IPRs when necessary and evaluate	8- IPR Management Strategy	This Chapter focuses on the ADROIT6G's methodology structure for the IPR management Plan and the IP protection through patents. A template for Innovation collection was provided to the partners to determine which one may be able to generate a patent and establish the correct strategy for managing, protecting and distributing IPRs among project participants.

	the costs for potential IP protection. (d) Monitor the project from the IPR point of view so that confidentiality and all the partners' defined IPRs in the CA are fully respected. (Output: D6.4, D6.5, D6.6, D6.7, D6.8)		

2 Dissemination and Communication (D&C) plan

This chapter outlines the objectives and strategy for Dissemination and Communication (D&C), detailing how the project aims to effectively share its findings and engage with its audience. It begins by presenting the key stakeholders and target audience for the project, ensuring that dissemination efforts are directed towards those who will benefit most. Following this, the chapter presents the metrics used to measure the success of these D&C activities. This includes a current status report on Key Performance Indicators (KPIs), providing a snapshot of how well the project is meeting its dissemination goals. Additionally, the chapter describes the D&C reporting tools utilized to monitor and evaluate the KPIs, ensuring ongoing assessment and improvement of communication efforts.

2.1 D&C Objectives

A comprehensive array of dedicated dissemination and communication activities have significantly contributed to the ADROIT6G project. The primary objective of the ADROIT6G dissemination and communication strategy was to raise awareness of the project and its outcomes among a broad audience, while also attracting potential users and stakeholders, by employing a D&C strategy. The communication and dissemination strategy for ADROIT6G is designed to ensure widespread awareness and adoption of the project's outcomes. It encompasses a range of activities aimed at both general audiences and specific stakeholders. The Objectives along with the target audience are presented in Table 4. "ADROIT6G Dissemination and Communication objectives".

Table 4. Dissemination and Communication objectives

Objectives Description	Target Groups								
	A	B	C	D	E	F	G	H	I
Provide a clear view of the project goals and its results, including the 6G-IA and SNS JU perspectives	X	X	X	X	X	X	X	X	X
Create an active community of interested stakeholders and potential users and collect knowledge and requirements considered by the project's activities	X	X	X	X	X	X			
Prepare the ground for the exploitation of project's results towards the industry		X	X	X	X				
Create awareness of the project amongst all stakeholders impacted by the results	X	X	X	X	X	X	X	X	X
Establish liaisons with other projects and initiatives for knowledge and innovation transfer		X	X	X	X				
Support the dissemination and exploitation of results (including the SNS programme results) by formulating adapted key messages, and prepare adapted D&C material	X	X	X	X	X	X	X	X	X
Recognition of the results (including the SNS programme results) among the research communities, standardisation bodies, potential users, policy-maker institutions			X		X	X	X		

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2.2 D&C Strategy

Dissemination and communication activities are carried out in four phases, as presented in detail in Table 5, while each phase has its own objectives, target audience and goals, and activities performed using the best-suited channels. Since the present deliverable D6.2 is submitted by M18, the D&C activities of Phase 1 and the initial part of Phase 2 are presented, while Phases 3 and 4 will be conducted and reported on later deliverables.

Initially, between Month 1 and Month 12 of the project, broad communication efforts were focused on reaching a wide public audience, and several target groups. These activities aimed to raise awareness of ADROIT6G and its potential benefits among the public. During the second Phase (M12-18), more targeted D&C initiatives were undertaken to highlight ADROIT6G's advancements and achievements to scientific communities, academia, small and medium enterprises (SMEs), relevant industries, third parties, and end-users. This specialized approach ensured that key stakeholders are informed about the project's progress and outcomes, facilitating potential collaborations, adoption, and utilization of ADROIT6G technologies. As the project evolves, the communication strategy adapts to emphasize concrete results and engage stakeholders effectively. Overall, Project Partners ensure visibility of project activities through various traditional and electronic dissemination materials distributed to a wide range of stakeholders on a quarterly basis.

Table 5. ADROIT6G Dissemination and Communication Phases

Type of Information	Target Audience	Channels	Goals
D&C Phase 1 – M1-M12			
Presentation of ADROIT6G Objectives and expected results of ADROIT6G	Industry, technological, research and academia Potential end-users International Stakeholders identified	Conferences, workshops Brochures, roll-ups, posters Website Social media channels	General visibility Attracting potential customers, and collaborators
D&C Phase 2 – M13-M26			
Presenting elaborated use cases of ADROIT6G Demonstration of usage and results	Potential end-users, Specific technological, research and academic communities, 6G vendors and application developers	Conferences, workshops Publications in journals Special session in major congresses/exhibitions Website Social media channels	Exposing synergies with other SNS projects Providing visibility Informing EC authorities Attracting potential collaborators
D&C Phase 3 – M27-M33			
Presenting elaborated use cases of ADROIT6G	Potential end-users Potential developers in ICT companies	Conferences, workshops Publications in journals	Attracting potential investors Attracting potential customers

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Demonstration of usage and results	Specific technological research and academic communities	Special sessions in major congresses/exhibitions Website Social Media Channels	
D&C Phase 4 – M34-M36			
Final results of ADROIT6G User oriented demonstration	Potential end-users Potential developers in ICT companies Specific technological, research and academic communities.	Website Publications in journals Industry focused events Client demonstrations and demos in major 5G events	Attracting potential customers Attracting investors Informing EC Authorities Demonstrating results to existing customers

2.3 ADROIT6G Stakeholders

ADROIT6G aims to implement a focused and thorough strategy, initiating effective Dissemination, Communication, and Exploitation (D&C&E) activities right from the project's inception. This strategy is committed to mobilizing the appropriate stakeholders and amplifying the effects of D&C&E activities. Recognizing the interconnectedness of these varied efforts for maximizing project outcomes, the consortium initially identified specific target audiences (A-I), listed in Figure 1. Building on this understanding of target audience groups and their anticipated engagement, the consortium established objectives for the unified dissemination and communication strategy, aligning them with the interests of the identified audience segments as outlined in Table 4.

Figure 1. Target Audience of ADROIT6G, listed from A to I.

The dissemination and communication activities of the ADROIT6G project are designed to engage diverse audiences effectively. For academia and research communities, scientific publications, conferences, and specialized workshops will provide in-depth technical insights and foster collaborative opportunities. Industry stakeholders, including telecommunications companies and tech innovators, will be targeted through industry conferences, webinars, and partnership meetings, focusing on practical applications and business implications. Public outreach and awareness campaigns will use social media, press releases, and public demonstrations to inform and educate the general public about the benefits and advancements of 6G technology. By tailoring these activities to the specific needs and interests of each audience, ADROIT6G ensures widespread engagement and impact.

2.4 Dissemination tools and activities

The aim of the dissemination tools is to maximize the outreach of the project for diffusing scientific and technological knowledge to specific target groups. Figure 2 presents the specific dissemination measures and means used, which are tailored to the needs and profile of each target audience, aiming to gain high visibility and exposure leveraging the multiplier effect through wide means of collaboration. ADROIT6G Dissemination activities and KPIs are summarized in Table 6 .

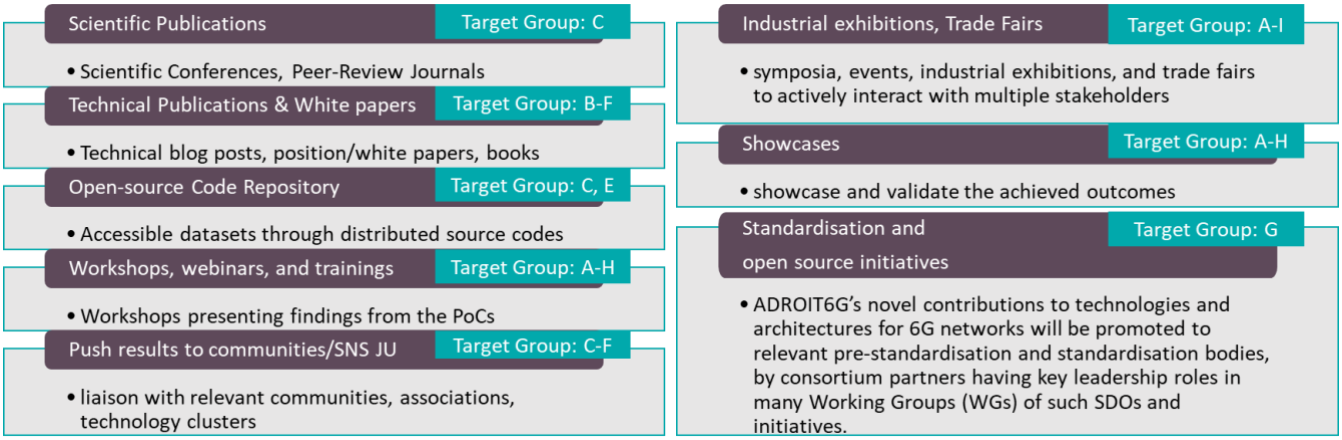

Figure 2. ADROIT-6G Dissemination Plan – Measures, Means, and Target Groups

Table 6. ADROIT6G Dissemination activities and KPIs.

Dissemination activity	Target Value
Scientific papers in peer-reviewed Journals	≥10
Scientific Papers in Conferences	≥15
White papers/factsheets	≥5
Public Deliverables	15
Open Datasets	≥3
Open-source code repository to publish the codes	≥1
PoC Workshops	3
Organization of Scientific Workshops	2; Average Number of attendees per workshop >80
Organization of Training Tutorials Organization of Summer Schools Organization of Webinars	4 3 3 Total Number of Enrolled Users (for online training tutorials, summer schools, webinars) >500
High Impact Communities/Associations where to push ADROIT6G results	>10

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Industrials Exhibitions	>10
Roll-up banners (at Exhibitions)	3
Brochures to stakeholders (at Exhibitions)	>1000
Showcasing Events	≥4 Different countries involved (of showcasing events) ≥4
Participants (at showcasing events)	>1000
Number of standardization contributions to different SDOs with adoption status	≥6

2.5 Communication tools and activities

ADROIT6G communication strategy and plan focuses on creating awareness amongst the full range of stakeholders including the public, get high exposure in the social media channels and press coverage, as well as liaise with relevant initiatives for knowledge transfer as outlined in Figure 3. The aim is to foster the adoption of the project's results by the industry and the society in general. ADROIT6G communication activities and KPIs are summarized in Table 7 .

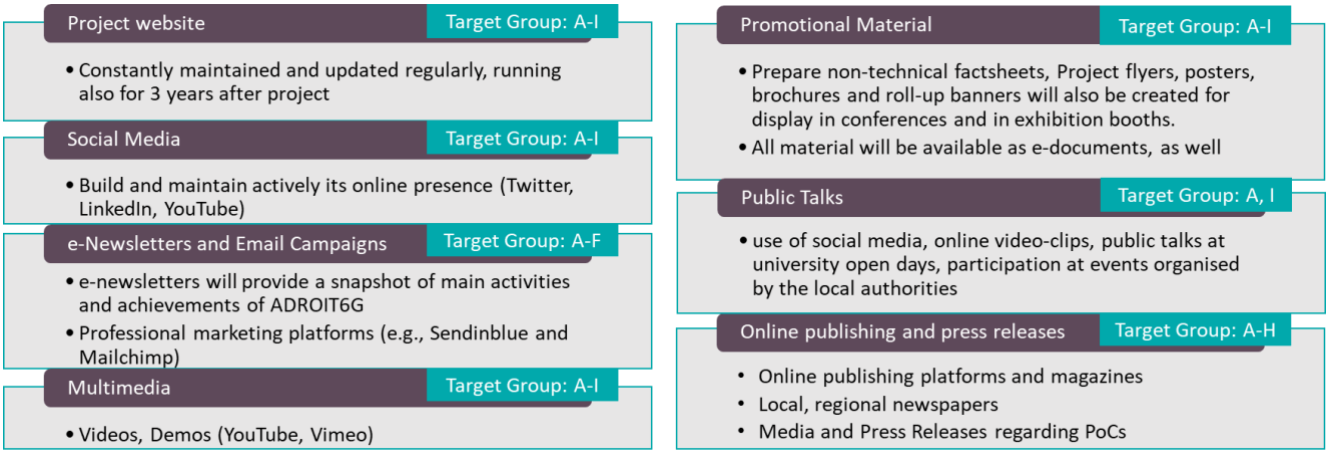

Figure 3. ADROIT-6G Communication Plan – Measures, Means, and Target Groups.

Table 7. ADROIT6G communication activities and KPIs.

Communication Activity	Target Value
Project Website	Online by M01; Unique visitors at M36 > 4000
Social Media	Followers by M36> 1000 Monthly Impressions average>500
e-Newsletters contributed/released	>6 Total mailing list of contact points >1000
Press-Releases	≥ 6
Events organised by partners	≥ 3 People per event >50
Promotional Material: Non-technical factsheets Project flyers/leaflets/brochures Hard Copies distributed Rollup Banners and posters	 >3 >3 >2000 >3
Multimedia:	

Promotional videoclips Number of interviews produced Number of views	>3 >6 >3000
Public talks/ Public events at universities	>5; Students per event>100
Public talks/ Open days	>5; Visitors/open day>50
Participation at events organised by partners	>3; People per event>100

3 Dissemination and Communication Activities Performed

This section outlines the dissemination and communication efforts carried out by the Consortium partners until June 2024. The ADROIT6G project adopts a comprehensive approach to ensure the effective sharing of project results and to maximize their impact across various stakeholders, as outlined below. For ADROIT6G Key Performance Indicators (KPIs) serve as compasses to achieve the project outreach and outcomes within the context of valuable and realistic metrics. These quantifiable metrics are the core of our D&C strategic planning, offering a succinct snapshot of performance against predetermined goals. ADROIT6G KPIs not only gauge progress but also drive accountability, foster continuous improvement, and ultimately steer the project toward sustainable growth, competitive advantage, and high-end results. Table 8 shows the KPIs set at the initiation of the project, their progress until June 2024, and the expected reach until the finalization of the project.

3.1 Dissemination Activities

The dissemination efforts for the ADROIT6G project are designed to maximize outreach and impact. These efforts encompass a range of activities aimed at engaging various stakeholders, including academic researchers, industry professionals, and the general public. Key dissemination activities include the publication of research findings in prestigious academic journals and the presentation of conference papers to engage with the global research community. Also, it produces technical publications and white papers to detail specific technologies and methodologies, while public deliverables ensure transparency and accessibility of key project outcomes. These efforts collectively aim to foster broad engagement and knowledge sharing across various stakeholders.

It is outstanding that by M18, ADROIT6G has already surpassed several key performance indicators (KPIs), signalling its formidable progress and unwavering commitment to the project. Adroit6G has demonstrated exceptional engagement with the scientific and research community by participating in Conferences, and Workshops, Publishing its results in Conference Proceedings as well as in Peer-Reviewed Journals. Moreover, its participation in Exhibitions, Trade Fairs, Showcases, and Invited Public Talks have outpaced projections, maximizing its outreach to several target audience groups. Also, Adroit6G's strong presence on social media from its initialization, has created a community with people and professionals maximizing its impact.

Table 8. ADROIT6G Dissemination KPIs and target values monitoring.

DISSEMINATION		
KPI	**Target Value**	**Achieved by June 2024 (M18)**
Scientific papers in peer-reviewed Journals	≥10	10
Scientific papers in Conferences	≥15	10
White papers/factsheets	≥5	0
Public Deliverables	15	5
Open Datasets	≥3	0
Open-source code repository to publish the codes	≥1	1
PoC Workshops	3	0
Scientific Workshops	2 Average Number of attendees per workshop >80	1
Online Training Tutorials Summer Schools Webinars	4 3 3 Total Number of Enrolled Users (for online training tutorials, summer schools,	0 1 0 ~100

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	webinars) >500	
High Impact Communities/Associations where to push ADROIT6G results	>10	2
Industrial Exhibitions	>10	11
Roll-up banners (at Exhibitions)	3	5
Brochures to stakeholders (at Exhibitions)	>1000	~850
Showcasing Events	≥4 Different countries involved (of showcasing events) ≥4	2 2
Participants (at showcasing events)	>1000	400-450

3.1.1 Journal publications

The dissemination efforts of the ADROIT6G project have already exceeded expectations, achieving and surpassing key performance indicators (KPIs) with ten journal publications and sixteen conference papers by June 2024, numbering in total 20 scientific publications. These contributions reflect the project's commitment to advancing 6G research and technology. The journal publications, featured in esteemed academic journals, provide in-depth insights into the project's findings, while the conference papers facilitate knowledge exchange and collaboration within the global research community. These accomplishments underscore the project's significant impact on the scientific and technological landscape of 6G development. All Journal and Conference Publications are accessible at ADROIT6G webpage, under the D&C tab, here, while main details are given in Table 9.

Table 9. ADROIT6G Journal Publications.

No	Partner	Title of publication	Journal	Authors	Year	Status
1	CNIT	Fair and Scalable Orchestration of Network and Compute Resources for Virtual Edge Services	IEEE Transactions on Mobile Computing	S. Tripathi, C. Puligheddu, S. Pramanik, A. Garcia-Saavedra, C. F. Chiasserini	2024	Published
3	CNIT	SEM-O-RAN: Semantic O-RAN Slicing for Mobile Edge Offloading of Computer Vision Tasks	IEEE Transactions on Mobile Computing	C. Puligheddu, J. Ashdown, C. F. Chiasserini, F. Restuccia	2024	Published
4	OULU	BayGO: Decentralized Bayesian Learning and Information-Aware Graph Optimization Framework	IEEE Transactions on Signal Processing	T. AlShammari, C. Weeraddana M. Bennis	2024	Published

5	EURE	Multi-Modal Latent Diffusion	MDPI Entropy	B. Mustapha, G. Franzese, P. Michiardi	2024	Published
6	OULU	DIN: A Decentralized Inexact Newton Algorithm for Consensus Optimization	IEEE Transactions on Machine Learning in Communications and Networking	A. Ghalkha, C.Ben Issaid, A. Elgabli, M. Bennis	2024	Published
7	CYENS	Content-Aware Network Traffic Prediction Framework for Quality of Service-Aware Dynamic Network Resource Management	IEEE Access	W. A. Aziz, I. Ioannou, M. Lestas, H. K. Qureshi, A. Iqbal V. Vassiliou	2023	Published
8	ISI/ATH; IQU	Towards Bridging the FL Performance-Explainability Trade-Off: A Trustworthy 6G RAN Slicing Use-Case	IEEE Transactions on Vehicular Technology	S.Roy, H.Chergui, Ch. Verikoukis	2024	Published
9	CYENS	A Novel Deep Hierarchical Machine Learning Approach for Identification of Known and Unknown Multiple Security Attacks in a D2D Communications Network	IEEE Access	S. V. Jansi Rani, I. Ioannou, P. Nagaradjan, C. Christophorou, V. Vassiliou, H. Yarramsetti, S. Shridhar, L. Mukund Balaji, A. Pitsillides.	2023	Published
10	ISI/ATH	Digital Twin and Meta RL Empowered Fast-Adaptation of Joint User Scheduling and Task Offloading for	IEEE Journal on Selected Areas in Communications	H. Xu, J.Wu, Q.Pan, X.Liu, Ch. Verikoukis	2023	Published

		Mobile Industrial IoT				

3.1.2 Conference Publications

No	Partner	Title of publication	Conference	Authors	Year
1	CYENS	ML-Aided Dynamic Clustering and Classification of UEs as VBs in D2D Communication Networks	International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)	I. Ioannou, P. Nagaradjane, A. Khalifeh, C. Christophorou, V. Vassiliou, G. V. S. Sashank, C. Jain, A. Pitsillides	2023
2	CYENS	Dual-Step Transfer Learning-Based Prediction Model for Next-Generation Intelligent Cellular Networks	IEEE ICC Workshops	W. A. Aziz, I. Ioannou, M. Lestas, V. Vassiliou	2023
3	OULU	Communication-Efficient Second-Order Newton-Type Approach for Decentralized Learning	IEEE WCNC	M. Krouka, A. Elgabli, C. B. Issaid, M. Bennis	2023
4	OULU	DIN: A Decentralized Inexact Newton Algorithm for Consensus Optimization	IEEE ICC	A. Ghalkha, C. Ben Issaid, A. Elgabli, M. Bennis	2023
5	ORO	6G Initial Developments for Flagship Applications Experiments	15th International Conference on Electronics, Computers and Artificial Intelligence (ECAI)	C.Patachia, R. Mihai, M. Iordache	2023
6	CNIT	Machine Learning Performance at the Edge: When to Offload an Inference Task	2nd Workshop on Networked Sensing Systems for a Sustainable Society	O. Chukhno, G. Singh, C. Campolo, A. Molinaro, C. F. Chiasserini	2023
7	ISI/ATH, CYENS, CNIT, ORO, CAFA	ADROIT6G DAI-driven Open and Programmable Architecture for 6G Networks	IEEE Globecom Workshops	C. Christophorou, I. Ioannou, V. Vassiliou, L. Christofi, J. S. Vardakas,	2023

				E. Seder, C. F. Chiasserini, M. Iordache, C. Ben Issaid, I. Markopoulos, G. Franzese, T. Järvet, C. Verikoukis	
8	OULU	Emergent Communication Protocol Learning for Task Offloading in Industrial Internet of Things	IEEE Globecom	S. Mostafa, M. P. Mota, A.Valcarce, M. Bennis	2023
9	IQU	Joint Explainability and Sensitivity-Aware Federated Deep Learning for Transparent 6G RAN Slicing	IEEE ICC	S.Roy, F. Rezazadeh, H.Chergui, Ch.Verikoukis	2023
10	CYENS	Towards Accelerating the Network Performance on DPUs by optimising the P4 runtime	32nd Euromicro International Conference on Parallel, Distributed and Network-Based Processing	D. Iliadis-Apostolidis, K. Manaa, M. Kadosh, I. Ioannou, V. Vassiliou, S. Kosta, J. J. Vegas Olmos	2024

3.1.3 Workshops, webinars, and trainings

3.1.3.1 Organization of Scientific Workshops

The ADROIT6G and CENTRIC projects are co-organising a Special Session at IEEE Computer Aided Modeling and Design of Communication Links and Networks (CAMAD 2024). By conjoining the expertise of ADROIT6G and CENTRIC, this Workshop/Special Session (Figure 4) will offer conference participants a comprehensive understanding of the intricate interplay between the 6G architecture, AI-driven user-centricity, and Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6G Networks energy efficiency.

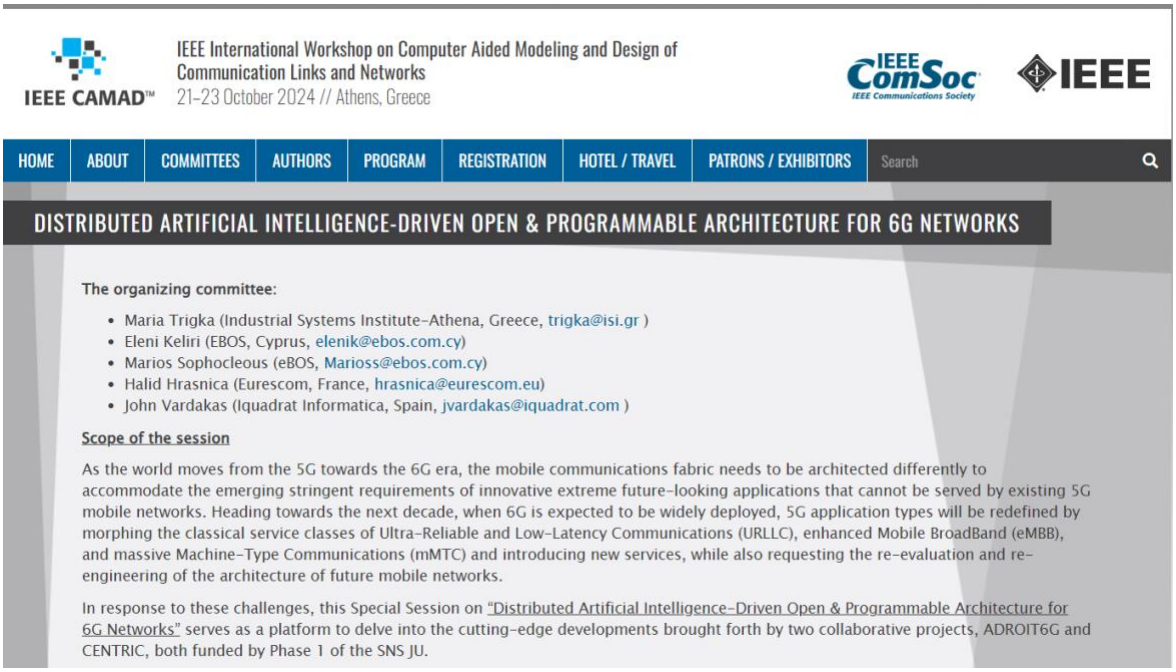

Figure 4. CAMAD 2024 Website Screenshot of Special Session on "Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6g Networks"

3.1.3.2 Organization of Webinars/ PoC Workshops

ADROIT6G is planning to organize PoC specific webinars as the project progresses. Specifically, CYENS, CAFA, and SIEMENS partners are responsible for organizing at least one PoC Workshop between M19-M36, which will be open to academic, research and industrial communities, to present the intermediate and the final project results and achievements with a focus on PoC's findings.

3.1.3.3 Organization of Summer Schools

ADROIT6G participates in the organization of the Summer and Spring Schools as means of knowledge transfer, capacity building, wider outreach, and sustainability. Our Partner ORO has participated on 15th of April at 2024 Spring School. The Spring School, founded in 2018, as an initiative undertaken by the Applied Distributed Systems research group, housed within the Faculty of Computer Science, of the "Alexandru Ioan Cuza" University of Iași (Figure 5), in collaboration with the Orange Educational Program. This esteemed event is specifically dedicated to students at the bachelor's, master's, and doctorate levels, as well as academic staff, from technically oriented faculties. It offers a unique opportunity for participants to enhance their understanding and expertise in the realm of Distributed Systems.

Figure 5. ORO presenting at 2024 Spring School of the University of Iasi.

3.1.4 Industrial Exhibitions and Showcases

The ADROIT6G project has actively showcased its innovative technologies and research at various industrial exhibitions, trade fairs, and showcases, significantly enhancing its industry presence and impact. These events have provided a platform to demonstrate the project's advancements in 6G technology, leading to increased industry engagement, new collaborations, and heightened interest from potential partners and stakeholders. For instance, participation in Events like EuCNC & 6G Summit, Mobile World Congress MWC Barcelona, Smart City Expo World Congress and the IoT Solutions World Congress has allowed the project to present its cutting-edge solutions, resulting in valuable feedback and fostering deeper industry relationships. These engagements have not only raised awareness about ADROIT6G but also facilitated the exchange of ideas and best practices, contributing to the broader discourse on the future of 6G networks. Overall, ADROIT6G participated in eight events, presented in Table 10, and also further information can be accessed at ADROIT6G Exhibitions.

Table 10. List of ADROIT6G attendance at Industrial Exhibitions, Trade Fairs and Showcases, type of dissemination material and the number of distributed materials.

No	Event Name	Dissemination material
1	IoT Solutions World Congress 2023	Rollup/Brochure
2	Mobile World Congress (MWC Barcelona) 2023	Rollup/Brochure
3	EuCNC 2023	Rollup
4	Smart Cities Expo World Congress (SCEWC) 2023	Rollup/Flyer
5	Mobile World Congress (MWC Barcelona) 2024	Rollup
6	Beyond Expo Thessaloniki	Leaflet
7	IoT Solutions World Congress 2024	Leaflet
8	EuCNC & 6G Summit 2024	Leaflet/Poster/ Demo

3.1.4.1 IoT Solutions World Congress 2023

ADROIT6G participated in the IOT Solutions World Congress held from January 31st to February 2nd, 2023, in Barcelona and hosted by the Iquadrat stand. The ADROIT6G project coordinator, prof. Christos Verikoukis, presented the objectives and expected results of ADROIT6G (Figure 6).

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Figure 6. ADROIT6G participation at the IOT Solutions World Congress

3.1.4.2 Mobile World Congress (MWC Barcelona) 2023

MWC Barcelona is the largest and most influential event for the connectivity ecosystem. From February 27th to March 3rd, ADROIT6G participated in the event and hosted at our partner's, Iquadrat, stand (Figure 7).

Figure 7. ADROIT6G at MWC Barcelona 2023

3.1.4.3 EuCNC 2023

The EuCNC & 6G Summit builds on putting together two successful conferences in the area of telecommunications: EuCNC supported by the European Commission, and the 6G Summit, originated from the 6G Flagship programme in Finland, one of the very first in its area. They bring together cutting-edge research and world-renowned industries, businesses, researchers and academia, globally attracting in the last years more than 1300 delegates from more than 40 countries all over the world, to present and discuss the latest results, and an exhibition with more than 70 exhibitors, for demonstrating the technology developed in the area, primarily by research projects from EU funded projects. EuCNC & 6G Summit 2023 took place between the 6th and 9th of June, in Gothenburg, Sweden, where ADROIT6G attended the event and was hosted at the 6G-BRICKS Project booth (Figure 8).

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Figure 8. Project Coordinator (ISI/ATH) representing ADROIT6G at EUCNC 2023 hosted in 6G-BRICKS Booth

3.1.4.4 Smart Cities Expo World Congress (SCEWC) 2023

ADROIT6G presented during SCEWC23 in Barcelona (Figure 9), hosted by Iquadrat's booth from November 7-9, 2023. The Smart City Expo World Congress is the world's biggest and most influential event on urban innovation. They connect leaders from the most innovative companies, governments, and organizations to move cities towards a better future.

Figure 9. ADROIT6G hosted at our partner Iquadrat booth during the SCEWC 2023.

3.1.4.5 Mobile World Congress (MWC Barcelona) 2024

ADROIT6G participated in MWC Barcelona (Figure 10), the largest and most influential event for the connectivity ecosystem. We showcased our project at the Generalitat de Catalunya's stand in Congress Square (CS220) and IQUADRAT's booth number 35 from 26th to 29th February, 2024. During this time, we had the privilege of presenting our project to the SNS JU Executive Director Erzsébet Fitori, Mr. Dimitris Papastergiou, the Minister of Digital Governance of Greece, and the Minister ("Conseller") of Business and Labour of the regional Government of Catalonia, Roger Torrent i Ramió.

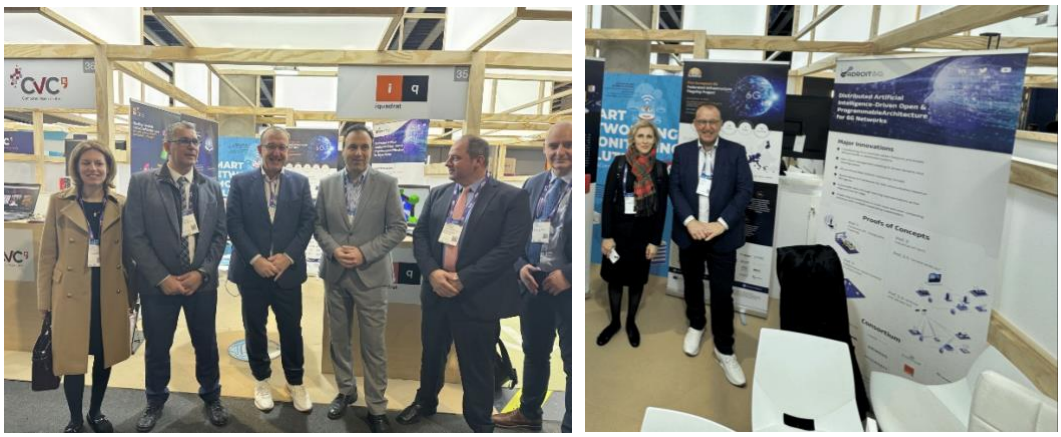

Figure 10. ADROIT6G participation at MWC Barcelona 2024

3.1.4.6 Beyond Expo Thessaloniki

Our Project Coordinator, ISI/ATH, participated in Beyond Expo in Thessaloniki International Exhibition and Congress Center, showcasing several projects, including ADROIT6G Project (Figure 11). ADROIT6G had a dedicated rollup and demo components at the booth. This prestigious event served as a prime opportunity to not only highlight our project's commitment to cutting-edge research and development but also to engage with industry leaders and stakeholders, fostering invaluable collaborations and pushing the boundaries of technological advancement.

Figure 11. ISI/ATH booth showcasing ADROIT6G at Beyond Expo Thessaloniki 2024.

3.1.4.7 IoT Solutions World Congress 2024

Our Project Coordinator (ISI/ATH) with a project partner (IQU), participated in in the IOT Solutions World Congress (Figure 12) held in the vibrant city of Barcelona from May 21st to 23rd, 2024. At IQU's and ISI/ATH's stand number 60, ADROIT6G showcased its ground-breaking solutions and cutting-edge technologies.

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Figure 12. Project Coordinator at IOT Solutions World Congress disseminating the project at stand number 60.

3.1.4.8 EuCNC & 6G Summit 2024

The EuCNC & 6G Summit took place between the 3rd and 6th of June 2024, in Antwerp, Belgium, and ADROIT6G attended the event (Figure 13) with its own Project booth (Number 43). At the Booth two demos were presented along with a Poster for each one. A poster was also presented at the Poster Session of the project, and an invited talk by Project Coordinator Prof. Christos Verikoukis was given at the 6G Series Workshop organised by Hexa-X-II.

Figure 13. ADROIT6G project partners at the EUCNC & 6G Summit 2024 Booth number 43.

3.1.5 Open-source code repository to publish the codes

Maintaining an open repository for ADROIT6G on GitHub is a crucial step towards fostering collaboration and innovation in the field of 6G technology. This repository serves as a central hub for developers, researchers, and industry professionals to access, contribute, and share code, documentation, and research findings. By promoting transparency and open access, ADROIT6G aims to accelerate the development of cutting-edge 6G solutions, encourage community-driven improvements, and facilitate the rapid dissemination of knowledge. The open repository not only supports collaborative efforts but also enhances the visibility and credibility of the project within the global tech community, paving the way for groundbreaking advancements in next-generation communication technologies.

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3.1.6 Invited talks and organization/participation in Panels

3.1.6.1 "Towards Realistic Usage of AI in 6G Networks" Workshop supported by Networld Europe

ADROIT6G took part at the 'Towards Realistic Usage of AI in 6G Networks' Workshop in Lisbon, on November 6, 2023. Giada Landi, representing Nextworks, delivered an insightful presentation titled "Challenges for Automating AI/ML Management in 6G Networks" (Figure 14). The workshop focused on the difficulties of implementing AI and ML in 6G networks, emphasizing issues such as limited improvements, high resource requirements, and the unpredictable nature of results. Organized by Networld Europe and supported by the SNS OPS project, the event was held alongside the Visions of Future Communication Summit.

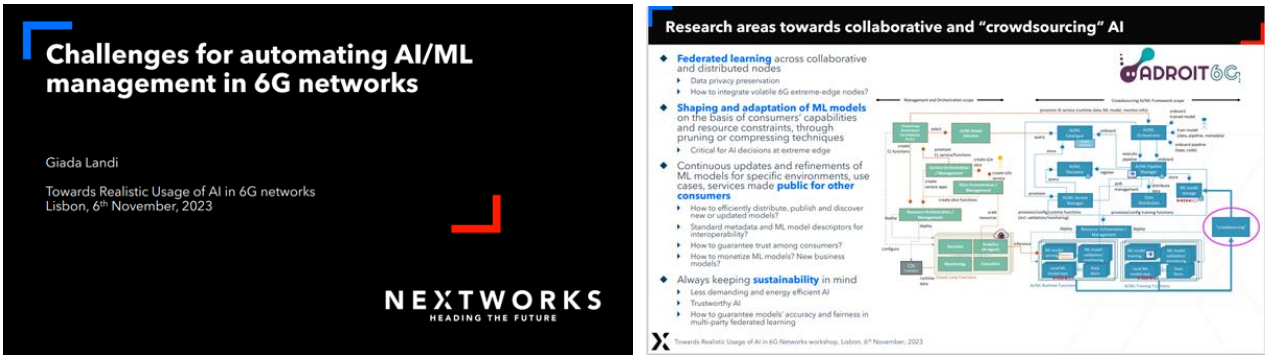

Figure 14. Snapshots from ADROIT6G presentation at Networld Europe Workshop

3.1.6.2 6G Series Workshop organized by Hexa-X-II

Our project coordinator, prof. Christos Verikoukis (ISI/ATH) presented "ADROIT6G: Distributed Artificial Intelligence-driven open and programmable architecture for 6G networks" at the 6G Series Virtual Workshop organized by Hexa-X-II on February 13, 2024 (Figure 15). The presentation has been recorded and uploaded on Hexa-X-II YouTube channel, and it is accessible here. Prof. Christos Verikoukis has also presented at the 6G Series Workshop organized by Hexa-X-II at the EuCNC & 6G Summit 2024, on June 3rd, 2024 in Antwerp, Belgium.

Figure 15. ADROIT6G presentation at the Online Hexa-X-II 6G Series Workshop.

3.1.6.3 IEEE GLOBECOM 2023

Prof. Christos Verikoukis, participated in the IEEE Global Communications Conference (GLOBECOM), one of the IEEE Communications Society's flagship events dedicated to driving innovation in nearly every aspect of communications. Prof. Verikoukis had the honor of presenting a paper related to the ADROIT6G project at a Panel Session (Figure 16). The 2023 IEEE GLOBECOM took place in Kuala Lumpur, Malaysia, from December 4 to 8, under the theme 'Intelligent Communications for Shared Prosperity.' The conference featured a comprehensive technical program, including 13 symposia, tutorials, and workshops, emphasizing advancements in technologies, systems, and infrastructure that continue to reshape the global telecommunications landscape.

Figure 16. Panel Discussion at IEEE GLOBECOM 2023.

3.1.6.4 InfoCom World 2023

At Infocom 2023 in Athens on December 14, 2023, prof. Christos Verikoukis and Dr. John Vardakas (Figure 17), represent ADROIT6G and present our project at session 6: Establishment of Novel Architectural Frameworks for the Support of B5G/6G Infrastructures. As the event concludes, we reflect on the insights gained and look forward to continued innovation and collaboration in the dynamic landscape of 6G technologies. The presentation was recorded by the conference and it is available here.

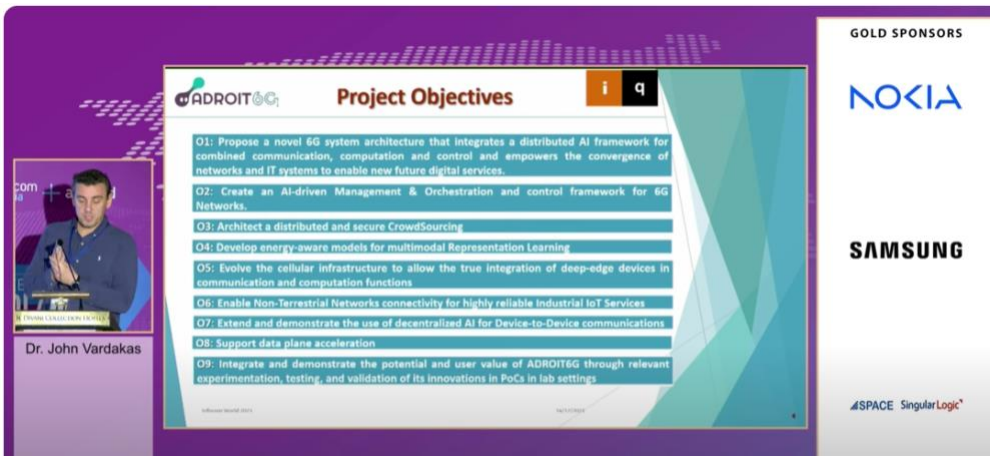

Figure 17. ADROIT6G partner from IQU, Dr. John Vardakas, presenting ADROIT6G at InfoCom World 2023.

3.1.6.5 Development Forum 2023

ADROIT6G co-organised a Panel Discussion at the 26th Development Forum Greece (Figure 18). The 26th Development Forum took place on November 18th and 19th 2023 in Greece, adopting a hybrid format. The event featured the physical presence of speakers and delegates, complemented by live broadcasts of all activities. The

primary focus of the 26th Forum Anaptyxis this year was to stimulate a widespread public debate on the theme: 'Collaborations and synergies everywhere.' These events garnered support from key entities in the State and Politics, Local Government, Education, Economy, Science and Research, as well as Culture and Sports Departments. Leading collective organizations from various sectors also actively participated.

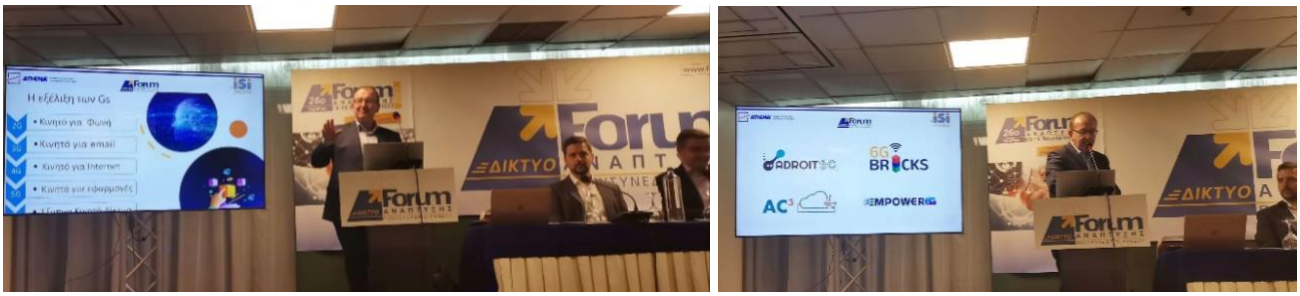

Figure 18. Prof. Christos Verikoukis, project coordinator, presenting at Development Forum 2023.

3.1.6.6 EUCNC&6G Summit 2024 – Invited talk at 6G Series by Hexa-X-II

Prof. Christos Verikoukis has also presented at the 6G Series Workshop organized by Hexa-X-II at the EuCNC & 6G Summit 2024, on June 3rd, 2024 in Antwerp, Belgium (Figure 19).

Figure 19. Invited talk at 6G Series by Hexa-X-II held at the EUCNC & 6G Summit 2024.

3.2 Communication Activities

Communication efforts regarding ADROIT6G project, and its outcomes involve utilizing available channels and tools by the project's partners to engage various audiences, as specified in Figure 1. This section outlines the actions performed as communication activities and underscores the communication channels that the consortium employed and will continue to employ to ensure effectiveness and alignment with the project's objectives and scope. Key components include the development and distribution of high-quality promotional materials such as roll-up banners, flyers, and brochures, created by partner eBOS. Additionally, the project leverages digital platforms, including a dynamic YouTube channel and active LinkedIn and Twitter accounts, to share updates, insights, and breakthroughs in 6G technology. Regular newsletters and press releases, along with participation in public talks and open days, further ensure that the project's advancements and contributions are widely disseminated and accessible to a broad audience. ADROIT6G Communication KPIs and target values monitoring are captured in Table 11 .

Table 11. ADROIT6G Communication KPIs and target values monitoring.

COMMUNICATION		
KPIs	**Target Value**	**Achieved by June 2024 (M18)**
Project Website	Online by M01; Unique visitors at M36 > 4000	Released at M01, Unique Visitors at M18= 568
Social Media	Followers by M36> 1000 Monthly Impressions average>500	935 ~450 Impressions monthly average
e-Newsletters contributed/released	>6 Total mailing list of contact points >1000	5 (3 released & 2 SNS JU)
Press-Releases	≥ 6	5
Events organised by partners	≥ 3 People per event >50	0
Promotional Material: Non-technical factsheets Project flyers/leaflets/brochures Hard Copies distributed Rollup Banners and posters	 >3 >3 >2000 >3	 0 2 ~750 2
Multimedia: Promotional videoclips Number of interviews produced Number of views	 >3 >6 >3000	 1 2 ~8900
Public talks/ Public events at universities	>5 Students per event>100	5 ~100
Public talks/ Open days	>5 Visitors/open day>50	2 ~50-70
Participation at events organised by partners	>3 People per event>100	0

3.2.1 Logo and Templates

The ADROIT6G Project logo is reflecting the visual identity of the project, as depicted in Figure 20. The logo has been made available to the consortium to use for official communication purposes. It serves as the basis for all other promotional materials, and define also the presence of ADROIT6G, in order to ensure consistent branding across all D&C channels. In addition, all D&C material, deliverables, social media channels, and website include and make use of the EU Funding statement, the EU Commission Disclaimer, and the 6GSNS logo, as shown in Figure 21.

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Figure 20. ADROIT6G Project Logo.

In alignment with our strategic outreach efforts, several Adroit6G templates were designed using mainly PowerPoint. For example, a talk announcement banner was created to effectively announce our conference/exhibition attendance on social media, enhancing our engagement with industry professionals and stakeholders (Figure 22). Numerous examples of ADROIT6G templates are depicted in Figure 23. All the material prepared is aligned with the logo appearance, its colours and style, to ensure its consistent presence.

Figure 21. ADROIT6G EU Funding and 6GSNS statement.

Figure 22. Example of talk announcement released in social media to communicate Conference/Exhibition attendance.

Figure 23. ADROIT-6G presentation template

3.2.2 Website

The official website was developed, by eBOS, based on user interface design principles and requirements defined in the Grant Agreement (GA), as detailed in a previous deliverable D6.1 “Project website and social media presence”. The website serves as a primary platform for communicating and disseminating ADROIT6G project information to interested stakeholders and the broader audience. It provides an overview of the project's objectives, emphasizing its importance and aims. Through its design and content, the website offers transparency by showcasing project progress, event schedules, and public documents. Additionally, it aims not only to inform but also to actively engage the general audience, encouraging their interest and participation in the development of 6G technology. With its dual focus on recruit additional interested stakeholders and disseminate the project outcomes, the website plays a crucial role in enhancing the project's visibility and impact within both specialized and wider communities.

The website has six (6) pages in the main menu: “Home”, “About”, “Proof of Concepts”, “Dissemination & Communication”, “News & Events”, and “Contact Us”. Several Menu Items have also a drop-list submenu, as shown in Figure 24 for the “Dissemination & Communication” tab. For instance, subsections such as “Public Deliverables”, “Workshops”, “Publications” are included in the drop-list. The website's architecture strictly adheres to the specifications and functional needs outlined in the previous Deliverable D6.1 [1] . As a critical tool, central to the D&C function, it was essential to design the site's taxonomy in a way to meet the project's requirements and fulfil all necessary criteria, as well as to be functional and attractive to the visitors.

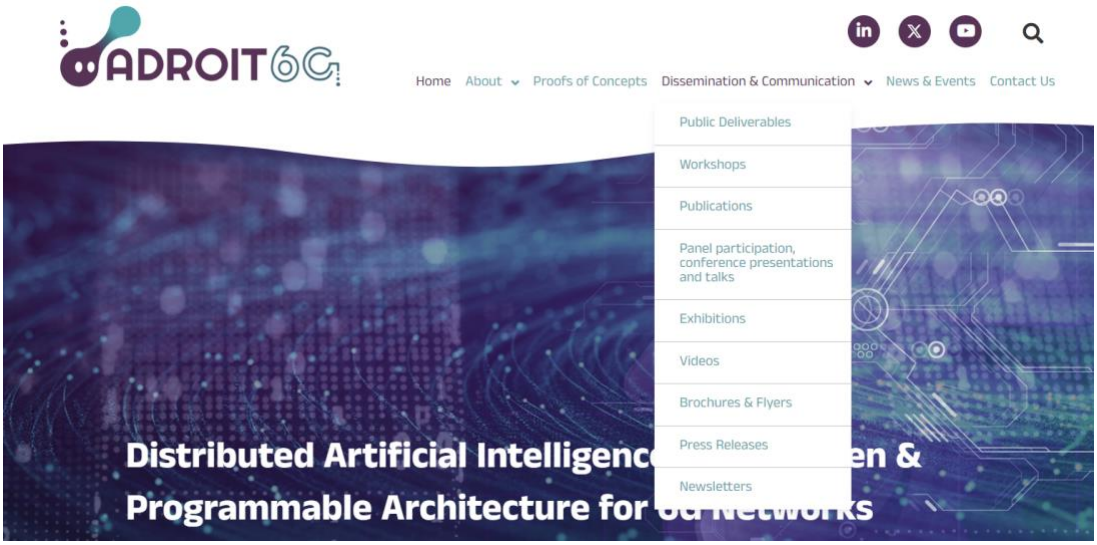

Figure 24. Main Menu Items and Drop-list example of "Dissemination & Communication"

3.2.2.1 Website Analytics

To effectively monitor and analyse visitor behaviour and engagement metrics on our website, we employed Google Analytics. This powerful tool provided us with comprehensive insights into various aspects of user interaction, including the number of visitors, their geographical locations, the duration of their sessions, and the specific pages they visited. By leveraging these statistics, we were able to gain a deeper understanding of our audience's preferences and behaviours, which in turn informed our strategic decisions aimed at enhancing user experience and optimizing site performance.

The Google Analytics data for the ADROIT6G website provides several key insights into user engagement and behaviour on the website. Over the reporting period (January 2023 to June 2024), the site attracted a total of 568 unique users. The average engagement time per user was 1 minute and 44 seconds, suggesting that visitors were interested to the content on the site. Figure 25 is depicting the daily user activity which shows fluctuations, with occasional spikes in traffic that correspond to specific events, announcements, or LinkedIn post with website link.

Figure 26, depicting the page views, reveals that the "Home page" is by far the most popular, garnering 1.2 million views. This is significantly higher than any other page on the site, indicating that most visitors begin their journey on the "Home page". Other notable pages include the "Consortium" page with 258 views, the "News & Events" page with 242 views, and the "Public Deliverables" page with 183 views. These numbers suggest that while visitors are primarily drawn to the "Home page", they are also being directed and interested in specific content areas related to the project's consortium, news, deliverables, and methodologies.

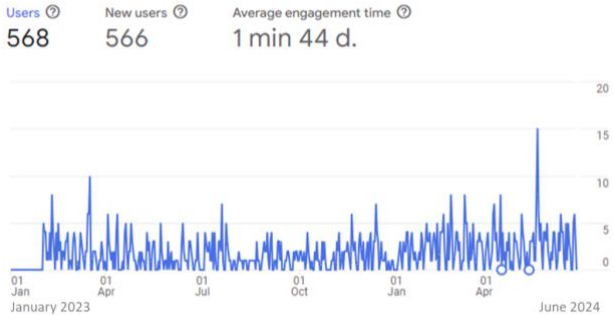

Figure 25. ADROIT6G website unique users from January 2023 to June 2024.

PAGE TITLE AND SCREEN CATEG...	VIEWS
Home - ADROIT6G	1.2 mm
Consortium - ADROIT6G	258
News & Events - ADROIT6G	242
Public Deliverables - ADROIT6G	183
Publications - ADROIT6G	159
Concept and Methodology - ADROIT...	152
Proofs of Concepts - ADROIT6G	148

Figure 26. ADROIT6G most visited pages and views per page from January 2023 to June 2024.

COUNTRY	USERS
Greece	82
Cyprus	73
Spain	62
France	54
Italy	40
Germany	35
Romania	34

Figure 27. ADROIT6G website users by country from January 2023 to June 2024.

The geographic distribution of users provides further insights into the reach and impact of the ADROIT6G project (Figure 27). The data shows a diverse international audience, with the highest number of users coming from Greece (82 users), followed by Cyprus (73 users), Spain (62 users), France (54 users), Italy (40 users), Germany (35 users), and Romania (34 users). The map visualization supports this, with darker shades of blue indicating countries with more significant user engagement. This geographic data is valuable for understanding where the project's audience is concentrated, which can inform future content development and outreach strategies to better cater to these regions.

In summary, the Google Analytics data for the ADROIT6G website indicates a healthy level of user engagement, with a significant proportion of new visitors and a moderate average engagement time. The Home page's popularity highlights its role as the primary entry point for visitors, while the geographic data underscores the project's broad international appeal. These insights can help guide future efforts to enhance user engagement and tailor content to meet the needs and interests of the audience effectively.

3.2.3 Social Media Channels

3.2.3.1 LinkedIn

The ADROIT6G LinkedIn account[1] serves as the project's professional hub, providing updates on advancements in 6G technology, research breakthroughs, and collaborative efforts. Posts are being regularly shared, ranging between 2 and 5, weekly. A snapshot of our LinkedIn page is shown in Figure 28, as well as numerous posts for examples. As of June 2024, the ADROIT6G LinkedIn account has reached 935 followers, with 355 new followers gained between March and June 2024. This significant growth can be attributed to increased engagement through strategic dissemination of activities, including public talks, webinars, and participation in major events.

[1] LinkedIn: ADROIT6G: Overview | LinkedIn

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The analytics of ADROIT6G on LinkedIn impressions, reveal a compelling reach and engagement within our professional network. As shown in Figure 29, ADROIT6G content consistently garners substantial impressions, with a steady increase the last 6 months, reaching around 6K Impressions, reflecting a strong visibility among industry peers and stakeholders (Figure 29). These metrics underscore our proactive approach to leveraging LinkedIn as a pivotal platform for networking and sharing all ADROIT6G News and advancements.

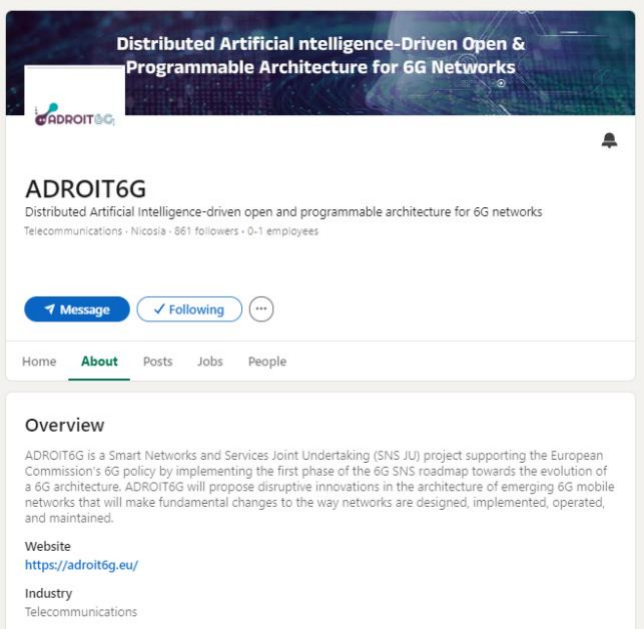

Figure 28. Left: ADROIT6G LinkedIn Account Home Page

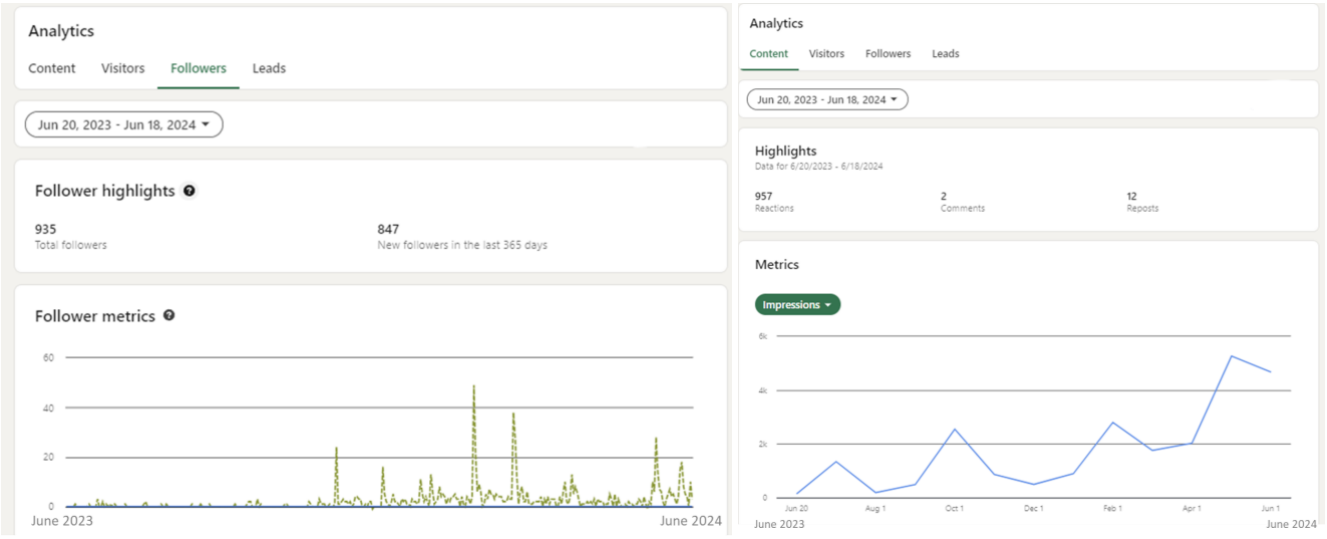

Figure 29. Left: Analytics on Followers; Right: ADROIT6G LinkedIn Content metrics: Impressions (steady increase from ~2K to ~6K); data extracted in June 2024.

3.2.3.2 X

The ADROIT6G X account[2] (Figure 30) serves as a dynamic platform for real-time updates, engaging with the latest advancements in 6G technology and the project's ongoing research. It provides followers with timely news, insights from industry events, and highlights from public talks and webinars. The account also fosters interaction with the broader tech community, sharing developments from related SNS projects and keeping the audience informed about key milestones and innovative breakthroughs.

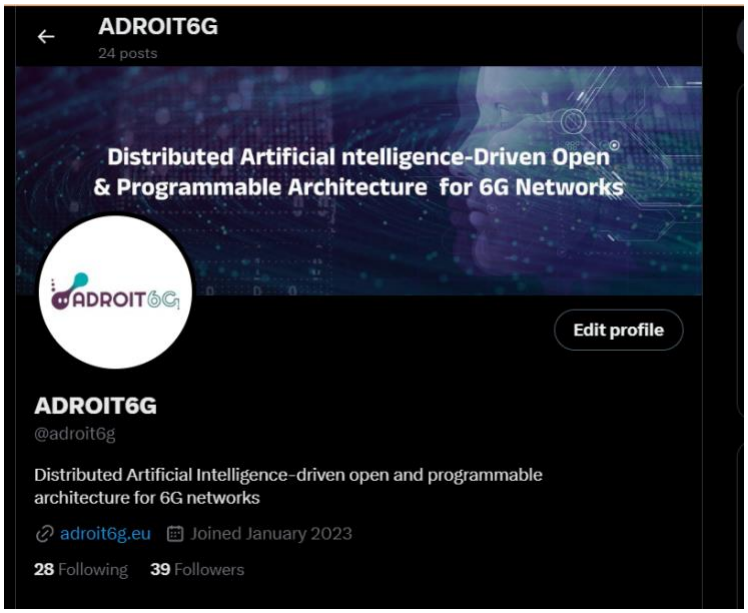

Figure 30. ADROIT6G X-account landing page.

3.2.3.3 YouTube Channel

The ADROIT6G YouTube channel[3] (Figure 31) is an engaging platform to highlight the project's advancements and cutting-edge research in 6G technology. It provides a platform that offers a range of content, including in-depth video presentations, webinars, and technical demonstrations, tailored to inform and captivate industry professionals, researchers, and technology enthusiasts.

The first video clip outlining ADROIT6G innovations has been uploaded on the YouTube Channel in May 2024, making it an essential resource for visual learning and up-to-date information on project progress. Also, a DEMO of ADROIT6G presented at the EuCNC & 6G Summit 2024, was uploaded on our YouTube Channel to become accessible to stakeholders and interested parties. More videos, including demos and online training tutorials, are planned within the 3rd Phase of D&C.

[2] Twitter: ADROIT6G (@adroit6g) / X
[3] YouTube: ADROIT6G - YouTube

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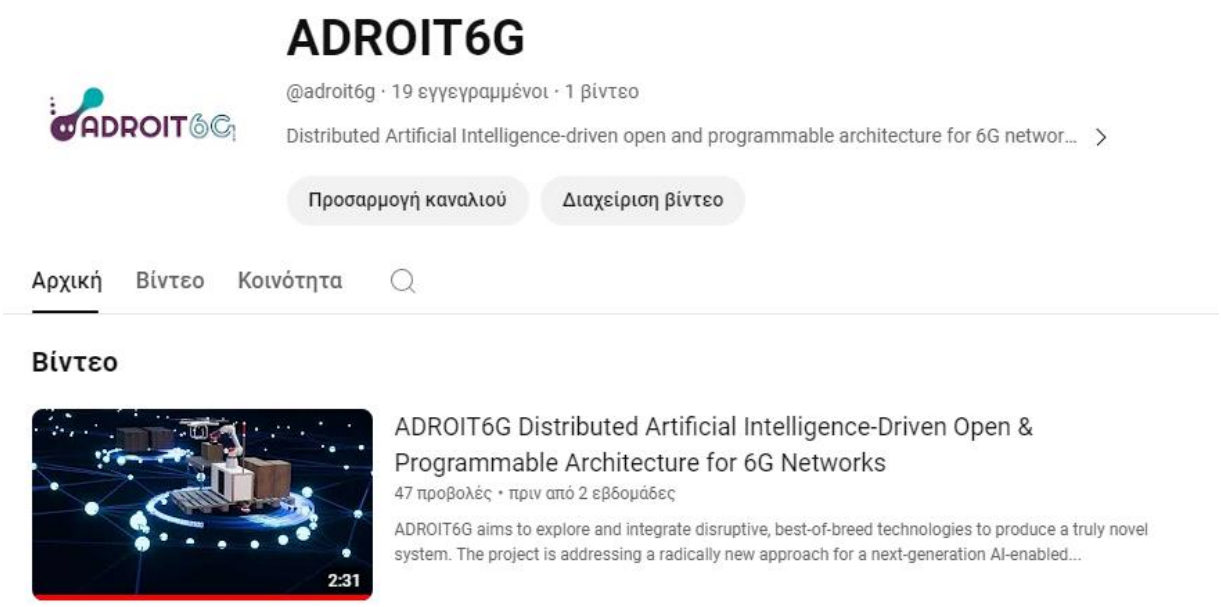

Figure 31. ADROIT6G YouTube Account Main Page.

3.2.4 Promotional materials

ADROIT6G has created a suite of high-quality promotional materials to effectively communicate the vision and progress of the ADROIT6G project. This includes visually striking roll-up banners, which are prominently displayed at conferences and events to attract and inform attendees about the project's objectives and innovations in 6G technology (Figure 32). Additionally, it has designed detailed flyers that provide concise yet comprehensive overviews of the project's key features, technological advancements, and benefits. These flyers are distributed at events and meetings, serving as quick reference guides for interested stakeholders. Moreover, a Leaflet was created to offer an in-depth look into the ADROIT6G project, covering various aspects such as project goals, PoCs, and partner contributions. These flyers and leaflets are instrumental in providing stakeholders with a thorough understanding of the project, fostering greater engagement and support.

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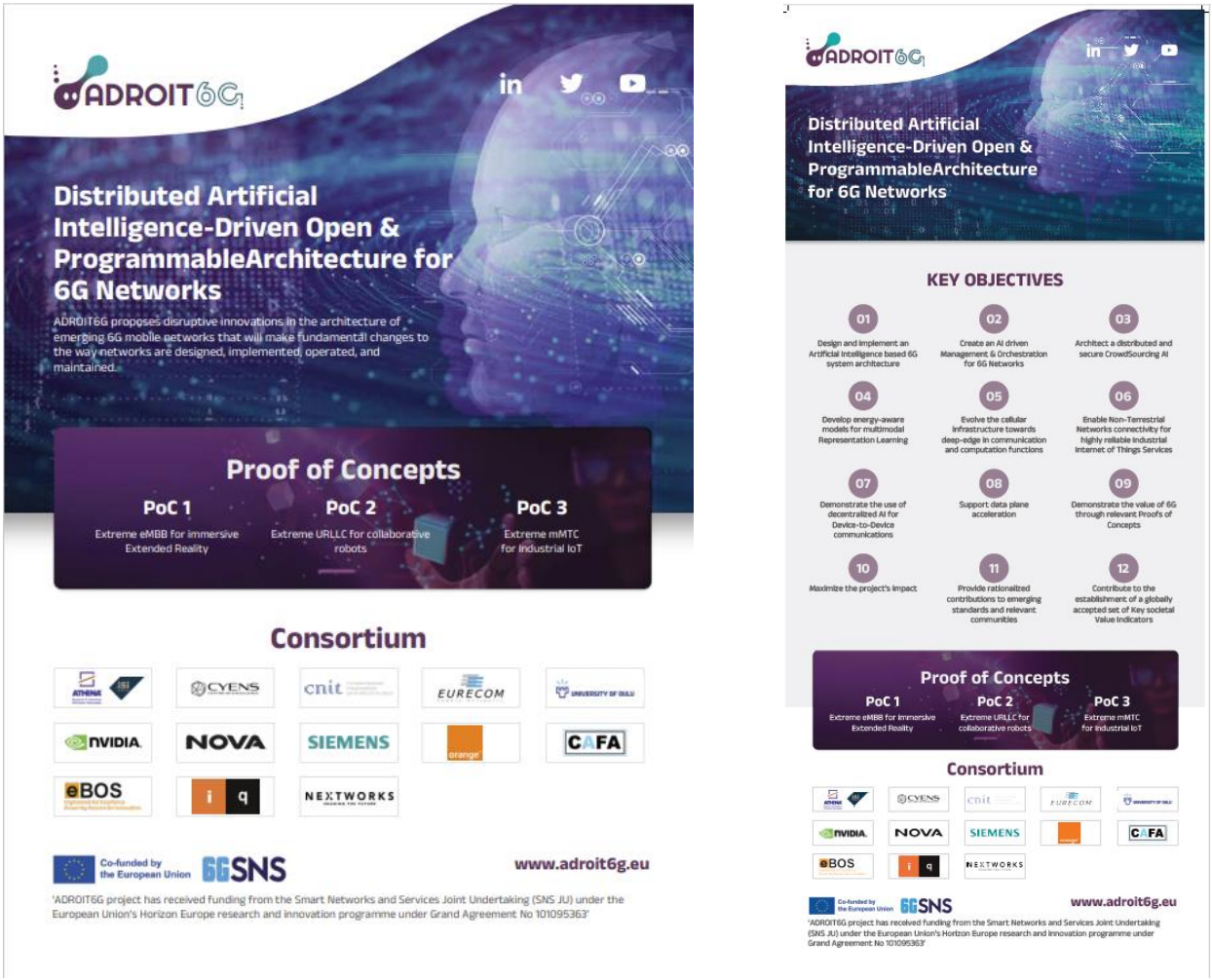

Figure 32. Left: ADROIT-6G Flyer, right: ADROIT6G Banner roll-up including Key Project Details

3.2.5 Newsletters and press releases

The ADROIT6G project has implemented a robust communication strategy, featuring three detailed newsletters (Table 12 , Figure 33) and six press releases (Table 13), including one business report, to ensure comprehensive coverage and timely updates on our progress. Each newsletter will provide in-depth reports on significant milestones, technological innovations, and upcoming events, fostering continuous engagement with our research community and partners. The press releases will disseminate major breakthroughs, strategic partnerships, and key events to industry leaders, media outlets, and the public. Additionally, the business report will deliver a thorough analysis, showcasing the project's market impact and potential to industry stakeholders and investors. This multifaceted approach ensures that all relevant audiences are informed and engaged throughout the project lifecycle.

Table 12 List of e-Newsletters and mailing lists.

	Type	Date	Link	Mailing List Contacts
1	e-Newsletters #1	June 2023	Newsletters - ADROIT6G	50
2	e-Newsletters #2	December 2023		120
3	e-Newsletters #3	June 2024		250

Figure 33. ADROIT6G Newsletters #1 and #2 Cover Page.

Table 13. List of ADROIT6G press releases

	Type	Title	Magazine/ Website	Contributors/ Partners	Link	Date
1	Press Release	Nova: Leads and coordinates innovative European Union research projects for Evolved 5G and 6G services	Xiaomi-Miui	NOVA	Download	Sep-2022
2	Press Release	Η Nova πρωτοστατεί και συντονίζει καινοτόμα ερευνητικά έργα της Ευρωπαϊκής Ένωσης για Evolved 5G και 6G υπηρεσίες! (In Greek Language)	iptvsat	NOVA	Download	Sep-2022
3	Press Release	The CYENS Center of Excellence is proud to announce the awarding of a brand new SNS JU Program, the ADROIT-6G!	CYENS media	CYENS	Download	Nov-2022

4	Press Release	ISI emerges as pan-European reference center for 6G technologies	Athenarc & Simvoulos epixiriseon/ Σύμβουλος Επιχειρήσεων (GR)	ISI/ATH	Download	Mar-2023
5	Business Report	Business Internet Security Report, 2023-2024	ORO Business 6th Edition	ORO	Download	Apr-2024

3.2.6 Videos

A detailed video was created that outlines the key technologies at the core of the ADROIT6G project. The video serves as an essential resource, providing a visual and comprehensive overview of our advancements in Distributed Artificial Intelligence, Open & Programmable Architecture, and user-centric 6G solutions. It highlights the innovative approaches and significant research contributions that are driving the future of telecommunications. This video is intended to inform and engage stakeholders, showcasing the technological progress and strategic vision of the ADROIT6G project. The video is uploaded and published on ADROIT6G YouTube Channel on the 20th of May 2024, gaining 48 unique visitors in 2 weeks, as depicted in Figure 34.

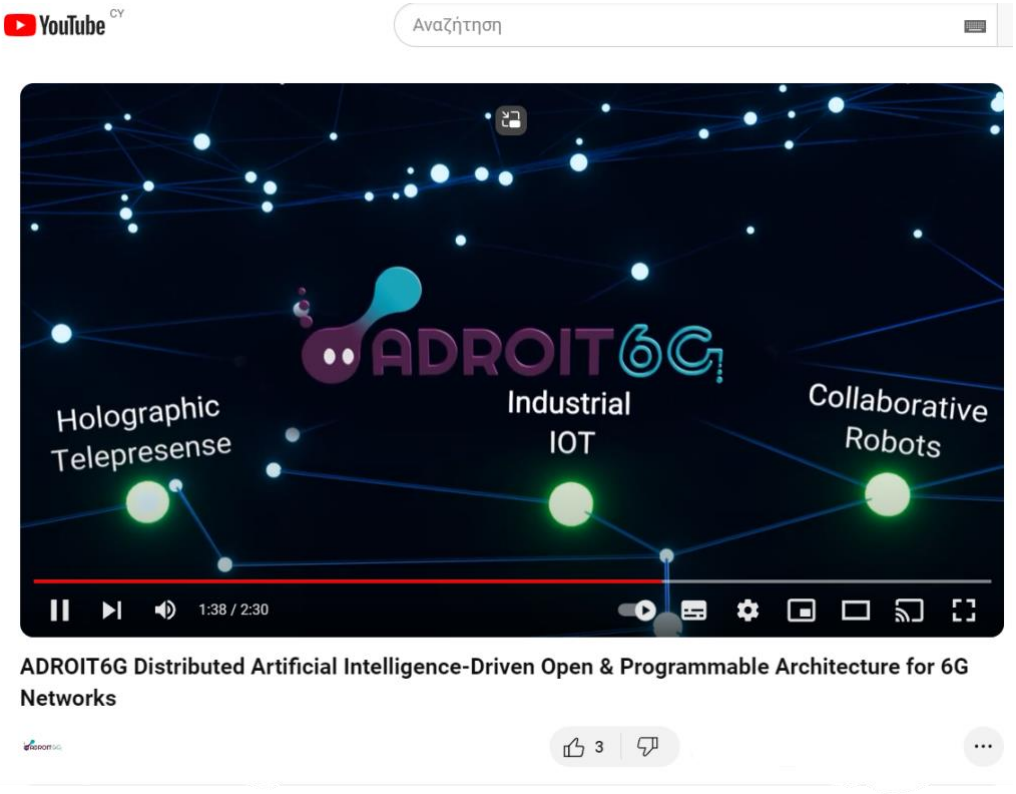

Figure 34. YouTube snapshot of the ADROIT6G promotional video.

The Adroit6G project showcased its innovative advancements in the 6G telecommunications sector during the "Introducing the SNS Projects" webinar, which was part of the “6G SNS Lunch Time Webinars” series (Figure 35). This presentation is available on YouTube with over 100 views, and highlights significant progress in network reliability, latency reduction, and spectrum efficiency. The increased visibility from the webinar significantly enhances Adroit6G’s reputation, attracting potential collaborators within the 6G SNS cluster. This not only amplifies the project's influence but also expands its reach, fostering greater interest and support from key stakeholders within the sector.

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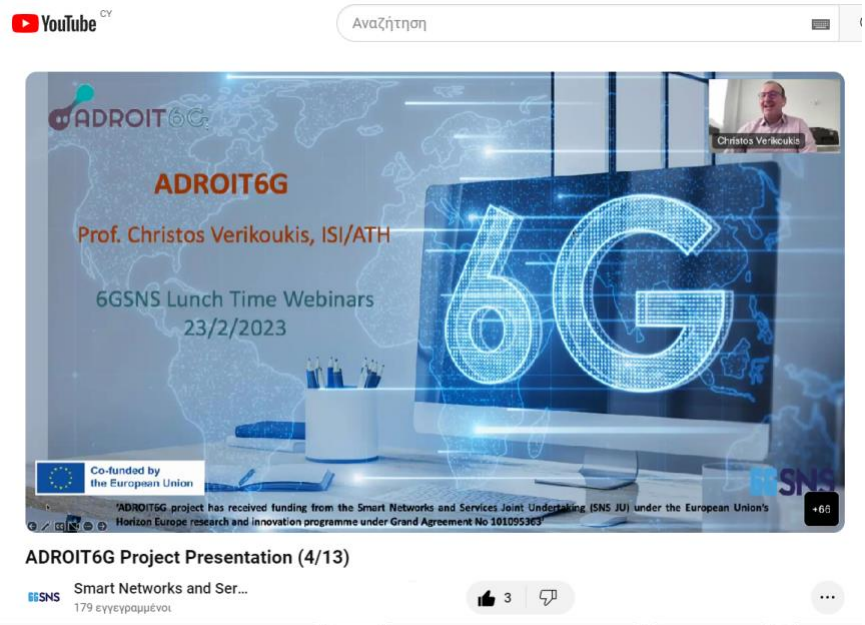

Figure 35. YouTube video snapshot of ADOIT6G project presentation at SNS JU Channel.

3.2.7 Public talks and Open Days

The ADROIT6G project actively engages with the public through various dissemination activities, including three public talks and participation in three open days, as detailed in Table 14. These public talks, delivered by project partners, aim to share insights on 6G advancements, foster dialogue, and inspire innovation within the broader community. Similarly, our participation in open days provides an interactive platform to showcase our research, demonstrate technological breakthroughs, and engage directly with diverse audiences. These efforts highlight our commitment to transparency, education, and community involvement in advancing 6G technology.

Table 14. ADROIT6G public talks and participation in Open Days.

No	Partner	Event name	Type	Date	Type of dissemination material	Participants	Link
1	EURE	Seminar series on AI	Public Events at Universities	Mar-23	Public talk/ presentation	60	Download
2	EURE	Czech Technical University in Prague	Public Events at Universities	Apr-23	Public talk/ presentation	49	Download
3	CYENS	Department of Engineering and Communication of SSN University	Public Events at Universities	Mar-24	Public talk/ presentation	27	Download
4	CNIT	European Researchers' Night 2023	Open Days	Sep-23	poster	280	Download

3.2.7.1 Seminar series on AI hosted by the Technology Innovation Institute in Abu Dhabi

ADROIT6G offered a tutorial titled "Generative Diffusion Models: Key Ideas, Current Practice, and Research Challenges," delivered by Prof. Pietro Michiardi, Full Professor and Head of the Data Science Department at EURECOM. The tutorial was part of the seminar series on AI hosted by the Technology Innovation Institute (TII) in Abu Dhabi on March 2nd, 2023.

3.2.7.2 Public talk at the Czech Technical University in Prague

ADROIT6G gave a presentation titled "Generative Diffusion Models: Key Ideas, Current Practice, and Research Challenges," delivered by Prof. Pietro Michiardi, Full Professor and Head of the Data Science Department at EURECOM (Figure 36). The public talk took place at the Czech Technical University in Prague on April 28th, 2023 and a video of his talk is available also here.

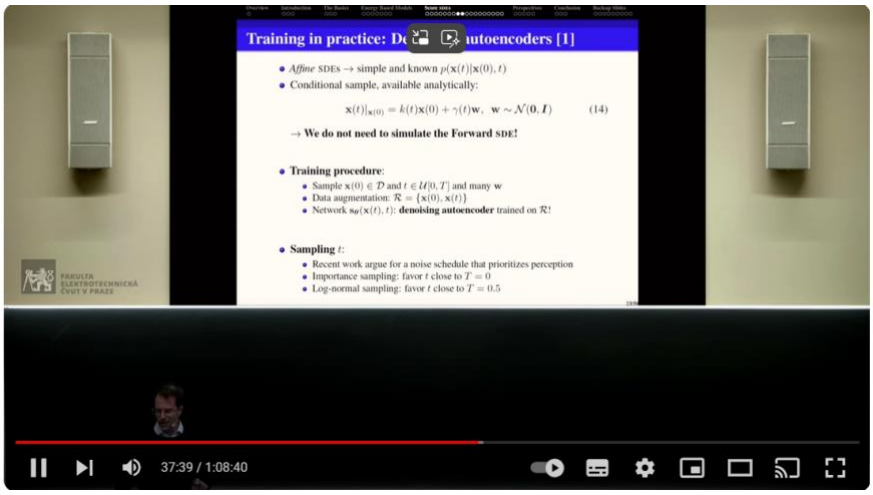

Figure 36. Snapshot of Prof. Pietro Michiardi's presentation

3.2.7.3 Public talk at the Department of Engineering and Communication of the SSN University

Our Project Partner, CYENS, presented at the International Conference on Wireless Communications Signal Processing and Networking (Technically Co-Sponsored by the IEEE) on 21-23 March 2024. Dr. Iacovos Ioannou from Cyens twice presented the innovative European project to the WISPNET 2024 conference in India, once with the conference participants and the second with the Department of Engineering and Communication of the SSN University (Figure 37).

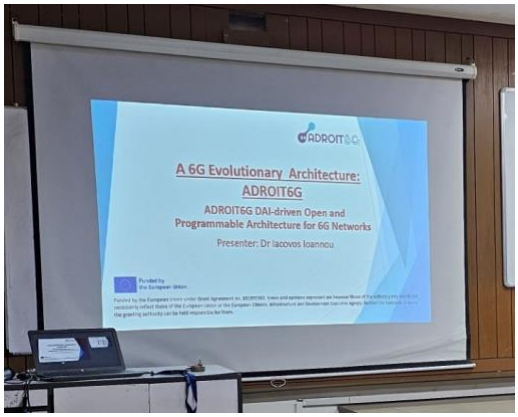

Figure 37. Presentation at the Department of Engineering and Communication of the SSN University.

3.2.7.4 European Researchers' Night 2023

ADROIT6G partner, CNIT, from the University Mediterranea of Reggio Calabria presented ADROIT6G during the European Researchers' Night held from September 24th to September 29th, 2023 (Figure 38).

Figure 38. ADROIT6G at the European Researchers' Night 2023.

3.3 High Impact Communities/Associations where to push ADROIT6G results SNS JU and 6G AI Working Groups

ADROIT6G is actively engaged in the Smart Networks and Services (SNS) working groups and clustering activities, demonstrating our commitment to fostering innovation and collaboration within the 6G ecosystem. By participating in these initiatives, ADROIT6G contributes to shaping the future of smart networks through shared knowledge, joint research efforts, and the development of cutting-edge technologies. Our involvement ensures that we stay at the forefront of industry advancements while collaboratively addressing challenges and leveraging opportunities that drive the evolution of next-generation networks.

By M18, ADROIT6G is actively participating in seven WG covering a range of interests such as software networks, 6G Architecture, pre-standardization and vision. To ensure engagement and active participation, each partner has joined a WG and has been assigned the role of a representative. This diverse and structured engagement underscores our comprehensive approach to addressing the multifaceted aspects of 6G development and implementation, ensuring a robust and inclusive framework for the future of smart networks. Additionally, some WGs have initiated a white paper where ADROIT6G is also contributing as an author (Table 15).

Table 15. Participation in SNS JU and 6G AI Groups

SNS JU WG	ADROIT6G Main Representative	Actions performed
6G Architecture WG	Marius Iordache, Orange Romania	Preparation of EUCNC Workshop "EU Collaborative Research & Innovation Focal Points in the SNS JU"
Software Networks WG	Marius Iordache, Orange Romania	Participated in WG discussions. Deliver a presentation of ADROIT6G in WG. ADROIT6G committed to its contribution on whitepapers.
Test, Measurement and KPIs Validation	Charemis Athanasios, NOVA	Meetings included: input on the Questionnaire for the KPIs collection for the publication of the SNS Whitepaper on KPIs, in the context of EUCNC Input on strategy, perspectives and scope for KPIs standardisation for 6G, Discussion on KPIs questionnaire, and whitepaper Initial Meeting for KVIs and planning, Input on KPIs, discussion on Whitepaper & contributions.

6G AI WG	ADROIT6G Main Representative	Actions performed
Vision	Stefania Sardellitti, Carla Fabiana Chiasserini, CNIT	Frequent attendance in WP meetings, engaged in WP discussions and outcomes.
Open SNS WG	Stefania Sardellitti, Carla Fabiana Chiasserini, CNIT	
Trials WG	Razvan MIHAI, Orange Romania	
Pre-Standardization WG	JJ Vegas Olmos, NVIDIA	

4 Exploitation and sustainability Strategy and plan

4.1 Exploitation Activities

4.1.1 Exploitation Plan

The ADROIT6G consortium prioritizes the strategic use of their advancements right from the project's outset, ensuring that their novel solutions meet the specific needs of 6G architecture and its future trajectory. This approach is backed by a strong commitment from the consortium's partners in both industry and academia, playing a pivotal role in amplifying the project's impact.

ADROIT6G plans to maximize the benefits of these innovations by prioritizing their commercial exploitation before public dissemination - the “first exploit, then disseminate” strategy. The monitoring and evaluation of the project's deliverables will be conducted by the Innovation Manager (EURE), the Exploitation Manager (ORO), and the Executive Board, with the General Assembly making the final call on whether these are to be commercialized or released as open source. Items identified for commercialization will be included in the project's exploitation plan, outlining their market potential.

The project's strategy for utilization encompasses a comprehensive array of actions, detailed as follows:

Identifying Innovations for Exploitation: This involves the discovery of technological advancements, scholarly contributions (like algorithms, theoretical models, and test outcomes), and added-value services (including consultancy and instructional offerings) aimed at the project's target audience.

Analyzing the Market: A thorough investigation will be conducted to determine the target demographic for ADROIT6G, with a particular emphasis on vertical IoT services. This includes assessing the competitive environment and spotting emerging trends.

Validation via Demonstrations and Use Cases: The effectiveness of the proposed exploitation strategies will be corroborated through the deployment of ADROIT6G's use cases and demonstration projects.

Developing Exploitation Models: The project will define and evaluate various avenues for both commercial and non-commercial exploitation. Initial models identified will be elaborated on in later discussions.

Crafting and Assessing Business Models: There will be an in-depth exploration into the feasibility and sustainability of different business models and alternate approaches for offering the project's solutions and services to its stakeholders. Considerations will include licensing models, pricing, and additional relevant elements.

IPR Strategy Development: In alignment with the Consortium Agreement's directives, a comprehensive plan for Intellectual Property Rights (IPR) management will be established. This plan is designed to enable both joint and solo commercial ventures by the partners involved in the project.

4.1.2 Exploitation Plan Phases

To ensure the sustainability of project results and facilitate their entry into the market following the project's end, the consortium has developed an Exploitation plan, illustrated in Figure 39.

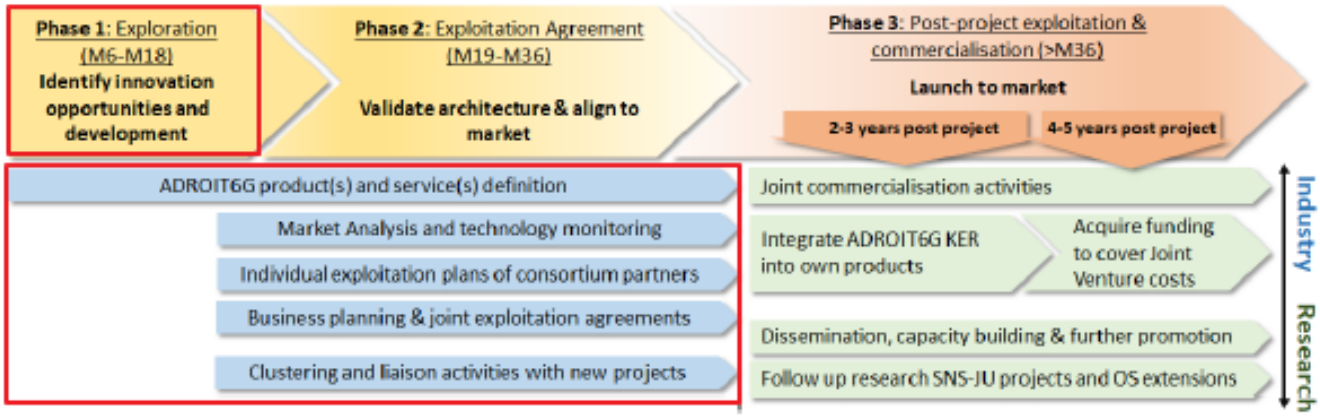

Figure 39. ADROIT6G Exploitation Plan Phases

As can be seen in the above, the plan is organized into three distinct phases:

- **Phase 1 (Months 6-18)** aims to lay the foundational groundwork necessary for the business plan's assessment.
- **Phase 2 (Months 19-36)** focuses on the verification of the developed solution against market needs and the preparation of a market launch strategy.
- **Phase 3 (After Month 36)** details the strategy for maintaining the project's achievements post-project and delineates the route to commercialization.

4.2 Project's Key Exploitable Results

There are three primary models for capitalizing on the project's outcomes, and the choice of a particular model is guided by these factors:

- The goals and profiles of the project partners and stakeholders.
- The strategy for sharing the project's results, whether it involves closed or open dissemination.
- The distribution of Intellectual Property Rights (IPRs) among the project partners.

4.2.1 Exploitation Models

Considering the above, we have 4 exploitation models, detailed below:

- **Research Exploitation Model:** This model utilizes project-derived research knowledge to refine current outcomes and fuel future research initiatives. It is particularly suited for academic and research entities intending to incorporate the project's discoveries into their research or teaching efforts under an open license, potentially paving the way for new research ventures.
- **Technological Exploitation Model:** Focused on employing the technological knowledge obtained to create novel products and offer enhanced services based on this technology. This model is attractive to telecom operators, manufacturers, and software developers eager to exploit the new technology. Moreover, entities involved in specific use cases are interested in this model for integrating the project's findings into their business practices.
- **Pre-Commercial Exploitation Model:** This model covers the initial activities aimed at bringing the project's innovations to end-users, following a licensing model specified in the project's commercial plan.

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The transition to commercial exploitation is expected to be gradual, starting with pre-commercialization efforts immediately after the project ends. This phase allows the project's innovations to mature and achieve a higher Technology Readiness Level (TRL) before entering the market, which is foreseen to happen within 2-5 years following the project's completion, depending on the specific asset. Telecom operators, manufacturers, and software developers are principally interested in this exploitation phase.

- **Consulting Market Exploitation Model** (services and technology): which implies the delivery of technology consulting services: to the early adopters in industry, to the new technology providers and integrators, as well as to the SMEs' networks and associations.

4.2.2 Key Exploitable Results and Exploitation Models

The partners in the consortium have committed to open-source policies, adopting a tiered approach to the management of generated knowledge. In this model, the creators of the knowledge maintain their rights but also share the software developed with fellow consortium members. A selection of the project's Key Exploitable Results (KER) will be released as open source to the academic and research community, incorporating certain restrictions to deter misuse.

At the same time, other KERs have been recognized for their considerable potential for commercial exploitation by consortium members. The preliminary strategies for utilizing the ADROIT6G KERs are documented in Table 16, anticipated to be elaborated and completed throughout the project. For those KERs targeted for commercial use by several consortium partners, arrangements regarding intellectual property rights (IP/IPR) will be made in advance. Furthermore, a strategy for joint commercialization, such as forming a joint venture, will be organized, aiming for a predetermined market entry timeline.

Table 16. Project's KER jointly and individually exploited by consortium partners

ADROIT6G KER	Partner	Type	Licensing	Services	Time to market
SLA-Driven E2E Slice Management	IQU, ATH	S	Commercial	Su, T, C, E	4y after project
DRL-based Zero-Touch Resource Management	IQU, EBOS	P	Commercial	Su, T, C, E	3-4y after project
Extreme 6G Use Cases	CYENS, CAFA, SIEMENS	D	Commercial	C, E	2y after project
NTN based services	SIEMENS	S	Commercial	E	2-3y after project
P4 open programmability	MLNX	P	OS	Su, T, C, E	2-3y after project
Edge Cloud enhancements for dynamic networks	SIEMENS	P	Commercial	E	3-4y after project
AI models discovery; AI training and validation	CNIT	S	Commercial/OS	Su, T, E	3-4y after project
AI models & metadata repository	CNIT	S	Commercial/OS	Su, E	3-4y after project

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Data management and synthetic data generation	EURE	P	Commercial/OS	Su, E	3-4y after project
DAI Framework	CYENS	P	Commercial/OS	Su, T, C, E	3-4y after project
Joint RAN & x-Edge resource scheduling	CNIT, NXW, OULU	S	Commercial/OS	Su, T, C, E	3-4y after project
Context-aware prediction for off-loading	CYENS	P	Commercial/OS	Su, T, C, E	3-4y after project
UE-VBSs and UE-VBS computing resource control	CYENS	S	Commercial/OS	T, E	3-4y after project
Control AI models selection & refinement	CYENS, EBOS	P	Commercial/OS	T, E	3-4y after project
MNO integrated solutions for next generation communication services	ORO, NOVA	P	Commercial	Su, T, C, E	4-5y after project
Scalable, secure & energy efficient interdomain data sharing & distribution	NXW	P	OS	T, E	Freely available as community versions by M36, extended further until 4y after the end of the project
AI pipelines Management	NXW	S	Proprietary License	Su, T, E	
"Green" AI orchestration	CNIT, CYENS	P	OS	T, E	
AI and Analytics Engine Orchestration	NXW	P	Proprietary License	Su, T, C, E	
Open datasets for the training of AI models	CNIT, CYENS P	P	OS	T, E	

* Type: Product (P), Service (S), Demonstrators (D)); Open Source (OS); Services: Support (Su), Training (T), Consulting (C), Extension (E)

4.3 Initial exploitation map

Based on the information within the project proposal and feedback from the partners so far, a High-Level Exploitation Ecosystem Diagram has been sketched, depicting all the important actors within this ecosystem and the way they interact within this ecosystem (Figure 40).

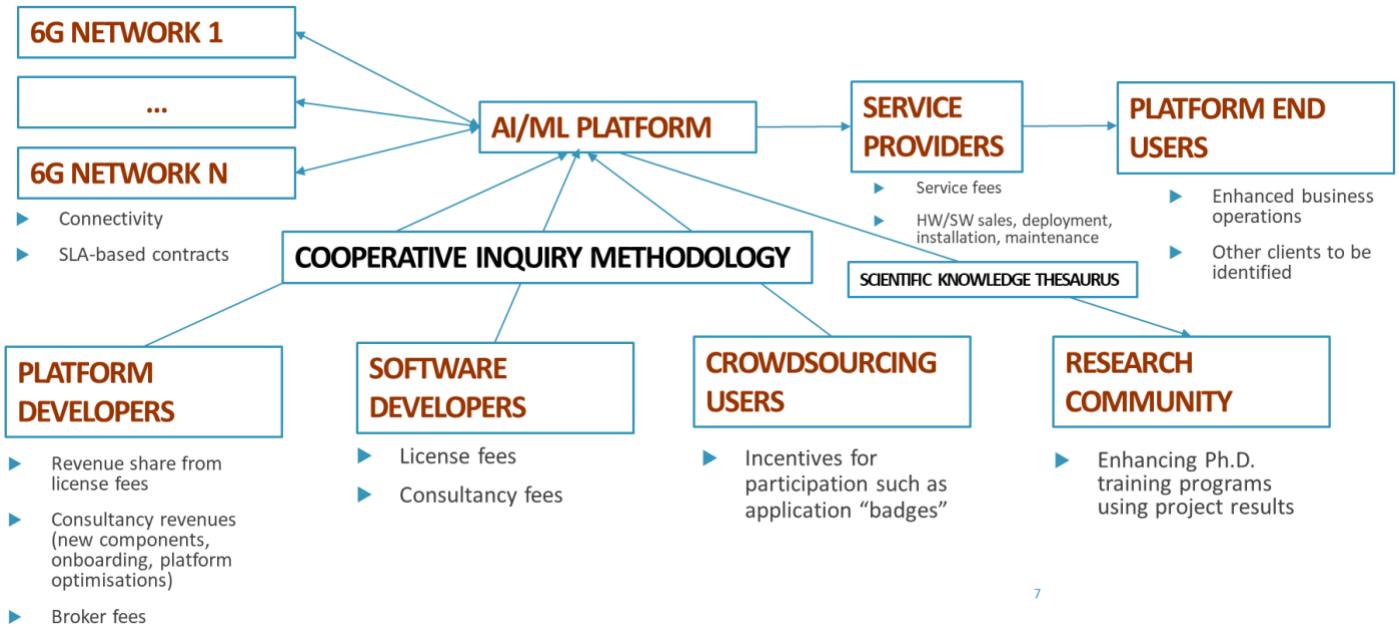

Figure 40. High-Level Exploitation Ecosystem Diagram

Below, a short description of each element of the ADROIT6G project:

6G Network 1..N – the 6G testbeds developed by the partners within the ADROIT6G project.

AI/ML Platform – the framework of AI capable platforms that will measure and improve the 6G KPIs and KVIs in extreme 6G Use Cases, also developed within the ADROIT6G project.

Platform Developers – developers of the 6G & AI/ML infrastructure on which the Use Cases will be deployed; NF, Network Applications or NFVI developers / deployment specialists.

Software Developers – developers of complex applications, serving various verticals, using the NFs, Network Applications and the NFVI developed by the platform developers.

Crowdsourcing Users – various end users – people or companies from within the 5G/6G and/or AI/ML industry that wish to experiment with the vertical applications developed in the ADROIT6G project.

Research Community – end users from the research community that will benefit from the development of an open-source Knowledge Base on 6G & AI/ML, thus enhancing the research capabilities on the subject.

Service Providers – usually companies with access to high end hardware or software resources, that have the capabilities to deploy various flavors of the 6G architectures developed within the ADROIT6G project and offer them to B2B and/or B2C users.

Platform End Users – various B2B or B2C end users from various industry verticals that can benefit from the 6G and/or AI/ML components developed within the ADROIT6G, components packaged in products or services usually sold (but not limited to) as subscription by the Service Providers.

Certain activities within ADROIT6G will be conducted using the Co-operative Inquiry Methodology, a research-action approach that emphasizes collaborative research with users rather than conducting research on them. This methodology entails focused workshops where researchers and end-user stakeholders (E.g: CYENS, CAFA, and SIEMENS) collaborate to develop an inquiry framework and explore their experiences and perspectives on the research subject. The ultimate objective of ADROIT6G is to define, validate, and establish reference network-level 6G KPIs and KVIs in extreme 6G use cases, thereby pushing the boundaries of 6G technology forward and bringing them closer to future exploitation.

4.4 Exploitation Reporting Tools

4.4.1 Project's Exploitation Tools

In terms of Exploitation tools, for Phase 1 of the Exploitation Plan, the main objective is the gathering of relevant information in terms of the partner's market profile, their individual exploitation goals, their joint exploitation plans as well as the outcomes they desire from the assets developed within the ADROIT6G project.

Individual Exploitation Plan

In the context of a project, especially those centered on research and development (R&D), innovation, or consortium-based initiatives, the scope of an Individual Exploitation Plan (IEP) is focused on outlining how each participating entity - whether a company, academic institution, or research organization—plans to utilize the project's outcomes to advance their own interests. This plan plays a vital role in optimizing the influence of the project's results at an individual level, ensuring that all participants can derive tangible benefits from their contributions (Table 17).

Market Analysis Questionnaire

The objective of a market analysis questionnaire is to collect thorough data regarding the market within which a product, service, or project is slated to function. Its aim is to offer insights into multiple facets of the market environment, aiding in strategic decision-making and planning.

Joint Exploitation Questionnaire

A tool used primarily within collaborative projects, with the following key objectives: Assessing Exploitation Interests and Capabilities, Identifying Potential Conflicts, Clarifying Intellectual Property Rights, developing a Joint Exploitation Strategy, Facilitating Commercial and Research Opportunities, Supporting Decision-Making for Future Investments, Ensuring Compliance and Ethical Standards.

Outcomes Register

Used in project management to track and manage the expected or achieved outcomes of a project, acting as a central repository for recording, monitoring, and assessing the results that a project intends to deliver or has delivered over its lifecycle.

Table 17 Individual Exploitation Plan – Partners' Answers.

Partner Name	Individual Exploitation Plan
ATH	ATH/ISI is a public non-profit research institute, thereby it belongs to academic partners. The outcomes of the scientific achievements will be published in top tier journals and conferences. ATH/ISI team will deliver public talks, webinars and lectures to local universities to disseminate the results to different Engineering schools in Greece. The exploitation of the advances over SotA is essential for ATH/ISI organisation because it will advance and expand its research team and portfolio to breakthrough areas critical for attracting new roles, involvement in EU projects and scientific cooperations with other organisations either in national or Europian level. After the end of this project, the outcomes will help to attract new roles such as PhDs, collaborating researchers (postdoc or non) and enhance Ph.Ds training programs.
CYENS	Within CYENS, we are passionately committed to harnessing the innovative outcomes and insights garnered from the ADROIT6G initiative. Our primary objective is to enhance our research capabilities, directly incorporating these innovations into our sphere of influence. Many of the Innovation Areas of ADROIT6G are within the scope of work of CYENS and could be exploited directly. Of particular interest are the concepts of

	Distributed AI, UE-based Virtual Based Stations, and Energy-aware Traffic Prediction. Furthermore, the whole philosophy of Crowdsourcing AI (and the supporting software solutions) can find applications in many of the areas of our work in the environment, health, education, and entertainment sectors. A parallel benefit and opportunity is the enrichment of the curriculum of the graduate programs of our Academic founding members, particularly through integrating comprehensive showcases and the latest technologies from the 5G/6G spectrum into relevant courses. This strategic enrichment of our educational offerings is designed to cultivate an environment where knowledge meets innovation, thereby empowering our students and researchers to lead and excel at the forefront of technology. Through this, we provide a profound understanding and hands-on experience with cutting-edge advancements, setting a solid foundation for our students to thrive in the rapidly evolving landscape of mobile communications.
CNIT	CNIT as a scientific and academic community aims at exploiting results and knowledge achieved through ADROIT6G for enhancing the syllabus of its Master/PhD courses, training Master/PhD students and early-stage researchers. The work carried out in ADROIT6G is expected to advance the SOTA in the areas of distributed and collaborative AI/ML techniques for network services and applications, and to provide the basis for Master/PhD students and young researchers to implement some stages of the AI/ML pipeline during their courses. Release of open-source software for the implementation of some of the AI/ML pipeline stages is also planned, which will help students/researchers to experiment with 5G/6G technologies.
EURE	EURE is a university and research center. Its exploitation plan for the results of the Adroit6G project include creation (or innovation of existing) courses targeted at Master and PhD students, and technical workshops.
OULU	6G technologies drive education and research advancements, with OULU offering innovative solutions for holographic education and AI-driven robotics. Collaboration with technology providers, regulatory bodies, and research institutions ensures applicability and regulatory compliance. Targeting industries like education and healthcare, OULU delivers high-performing solutions to gain an advantage over competitors. Exploitation plans include short-term direct use, medium-term patent development, and long-term investment in advancements. Our network of partners facilitates validation and exploitation, providing access to expertise and resources.
MLNX	MLNX aims at delivering expertise in network interface and open programmability to integrate RISC-V processors as acce-lerators. The exploitation plan departs from the goal of rele-asing ADROIT6G developme-nts as software developme-nt kits.
SIEMENS	From the exploitation side, Siemens expects to advance knowledge and reinforce its understanding in 6G architectures and capabilities, extend the functionality of its Private 5G solution to support novel 6G features and extend the R&D activities. Moreover, ADROIT6G results from Satellite-capable Railway PoC will enable a better understanding of possible enhancements or alternative solutions, which knowledge transfer will be conduct towards the relevant business units.
ORO	Based on the exploitation plan, ORO, as relevant Telco operator, is expected to exploit the ADROIT6G results in the area of novel 5G/6G network services and slices, path to Autonomous Level 4, with support of the AI/ML techniques applied also to the end-user's application. There is a huge interest and exploitation availability in the area of

	Management and Orchestration, with support of innovative applied AI/ML pipelines, for future technical and business-oriented implementations.
CAFA	CAFA is an Estonian robotics company that develops UGV and UAV platforms for various jobs. CAFA Tech plans to use the know-how gathered within the ADROIT6G project to control robots controlled via 5G/6G and to integrate control applications into 5G/6G networks based on the MEC principle.
EBOS	EBOS is an innovative ICT services SME with a wide range of expertise in applications development and in ICT services. EBOS has a vast experience in R&D/R&I from their participation in 6 FP7 and 23 H2020 projects. From the exploitation side, EBOS expects to advance knowledge and reinforce understanding in 6G architectures, extend the functionality of our 5G IoT testbed to support novel 6G features and extend the company's R&D activities.
IQU	The innovative technological advancements for network management and resource allocation will be embedded in IQU's existing product portfolio of testing platforms and performance evaluation tools for next-generation wireless networks. IQU will strengthen its capability to deploy and test various use-cases at 5G infrastructures, and will sell the existing solutions as a service to telecom operator or MVNOs.
NXW	NXW is active in the ICT sector, offering solutions in 5G and Beyond 5G Networks, edge and cloud computing, NFV and SDN technologies, AI-driven service and network orchestration, control plane solutions for wired and wireless transport networks, IoT platforms, and far-edge computing in the consultancy market as a third-party software developer and technology provider. Products and services developed by NXW in the project and the expertise gained through the development and integration of the ADROIT6G solutions are leveraged to consolidate NXW's position within the market. The target customers include vendors, small operators, and service providers.

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4.4.2 Partners' answers to deployed Project Exploitation Tools

The answers to the deployed Exploitation Tools have been summarized and added in the tables within Annex I: Partners' Answers to Project Exploitation Tools.

4.5 ADROIT6G Market Analysis

The telecommunications industry is on the brink of a revolutionary transformation with the advent of 6G technology. This analysis delves into the key market drivers, the commercial potential of 6G innovations, and identifies crucial stakeholders and potential partners. The sector is influenced by rapid technological advancements, integration of artificial intelligence, sustainability initiatives, and regulatory changes. Also, the current Market Analysis is the synthesis of the responses to the questionnaires sent to all the partners of the ADROIT6G consortium.

4.5.1 General Market Conditions, Customer Demographics, and Future Needs

Market Conditions include the growing demand for rapid and efficient processing, automation, and enhanced data control. For instance, Siemens' implementation of Industrial 5G is transforming decision-making, manufacturing processes, and factory maintenance by enabling applications like mobile robots and autonomous logistics within factories. This ecosystem of private 5G infrastructure, end devices, and real applications is a significant market driver.

Current market trends highlight the integration of acceleration technologies into hardware devices, transitioning towards open-source development, and the rise of developer communities. The need for customizable solutions is also a trend driving growth, especially in sectors requiring specialized processing capabilities such as large data centers, telecommunications, gaming, automotive, healthcare, and government agencies

Innovations like direct-to-satellite connectivity are gaining traction, with unmodified cellular smartphones and IoT devices now leveraging satellite networks. This addresses connectivity needs in remote areas and complements existing cellular coverage, significantly benefiting services like Siemens Mobility and Smart Infrastructure.

The market is witnessing a shift towards advanced network architectures, including the evolution to 6G, which incorporates AI/ML capabilities. This evolution presents substantial growth opportunities by extending the functionality of current technologies and enabling the development of new, innovative solutions.

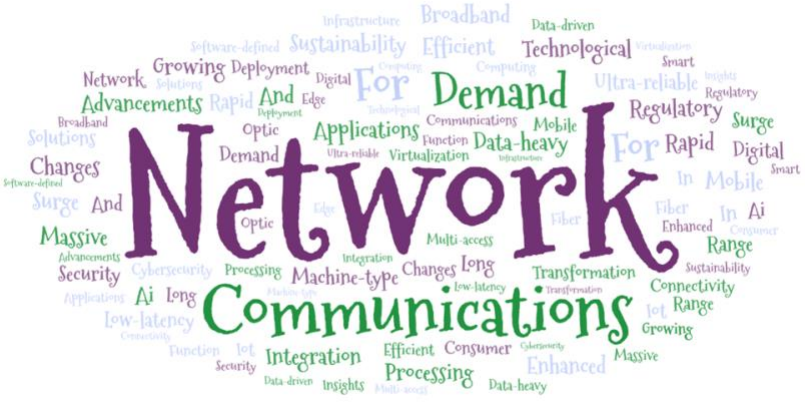

Figure 41. Word Cloud of AdroIT6G Market Analysis

This word cloud (Figure 41) highlights the key market drivers and trends such as technological advancements, the demand for network communications, AI integration, sustainability, consumer demand for connectivity, regulatory changes, etc. [1] [4].

The list of words can be found in the below list and in the Key Market Drivers and Trends Keywords.

4.5.2 Main Market Drivers, Market Trends, Latest Innovations, and Growth Opportunities

Considering all partners' answers received so far, we have sketched the following list of **Key Market Drivers**:

Growing Demand for Rapid and Efficient Processing - Enhanced processing speed is critical in various sectors such as large data centers, telecommunications, gaming, automotive, healthcare, and governmental agencies.
Surge in Data-Heavy Applications - Industries are experiencing an increase in data-intensive applications, driving the need for more efficient processing solutions.
Technological Advancements in GPUs and RISC-V Processors - Innovations in graphics processing units (GPUs) and RISC-V processors are crucial for meeting the increasing processing demands.
Increasing Need for Customizable Solutions - There is a growing need for solutions that can be tailored to specific industry requirements and applications.
Industrial 5G and Automation - Siemens is leading in Industrial 5G, enabling applications such as mobile robots, autonomous logistics, and driverless transport systems within factories.

Data Control through Private 5G Infrastructure - Siemens' private 5G infrastructure allows users full control over their data, facilitating custom configurations for specific applications.
Direct-to-Satellite Connectivity - Leveraging satellite networks for connectivity, especially in remote areas where cellular service is unavailable, complements existing cellular coverage and is crucial for sectors like Siemens Mobility and Smart Infrastructure.

When it comes to **Key Market Trends**, based on the data gathered so far, the following are important:

Incorporation of Acceleration Technologies into Hardware Devices - Acceleration technologies are increasingly being integrated into hardware devices to boost performance. **Transition Towards Open-Source Development and Programmability** - There is a trend towards open-source development, encouraging programmability and the growth of developer communities.
Providing Tailored Solutions for Specialized Sectors - Companies are focusing on creating customized solutions to meet the specific needs of different industries.

Advancements in 5G and Evolution towards 6G - The evolution from 5G to 6G, including integrating AI/ML capabilities, is a significant trend in enhancing communication networks and enabling new applications.

Holistic Management of Communication and Computing Resources - Integrating communication and computing infrastructures on a global scale, including industrial edge computing and private wireless networks, is becoming increasingly important.

These drivers and trends highlight the dynamic nature of the market, emphasizing the importance of technological advancements, customization, and the integration of new communication standards in driving growth and innovation across various industries.

[4] Heimerl, F., Lohmann, S., Lange, S., & Ertl, T. (2014). *Word Cloud Explorer: Text Analytics Based on Word Clouds*. Springer.

Considering the above Key Market Drivers and Trends, we have sketched a Key Market Drivers and Trends Frequency of mentions chart, as described in Figure 42 , the chart showing the importance of various market drivers, emphasizing technological advancements.

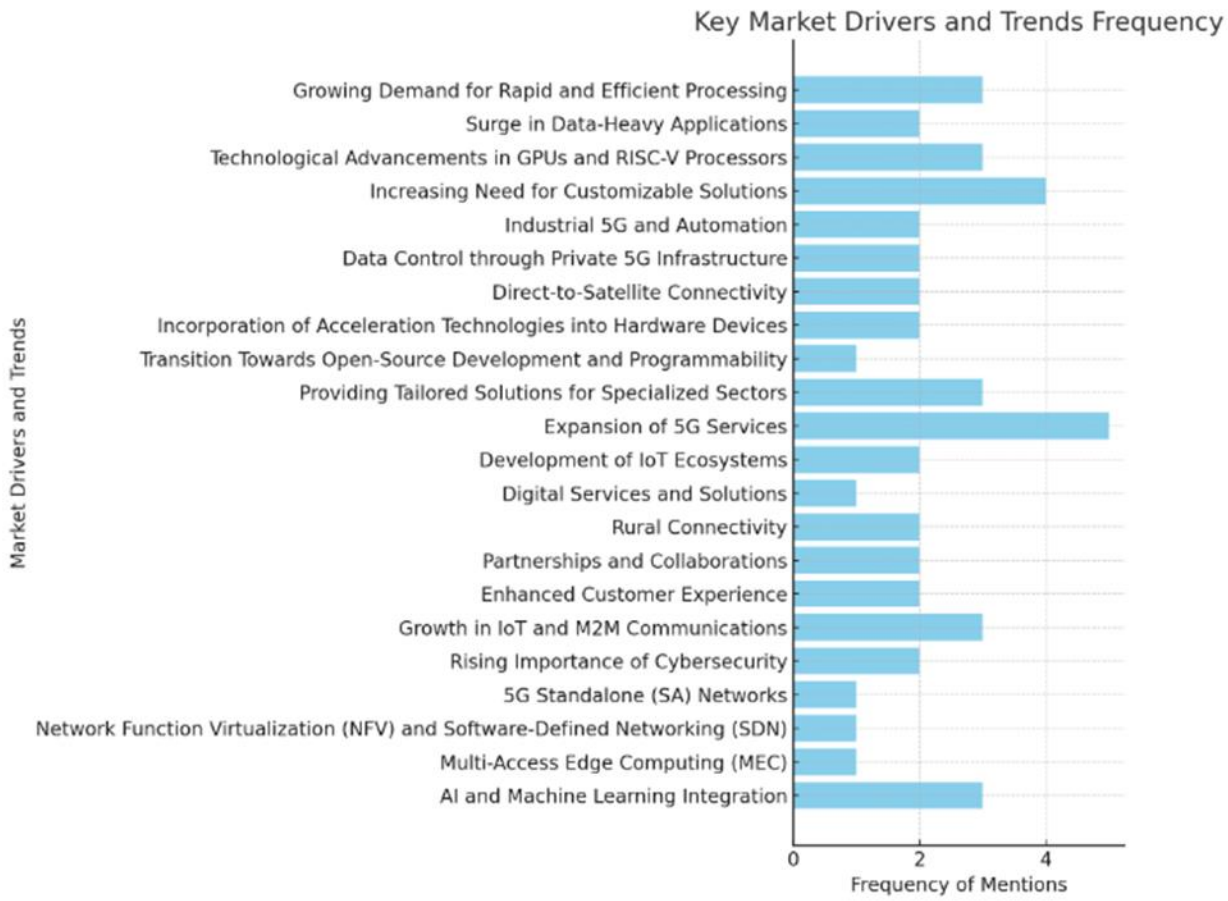

Figure 42. Key Market Drivers and Trends Frequency of ADROIT6G Market Analysis.

As one can see from the above, the most important Key Market Driver is the Expansion of 5G Services, followed by concepts like Rapid and Efficient Processing, Growth in IoT and M2M Communications and AI & Machine Learning Integration.

4.5.3 Exploitable 6G Results with Commercial Potential

The exploitable 6G results with commercial potential from the ADROIT6G project include advancements in AI/ML-based network services and network services orchestration. These results are geared towards enhancing training at the Master and PhD levels, with implementation expected within 2-3 years after project completion.

These include, in terms of importance, the following:

Enhanced Mobile Broadband (40%): As the demand for higher data rates and more connected devices increases, enhanced mobile broadband will likely hold the largest share of commercial potential in 6G applications.

Massive Machine-Type Communications (25%): This involves communications between devices with minimal human intervention and is crucial for the IoT sector.

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Ultra-Reliable Low-Latency Communications (20%): Critical for applications requiring instantaneous response and reliability, such as autonomous vehicles and industrial automation.

Long Range Communications (15%): Important for rural and remote communications, providing broad coverage and connectivity.

4.5.4 Key Stakeholders and Potential Partners

In terms of key Stakeholders when considering 6G Commercialization, chart illustrates the distribution of key stakeholders involved in the commercialization of 6G technologies, as described in Figure 43:

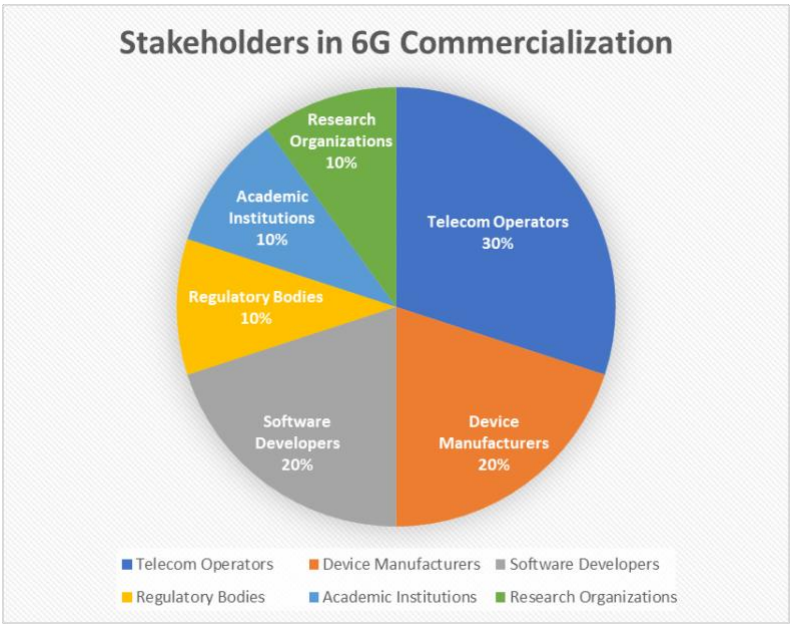

Figure 43. Stakeholders in 6G Commercialization

The most important stakeholders are Telecom Operators, which also are central to the deployment of new technologies and services.

Also of importance are Device Manufacturers, which are essential for creating 6G-capable devices that meet the new standards and consumer expectations.

Software Developers are key in developing the ecosystems that will run on these new networks, including applications and management software.

Regulatory Bodies are Important for ensuring compliance with laws and regulations, which will shape the market environment.

Academic Institutions and Research Organizations - Crucial for ongoing research and development in advanced telecommunications technologies.

In terms of Potential Partners, the ADROIT6G Consortium must establish relationships with multiple entities such as the ones depicted in the below diagram of Figure 44:

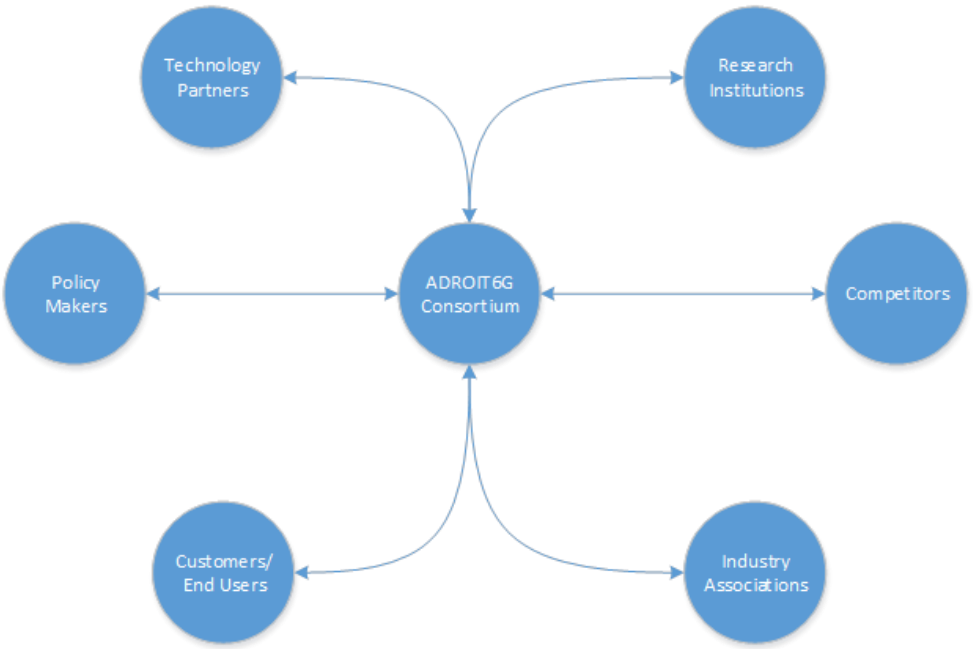

Figure 44. ADROIT6G Consortium Potential Partners Network Diagram

The above depicted interactions between the ADROIT6G Consortium and the other entities are listed below:

- **Technology Partners** provide support and collaboration for technological advancements.
- **Industry Associations** help in standardization and market penetration.
- **Research Institutions** collaborate on technology development and validation.
- **End Users/Customers** benefit directly from the innovations and solutions provided by ADROIT6G.
- **Competitors** influence the strategic positioning and innovation pace.

4.5.5 Conclusions

The telecommunications sector is poised for significant changes driven by technological advancements, AI integration, sustainability efforts, and regulatory changes. Stakeholders must align their strategies with these drivers and engage with potential partners to fully capitalize on the opportunities presented by the upcoming 6G technology.

To be more specific, in terms of Strategic Recommendations, Stakeholders should follow the below:

- **Invest in R&D**: Stakeholders should continue to invest in research and development to stay at the forefront of 6G technology.
- **Forge Strategic Partnerships**: Collaboration between telecom operators, device manufacturers, and software developers can accelerate the development and deployment of 6G solutions.
- **Engage with Regulatory Bodies**: Proactive engagement with regulators can help shape favorable policies and ensure compliance.
- **Focus on Sustainability**: Integrating sustainable practices into business operations can enhance corporate responsibility and appeal to environmentally conscious consumers.

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5 Standardization plan

5.1 Standardization Activities

5.1.1 Description of the Relevant SDOs

5.1.1.1 ***3GPP***

In 3GPP, ADROIT6G follows the specific working groups:

a. **The Technical Specification Group (TSG) Core Networks and Terminals (TSG CT)** working group within 3GPP plays a critical role in defining the core network and terminal aspects of mobile communications standards. The main functions and responsibilities of the TSG CT working group are:

   Standardization of Core Network: TSG CT is responsible for developing and maintaining the specifications for the core network. This includes the architecture and protocols needed to support various services in the core network of mobile communications, such as switching, routing, and data transport.

   Terminal Aspects: TSG CT addresses terminal specifications, ensuring that mobile devices can efficiently and effectively communicate with the network. This includes standards for connectivity, service access, and mobility management.

   Interoperability: TSG CT ensures that different components of the network and terminals can interoperate seamlessly. This involves standardizing interfaces and protocols to facilitate compatibility between equipment from different vendors.

   Service and Application Support: The group defines how new services and applications are supported by the core network. This includes enhancements for existing services and the introduction of new capabilities that leverage the core network's infrastructure.

   Evolution of Mobile Networks: TSG CT plays a key role in the evolution of mobile networks, from legacy technologies to current and future generations. They ensure backward compatibility and smooth transitions between generations.

   Security: Ensuring the security of the core network and terminals is a critical aspect of TSG CT's work. This includes developing specifications for authentication, encryption, and other security measures to protect data and user privacy.

   Quality of Service (QoS): The group is responsible for defining standards that ensure a high quality of service for end-users. This involves specifications for network performance, reliability, and resource management.

   Coordination with Other Groups: TSG CT works in coordination with other TSGs and working groups within 3GPP to ensure comprehensive and cohesive standardization across the entire mobile communication system. This includes collaboration with groups focusing on radio access networks, service, and system aspects, and more.

b. The **Service and System Aspects 2 (SA2)** Working Group within 3GPP is responsible for the architecture and functional aspects of the system, primarily focusing on the service and system aspects of mobile networks. The main roles and responsibilities of this WG are:

   System Architecture: SA2 is responsible for developing and maintaining the overall system architecture for mobile networks. This includes defining the high-level architecture and functional split for different network elements and services.

   Network Functions and Interfaces: The working group specifies the functions of various network components and the interfaces between them. This ensures that all parts of the network can communicate effectively and work together seamlessly.

   Evolved Packet Core (EPC) and 5G Core (5GC): SA2 has a expressive role in the design and specification of the EPC for the 5G Core network. This involves detailing the structure, functionalities, and interactions of core network elements.

Service Requirements: The group translates service requirements into technical specifications. This involves defining how new services will be supported by the network, ensuring that the necessary capabilities and functionalities are in place.
Mobility Management: SA2 handles the specification of mobility management protocols and procedures, ensuring that users can move seamlessly across different cells and network domains without losing connectivity or service quality.
Session Management: SA2 specifies how user sessions are established, maintained, and terminated. This includes managing data flows, quality of service, and session continuity.
Quality of Service (QoS) and Policy Control: SA2 defines the mechanisms for ensuring QoS and policy control. This involves specifying how network resources are allocated and managed to meet the service requirements of different applications and users.
Network Slicing: The working group specifies the concepts and mechanisms for network slicing, which allows the creation of multiple virtual networks on a shared physical infrastructure, each optimized for different types of services and applications.
Interworking and Compatibility: SA2 ensures that the new network architectures and protocols can interwork with existing systems and technologies. This includes maintaining backward compatibility and facilitating smooth transitions between different network generations.
Security: While primarily focused on architecture, SA2 also considers security aspects related to the system design, ensuring that the architecture supports robust security mechanisms to protect network integrity and user data.
Coordination with Other Groups: SA2 works closely with other working groups within 3GPP, such as those focusing on RAN, core networks and terminals, and other service and system aspects. This coordination ensures a holistic and integrated approach to developing mobile network standards.

*5.1.1.2 **ETSI***

a. **The ETSI Zero-touch network and Service Management (ZSM) WG** focuses on defining the end-to-end architecture and solutions for the automation of network and service management. The key roles and responsibilities of the ETSI ZSM WG are:
Developing Standards for Automation: The ZSM WG develops standards and specifications for automating the management of networks and services. This includes creating frameworks, interfaces, and protocols that enable zero-touch automation.
End-to-End Architecture: The working group defines a comprehensive end-to-end architecture that covers all aspects of network and service management. This architecture supports full automation and is designed to be flexible and adaptable to various network environments and technologies.
Integration and Interoperability: The ZSM WG ensures that the solutions developed are interoperable with existing systems and technologies. This includes defining interfaces and protocols that facilitate seamless integration of automation solutions with current network management and orchestration systems.
Focus on AI and Machine Learning: The working group leverages AI and ML techniques to enhance automation capabilities. This involves defining how AI and ML can be integrated into the network management processes to improve efficiency, accuracy, and adaptability.
Use Cases and Requirements: The ZSM WG identifies and develops use cases and requirements for zero-touch automation. These use cases span various aspects of network operations, including deployment, monitoring, maintenance, and optimization.
Security and Reliability: Ensuring the security and reliability of automated network management solutions is a key focus. The working group develops standards that address security challenges, such as protecting against cyber threats and ensuring the reliability of automated processes.

Collaboration with Other Standards Bodies: The ZSM WG collaborates with other standardization bodies and industry groups to ensure alignment and avoid duplication of efforts. This collaboration helps in creating a cohesive set of standards that are widely accepted and adopted.
Feedback and Iterative Development: The working group follows an iterative development process, incorporating feedback from industry stakeholders, pilot projects, and proof-of-concept implementations. This iterative approach helps in refining the standards and ensuring their practical applicability.
Facilitating Industry Adoption: The ZSM WG promotes the adoption of zero-touch automation standards by the industry. This involves organizing workshops, seminars, and dissemination activities to educate stakeholders about the benefits and implementation of ZSM solutions.
Defining Performance Metrics: The working group defines performance metrics and KPIs (Key Performance Indicators) for automated network management. These metrics help in assessing the effectiveness and efficiency of ZSM solutions in real-world deployments.
Supporting Multi-Vendor Environments: The ZSM WG aims to support multi-vendor environments, ensuring that automation solutions can operate across equipment and software from different vendors. This is crucial for achieving wide-scale adoption and interoperability.
Contributing to 5G and Beyond: The working group contributes to the evolution of 5G and future networks by providing automation standards that enhance the management capabilities of these networks. This includes addressing the complexities introduced by new technologies and use cases in 5G and beyond.
Sustainability and Efficiency: The ZSM WG also focuses on improving the sustainability and operational efficiency of networks through automation. By reducing the need for manual intervention and optimizing resource usage, automation can contribute to more sustainable network operations.

b. The **ETSI NFV WG** focuses on developing standards and specifications for the virtualization of network functions, a fundamental aspect of modern telecommunications infrastructure. The key roles and responsibilities of the ETSI NFV WG are:
Developing NFV Standards: The NFV WG is responsible for creating the standards and specifications that define how network functions can be virtualized. This includes the architecture, interfaces, and protocols necessary for NFV.
NFV Architecture: The working group defines the reference architecture for NFV, which includes key components such as the NFV Infrastructure (NFVI), Virtualized Network Functions (VNFs), and the NFV Management and Orchestration (MANO) framework.
Interoperability and Integration: Ensuring that NFV solutions are interoperable with existing network infrastructure and can integrate seamlessly with various technologies and vendors is a major focus. The NFV WG develops standards to facilitate this interoperability.
Performance and Reliability: The NFV WG addresses performance and reliability concerns related to virtualized network functions. This includes defining requirements and metrics for performance, reliability, and scalability of NFV deployments.
Security: Security is a critical aspect of NFV, and the working group develops standards to ensure the security of virtualized network functions. This includes protecting the integrity, confidentiality, and availability of network services.
Management and Orchestration (MANO): The NFV WG defines the standards for the management and orchestration of virtualized network functions. This includes specifying how VNFs are deployed, managed, and scaled within the NFV infrastructure.
Lifecycle Management: The working group develops standards for the entire lifecycle of virtualized network functions, from initial deployment and configuration to ongoing management, scaling, and eventual decommissioning.
NFV Infrastructure (NFVI): The NFV WG specifies the requirements for the underlying infrastructure that supports NFV. This includes computing, storage, and networking resources that are used to host VNFs.

Network Service Descriptor (NSD) and VNF Descriptor (VNFD): The working group defines the descriptors that describe network services and VNFs. These descriptors are used to automate the deployment and management of network services.
Open-Source Collaboration: The ETSI NFV WG collaborates with open-source projects and communities to ensure that NFV standards are implemented and adopted widely. This collaboration helps in aligning standards with practical implementations.
Industry Adoption and Use Cases: The NFV WG promotes the adoption of NFV standards by the industry through the development of use cases and demonstrations. These use cases highlight the benefits and applications of NFV in real-world scenarios.
Coordination with Other Standards Bodies: The working group collaborates with other standardization bodies and industry organizations to ensure alignment and coherence in the development of NFV standards. This helps in creating a unified approach to network virtualization.
Continuous Improvement: The NFV WG follows an iterative process for standards development, incorporating feedback from stakeholders, pilot projects, and proof-of-concept implementations. This continuous improvement approach ensures that the standards evolve to meet emerging requirements and challenges.

c. The **ETSI Multi-access Edge Computing (MEC) WG** focuses on developing standards and specifications for edge computing within mobile networks. MEC is a key technology for bringing cloud computing capabilities closer to the end-users and devices at the edge of the network, thus reducing latency and improving performance for various applications. The key roles and responsibilities of the ETSI MEC WG are:

Developing MEC Standards: The MEC WG is responsible for creating the standards and specifications that define the MEC framework, including its architecture, interfaces, and protocols necessary for edge computing.
MEC Architecture: The working group defines the reference architecture for MEC, which includes key components such as MEC hosts, MEC platforms, and the various services and applications that run on MEC infrastructure.
Interoperability and Integration: Ensuring that MEC solutions are interoperable with existing network infrastructure and can integrate seamlessly with various technologies and vendors is a major focus. The MEC WG develops standards to facilitate this interoperability.
Service APIs: The MEC WG specifies the APIs for services running at the edge. These APIs enable application developers to leverage MEC capabilities for enhancing the performance and functionality of their applications.
Performance and Reliability: The MEC WG addresses performance and reliability concerns related to edge computing. This includes defining requirements and metrics for performance, reliability, and scalability of MEC deployments.
Security: Security is a critical aspect of MEC, and the working group develops standards to ensure the security of edge computing services. This includes protecting the integrity, confidentiality, and availability of edge applications and data.
Deployment and Management: The MEC WG defines the standards for the deployment and management of MEC infrastructure and applications. This includes specifying how MEC resources are orchestrated, managed, and scaled within the network.
Lifecycle Management: The working group develops standards for the entire lifecycle of MEC applications, from initial deployment and configuration to ongoing management, scaling, and eventual decommissioning.
MEC Infrastructure: The MEC WG specifies the requirements for the underlying infrastructure that supports edge computing. This includes computing, storage, and networking resources that are used to host MEC applications.

Edge Application Deployment: The working group defines standards and guidelines for deploying edge applications, ensuring that they can be easily and efficiently rolled out across diverse edge environments.
Use Cases and PoCs: The MEC WG develops use cases and demonstrates proof-of-concepts to highlight the benefits and applications of MEC in real-world scenarios. These use cases help in promoting the adoption of MEC standards by the industry.
Open-Source Collaboration: The ETSI MEC WG collaborates with open-source projects and communities to ensure that MEC standards are implemented and adopted widely. This collaboration helps in aligning standards with practical implementations.
Coordination with Other Standards Bodies: The working group collaborates with other standardization bodies and industry organizations to ensure alignment and coherence in the development of MEC standards. This helps in creating a unified approach to edge computing.
Sustainability and Efficiency: The working group also focuses on improving the sustainability and operational efficiency of networks through edge computing. MEC can lead to more efficient use of resources and reduced operational costs.
Continuous Improvement: The MEC WG follows an iterative process for standards development, incorporating feedback from stakeholders, pilot projects, and proof-of-concept implementations. This continuous improvement approach ensures that the standards evolve to meet emerging requirements and challenges.

d. The **ETSI Open-Source MANO (OSM) WG** focuses on the development of an open-source MANO stack aligned with ETSI NFV standards. This initiative aims to provide a production-quality MANO framework that is open to the community and can be integrated with various NFV solutions. The key roles and responsibilities of the ETSI OSM WG are:

Development of Open-Source MANO: The primary goal of the OSM WG is to develop and maintain an open-source MANO stack. This stack is designed to meet the requirements of ETSI NFV and provide a comprehensive platform for managing and orchestrating VNFs.
Standards Alignment: The OSM WG ensures that its open-source MANO stack is fully aligned with the ETSI NFV standards. This alignment ensures that the solutions developed are interoperable with other NFV-compliant systems and meet industry standards.
Community Collaboration: OSM is a collaborative project involving various stakeholders, including network operators, vendors, research institutions, and individual contributors. The WG fosters an open community where participants can contribute to and benefit from the project.
Interoperability and Integration: One of the key focuses of the OSM WG is to ensure that the MANO stack can integrate seamlessly with different NFV infrastructures and VNF providers. This includes developing plugins and adapters for various infrastructure platforms.
Continuous Integration and Delivery (CI/CD): The OSM WG implements CI/CD pipelines to ensure that new features and bug fixes are integrated, tested, and delivered efficiently. This approach helps in maintaining a high-quality and stable codebase.
Automation and Scalability: The OSM stack is designed to support high levels of automation and scalability. This includes automated deployment, scaling, healing, and lifecycle management of VNFs and network services.
Extensibility and Flexibility: The OSM architecture is designed to be extensible and flexible, allowing for the integration of new features and capabilities as required by the evolving needs of the NFV ecosystem.
Performance and Reliability: Ensuring high performance and reliability of the MANO stack is a key responsibility. The OSM WG continuously works on optimizing the performance of the stack and ensuring it can handle production-grade deployments.
Documentation and Tutorials: The OSM WG provides comprehensive documentation and tutorials to help users understand, deploy, and manage the OSM stack. This includes user guides, API documentation, and best practices.

Security: The working group ensures that security is a key consideration in the development of the OSM stack. This includes secure coding practices, vulnerability management, and compliance with security standards.
Use Case Implementation: The OSM WG works on implementing and validating various use cases to demonstrate the capabilities of the MANO stack. These use cases help in showcasing the practical applications and benefits of OSM.
Compliance and Testing: The working group develops and maintains testing frameworks and compliance programs to ensure that the OSM stack meets the necessary standards and requirements. This includes functional, performance, and interoperability testing.
Release Management: The OSM WG follows a structured release management process, with regular releases that include new features, improvements, and bug fixes. Each release is thoroughly tested to ensure stability and reliability.
Ecosystem Building: The OSM WG works on building a robust ecosystem around the OSM stack, involving various partners and stakeholders. This ecosystem includes VNF vendors, infrastructure providers, and solution integrators.

*5.1.1.3 **OpenAirInterface (OAI)***

The OAI is an open-source software platform that focuses on the development and implementation of 5G RANs. It aims to provide an open and flexible framework for researchers, developers, and operators to experiment, prototype, and deploy advanced mobile communication technologies. Here are the key aspects and roles of OpenAirInterface:
Open-Source RAN Platform: OpenAirInterface is primarily known for its open-source nature, offering a platform where developers can access and modify source code for implementing RAN functionalities.
Research and Development: The platform is widely used in academic and research communities for studying and developing advanced wireless communication technologies. Researchers can use OAI to prototype new algorithms, protocols, and techniques in a real-world RAN environment.
Prototyping and Testing: Telecom equipment manufacturers and vendors often use OAI for prototyping new RAN solutions and testing interoperability with other components. It provides a flexible environment for testing various configurations and scenarios.
Educational Purposes: OAI is also used in educational institutions to teach students about mobile communication standards, RAN architectures, and network protocols. It offers a hands-on learning experience for understanding the complexities of wireless networks.
Customization and Adaptation: Users can customize and adapt the OAI software stack to meet specific research or deployment requirements. This flexibility allows for experimentation with different network configurations and optimization strategies.
Community Collaboration: OAI fosters a collaborative community of developers, researchers, and enthusiasts who contribute to its continuous improvement. Contributions can include bug fixes, new features, optimizations, and documentation enhancements.
Support for Multiple Interfaces: It supports various interfaces defined by 3GPP, enabling interoperability with different network components and devices compliant with LTE and NR standards.
Integration with SDN and NFV: OAI can integrate with SDN and NFV architectures, allowing for dynamic network management and efficient resource utilization in virtualized environments.
Deployment in Real-world Networks: While primarily used for research and development, OAI has also been deployed in real-world networks in certain experimental and pilot projects, demonstrating its potential for practical implementations.
Continuous Development and Enhancement: The OAI community continues to evolve the platform by adding support for new features, improving performance, enhancing security, and ensuring compliance with the latest 3GPP specifications.

5.2 Standardization road map

The ADROIT6G architecture, at least for the AI-driven management and orchestration part, is inspired and aligned to the ETSI ZSM principles and architecture for what concerns enabling full automation in end-to-end service management and operation. Specifically, ADROIT6G proposes an AI-enabled zero-touch closed loop framework which include closed loop governance capabilities integrated with the ADROIT6G crowdsourcing AI/ML framework to realize AI-driven distributed closed loops. The closed loop approach proposed and implemented in ADROIT6G follows the ETSI ZSM closed loop solution, enhanced to support and integrate the ADROIT6G AI capabilities.

As other ETSI ISGs, ZSM offers the possibility to contribute to the ISG activities by proposing the realization of Proof-of-Concepts which aim at demonstrating selected ZSM principles, solutions and topics (including general ZSM scenarios, closed loop automation, cross-domain end-to-end services). ZSM PoCs are therefore a very good candidate as standardization contribution for ADROIT6G; while for the project it represents a concrete input towards a relevant standardization forum, ETSI ZSM welcomes new PoC proposals as important tool demonstrate ZSM as a viable solution. Given the alignment of the project AI-driven management and orchestration innovations to the ETSI ZSM principles, the following subsection presents the plan established by ADROIT6G to propose a new Proof-of-Concept to ETSI ZSM.

5.2.1 Plans for the implementation of a ETSI ZSM Proof-of-Concept

ETSI ZSM has defined in the ETSI ZSM 006 specification [2] a framework to coordinate and promote multi stakeholder PoCs focusing on key aspects of ZSM. PoCs are considered by ETSI ZSM key to inform the industry about the work of the ISG on specific topics, with public demonstration of ZSM concepts that can help to build commercial awareness and confidence in related solutions, fostering the creation of a heterogeneous open ZSM ecosystem.

ADROIT6G has identified the ETSI ZSM PoC framework as a viable option to contribute to standards, aiming at propose the implementation of a PoC including innovations from WP3 and WP4 in the area of closed loop automation and crowdsourcing AI. The process for submitting and implementing a PoC within ETSI ZSM is regulated in the ETSI ZSM 006 specification [2] , as depicted in Figure 45. Three main entities and teams are identified. The ISG ZSM identifies the PoC topic and process the contributions provided by the PoC teams on the selected topics. The PoC Management team (composed by ETSI ZSM delegates) supervises the PoC activity process, reviewing PoC proposals and PoC reports, monitoring the PoC progresses and assessing the acceptance of PoC results. The PoC Team is formed by those organizations participating in the PoC project (in the specific case it will include a selection of ADROIT6G partners), and thus in charge of preparing and submitting the PoC proposal, implementing the PoC according to the time plan included in the proposal and providing periodic updates on the progress to the ISG ZSM in the form of contributions. The PoC Team is also responsible to prepare and show a demonstration of the PoC in a public event and then prepare and submit the PoC final report.

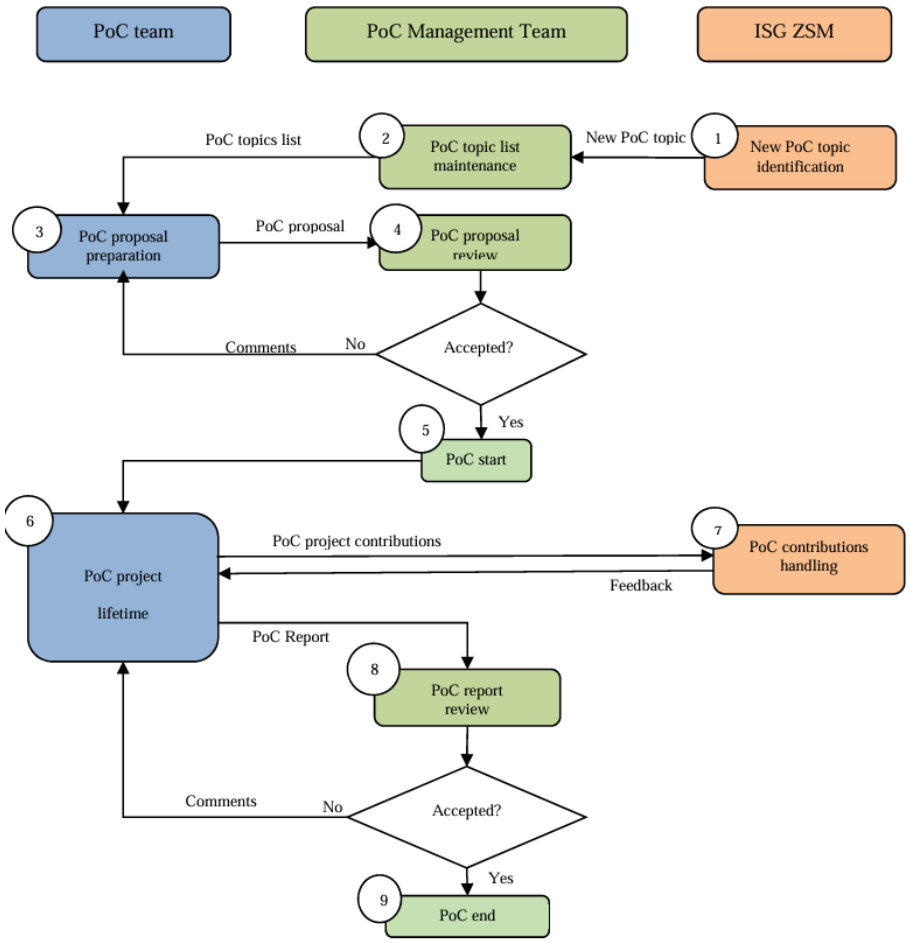

Figure 45. ETSI ZSM PoC activity process (ref. ETSI ZSM 006)

ADROIT6G has defined a roadmap to propose and implement a PoC to ETSI ZSM, as depicted in Figure 45. Among the topics identified by ETSI ZSM [3] , ADROIT6G targets the implementation of a PoC that will cover at least one of:

- Automation in Multi-Stakeholder Ecosystems (Topic 2)
- Intent-driven Closed-Loop automation (Topic 3)

Specifically, starting from the "AI/ML framework and closed loops for automated service operation and network slice performance prediction" demo prepared for the EUCNC&6G Summit 2024 by Orange Romania and Nextworks [4] , ADROIT6G will identify the exact PoC scope during Q4-2024 (stage 3 in Figure 45). As a preliminary plan, ADROIT6G considers preparing a PoC proposal in distributed closed loop automation enabled by the crowdsourcing AI/ML framework in a multi-stakeholder environment, possibly applied to an end-to-end service supporting one of the ADROIT6G use case scenarios. As part of the PoC scope identification phase, the selection and setup of the PoC Team will be also performed. According to the ETSI ZSM PoC framework requirements, the PoC Team will be formed by at least three organizations (at least one network provider or service provider, and at least two suppliers, with possibility of having other types of organizations such as universities, research centres, etc.), with a main point of contact being an ETSI ZSM member or participant (e.g., Nextworks). The PoC Team will be formed by ADROIT6G partners, and the possible participation of external organizations (e.g., from the telco industry) will be also considered to guarantee more value and visibility to the proposal. The current plan is to submit the PoC proposal at the end of Q4-2024 (stage 4 in Figure 45) to start the PoC activity in Q1-2025 (stage 5 in Figure 45). According to the ETSI ZSM PoC framework requirements in terms of PoC duration (to be comprised between 3 and 9 months), ADROIT6G plans to perform the PoC activity in a total of 6 months (stage

6 in Figure 45, and therefore complete the implementation and demo preparation by the end of Q2-2025 (Figure 46), targeting a public demonstration at EUCNC&6GSummit 2025.

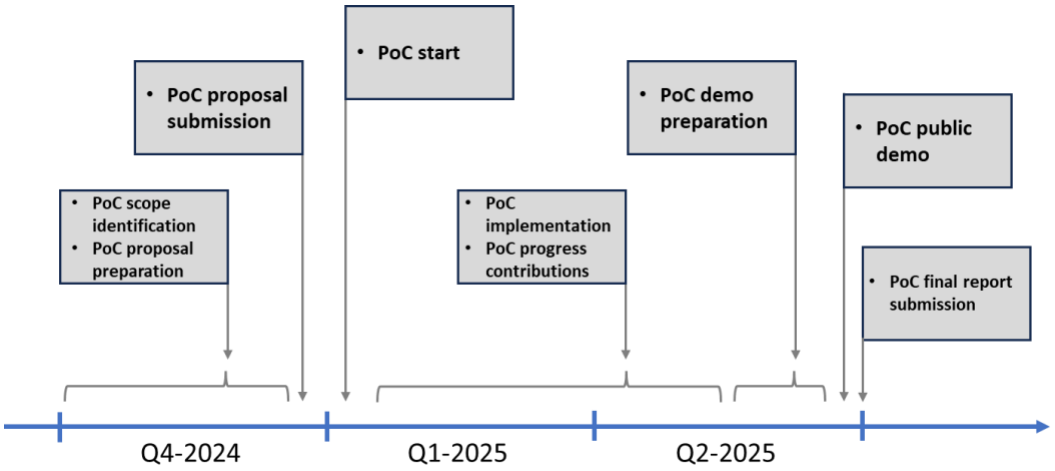

Figure 46. Plan for the implementation of a ADROIT6G ETSI ZSM PoC

6 IPR Management Strategy

6.1 IPR Management during the project

Given the strong exploitation potential that ADROIT6G presents, consortium partners will follow a series of steps to ensure the protection of the newly generated Intellectual Property (IP), as well as their background. Figure 47 presents ADROIT6G's knowledge management and protection plan. Furthermore, consortium partners have agreed on the project's exploitation strategy. Initial steps have also been taken to form a Consortium Agreement (CA) achieved on confidentiality measures, data management, Intellectual Property Rights (IPR) management and joint ownership.

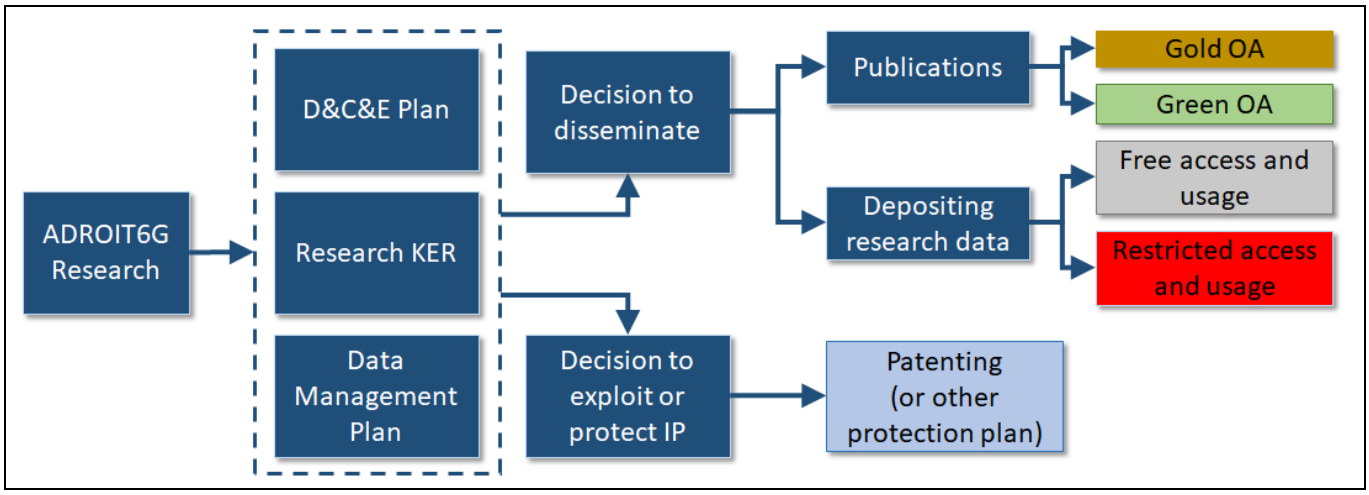

Figure 47. ADROIT6G's knowledge management and protection plan.

The IPR management will handle the following matters:

- Protect the pre-existing know-how and information related to the use of knowledge owned by individual partners from work carried independently of the ADROIT6G project. It is important to guarantee confidentiality on any information disclosed by the partners during the project development. The partners will be asked to specifically designate in the CA their Background to be provided during the implementation. Any material not expressly listed in the CA, will be deemed as excluded from the Background. The partners may require the acceptance of specific license terms to grant access rights to the Background.
- Protect IPR of any knowledge gained within the ADROIT6G project. Each participant who has developed some innovative contribution within the project shall formally notify the project coordinator on IPR issues, including any special requirement for the use of this IPR in addition to or deviating from the standard IPR-rules. For avoidance of doubt, under standard IPR-rules the party creating the IP shall be the sole owner of the associated IPR. The other project partner will be notified, and a time margin will be allowed to raise any objections against the IPR statement. If no objections are raised, the IPR shall be granted; otherwise, the Steering Committee will initiate any necessary processes to resolve the conflict of interests.
- Explicit rules concerning IP ownership, access rights to any Background and results for the execution of the project and the protection of IPRs will be addressed within the CA. This is a major step to enable the deployment of both open-source building blocks (the open-source components must be specified with their associated license), and equipment vendors functions or equipment (proprietary solutions with an R&D license that must be granted to a dedicated list of project partners) in the *Proof of Concepts*.
- Access to the knowledge generated within the project will be granted royalty-free to the ADROIT6G partners for the execution of the project.

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- A record of all IPRs and licensing issues within the project will be kept and clear procedures for the access and use of this knowledge will be set.
- Define the exploitation potential of the obtained results and decide to disseminate or protect.
- Define a contingency plan to ensure access to project's crucial knowledge if a partner with specific IPRs leaves the consortium. Policies for the partial/full ownership transfer of results between partners will be defined in the CA.
- The Foreground developed during the project will be owned by the partner producing it (ownership and joined ownership rules will be defined in CA). Such development could also take the form of open-source contributions, which are leveraged by the ADROIT6G project especially if they create or enhance modules that could lead to de-facto standards. In such a case, it will be every partner's responsibility to comply with the license scheme of the targeted open-source alliance. If any result is created jointly by at least two partners and it is not possible to distinguish between the contribution of each of the partners, such work will be jointly owned by the contributing partners.

Knowledge Management and IPR activities will be addressed in task T6.4 'Innovation, data management and IPR activities' led by ATH/ISI. The task will develop and finalise a detailed Knowledge Management and IPR Strategy (Table 18). An integrated approach will be followed for the identification, capture, retrieval, distribution, sharing, use and reuse of generated information and knowledge assets. This will be essential to drive the value and benefits of these assets and contribute towards maximising the innovation impact of the action. Knowledge management sessions will take place regularly during project meetings and partners will sign compliance declarations of IP policies and procedures.

Table 18. Methodology structure for the IPR Management Plan in ADROIT6G.

Rules and agreements for the ownership and access to IP elements	Definition of the policies for the ownership and access of all the IP elements identified, with the guiding principles of fairness across IP contributors and ensuring the freedom-to-operate to the overall project, including the long-term sustainability of its pilots. • Ownership and access to Background IP elements: explain and detail the results of the identification of Background IP elements. • Ownership and access to Foreground IP elements: the focus is on detailing some of the information related to the identification of Foreground IP elements, such as licensing model, joint ownership conditions (if applicable), access conditions for other partners, etc.
Innovation and IP risk strategy	The interdependencies analyzed can help identify risks, such as: • **During project execution**: lack of access (by the indirect owner or by other project partners) to a specific Background element can hamper the execution of some activities in the workplan, the achievement of some Foreground elements and, ultimately, the achievement of some inventions. • **After the end of the project:** lack of, or unaffordable conditions in, access (by the indirect owner, or by other project partners) to specific Background/Foreground elements can block the usage of some Foreground elements and related inventions. The goal of this work is to identify the major innovation-related risks and to define a strategy to deal with each of them. • **Innovation and IP risks analysis, to identify several risk parameters.** • I**nnovation and IP risks management, providing a mitigation plan and a contingency plan.**

6.2 IP Protection through patents

To protect and retain the commercially strategic IP "for Europe" and "within Europe", which in turn gives exploitation partners a strategic international competitive advantage on a world-wide stage, at least 3 strategic patent filings are foreseen in ADROIT6G at both European Patent Office (EUPO) and US Patent and Trademark

Office (USPTO) with a view to securing and protecting the competitive and commercial advantages from the project's outcomes within Europe in a way that will not impede the underlying aspirations to Open Science.

A strategic imperative from the EC is boosting patent protection of strategic and commercially sensitive innovation from EC R&D funded projects. Progress on this imperative is evidenced in several recent communications from the EC[5, 6, 7] and relevant EC tenders[8, 9] that promote the objective of boosting the commercialisation of EU research results. ADROIT6G respects and responds to the above strategic mandate and imperative from the EC. In this respect, ISI/ATH will act as ADROIT6G's Innovation Manager and the strategy for protecting IP in ADROIT6G involves filing patents for valuable innovations generated by the project. This enhances the competitive standing of the participating partners. Several partners will participate in the patent filing process to support the project's commercialization efforts. These partners will collaborate with the project's innovation manager (ISI/ATH), who will provide guidance and advice on filing the most significant and strategic patents resulting from the project. The project aims to file one patent from each participating technology partner, totalling three patents.

Summary of Project Interest Areas with High Patent Potential

By considering the business interests of the partners involved in the patent protection activities in ADROIT6G and the innovative concepts and technologies of the project, the following are highlighted as key focus areas with high patent potential from within the project

1. Zero-Touch management, network orchestration and slice reconfiguration for 6G Networks
2. CrowdSourcing AI
3. Distributed AI with Belief-Desire-Intention eXtended (BDIx) agents
4. UEs as Virtual Base Stations computing concept
5. Energy-efficient communication – Green networking using AI
6. Data plane performance - multi-tenancy programmable network
7. Non-Terrestrial Networks (NTN)

This list reflects a preliminary evaluation of the subject areas expected to be of greatest interest to the partners involved in patent protection activities. This evaluation was based on information available at the early stages of the project and discussions with the relevant partners mentioned above. When evaluating the patent potential of the project, it is crucial to note that ADROIT6G features three well-defined and market-relevant Proof-of-Concepts, with active contributions from the partners. Each PoC demonstrates significant innovation and patent potential due to the advanced technology being developed, the ambitious KPI targets, and the focus on addressing real-world challenges in the field of 6G networks. The above list outlines the primary target areas for potential patenting efforts. As the patenting process unfolds, these areas will be reviewed and refined through consultations with the project's patenting team.

The first version of the IP management plan is closely connected to innovation management, focusing on the discovery and implementation of new creative concepts and the introduction of new services, procedures, etc., to the marketplace. Every ADROIT6G partner will engage in innovation endeavors that align with their skills and goals to enhance the impact of ADROIT6G. They will give importance to originality/novelty in their work (such as algorithms, interfaces, procedures) and develop a personalized innovation management plan detailing how innovation will be accomplished. This plan will be regularly revised during the project.

More specifically, partners were required to fill in a table with their information regarding innovation activities, expected results, competition, starting and ending TRL levels, and the planned approach to achieve these

[5] https://ec.europa.eu/growth/industry/intellectual-property_en
[6] http://ec.europa.eu/trade/policy/accessing-markets/intellectual-property/
[7] https://ec.europa.eu/docsroom/documents/26583
[8] https://etendering.ted.europa.eu/cft/cft-display.html?cftId=3518
[9] https://etendering.ted.europa.eu/cft/cft-display.html?cftId=3655

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objectives. This data, as well as updates during the project, will be used to determine which partners may be able to generate a patent and establish the correct strategy for managing, protecting and distributing intellectual property rights among project participants. In the following tables, the innovation management per partner is provided.

ISI/ATH

Innovation (1)	TRL M01	TRL M36
Robust Algorithms for Joint Resource Management satisfying Performance and Energy Constraints.	TRL2	TRL4
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
Other research groups in the field of AI for 6G Networks.	We go beyond the state of the art, by using a Multi-Objective RL (MORL) agent to assign communication links, resource blocks, and network entities to each user, asking for a specific service type. This service-type realization creates slices and clusters network entities for each request. The proposed approach targets joint communication and computational resource allocation, with significant low computational complexity. Considering service types as multiple contradictory objectives to be optimized simultaneously, we deploy a MORL agent that can be trained for all the objectives and can be used for any preferred service type. While by handling the trade-off between different service types the MORL agent improves consistency compared to having multiple single agents for each service type, it also significantly reduces the number of agents, neural networks, and training processes.	

Innovation (2)	TRL M01	TRL M36
Predictors for Real-time VNF Migration, Placement and Scale-out.	TRL2	TRL4
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
Other research groups in the field of AI for 6G Networks.	Within the concept of RL, we leveraged advanced DQNs architectures, the so-called *Duelling Double DQNs – DDDQN* to improve migration decision and VNF placement, and thus optimize ADROIT6G functionality and lay the foundation of the proposed approach. By combining RL with advanced neural architectures into the NFV-enabled ADROIT6G infrastructure, it will be possible to promote the network functionality via algorithmic innovation to achieve both the required domain objectives (e.g., for reducing cost, minimizing the end-to-end latency, reducing energy consumption, etc.) and the level of intelligence and automation in VNF operations scheduling. The	

	DDDQN RL agent dynamically decides on the placement of VNFs based on their resource requirements (CPU, memory, disk usage) and the current load on different nodes. This is critical for optimizing resource utilization and ensuring high service quality. A decentralized mechanism based on Voting makes the final decision in terms of the optimal placement.	
Innovation (3)	**TRL M01**	**TRL M36**
A cloud-native SLA driven stochastic policy to guarantee a scalable and fast operation of constrained FL based analytic engines that perform statistical slice level resource provisioning at RAN-Edge	TRL2	TRL4
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
Other research groups in the field of AI for 6G Networks.	The proposed method addresses the challenge of adapting learning rates to accommodate the heterogeneity in data across different clients, ensuring efficient model updates. Telecommunication environments, especially in the 6G RAN-edge domain, are characterized by dynamic conditions. The proposed approach dynamically adjusts the learning rate based on real-time variations in client performance, allowing the federated learning system to adapt to changing conditions. SLAs are crucial in telecommunications to ensure specific performance and reliability standards. The proposed approach integrates SLA metrics, such as CPU load, into the learning rate adjustment mechanism to enhance the compliance of federated learning with these SLAs. The FL process needs to operate efficiently within resource constraints present in the telecommunication environment. The adaptive learning rate mechanism considers resource-related metrics, contributing to a more resource-efficient federated learning process. The method aims to optimize the convergence speed of the global model. Also, by dynamically adjusting the learning rate based on SLA metrics, it seeks to achieve faster convergence, addressing potential challenges associated with static learning rates.	

IQU

Innovation	TRL M01	TRL M36
DRL-based Zero-Touch Resource Management	TRL3	TRL4
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
Other research groups working in the field of AI for 6G Networks and next generation of services to enable network self-configuration, self-optimization, self-monitoring, and self-healing without further human intervention (e.g., Nokia, Huawei).	We go beyond the state of the art, by proposing an innovative Decision Engine empowered by Hierarchical Reinforcement Learning (HRL), a multi-scale strategy that orchestrates decisions across all network domains through local RL agents' coordination, considering cross-domain trade-offs and/or modify Deep RL functions to adapt to different operating conditions and performance levels. The architectural and algorithmic assumptions of this DE will ensure efficient, scalable, and autonomous network operations (e.g., flexible and scalable VNF and CNF deployment across various network environments while automatically maintaining Service Level Agreements (SLA)), enhancing not only the performance and reliability of 6G networks but also paving the way for new applications and services that can leverage the full potential of next-generation connectivity. Finally, the proposed DE will be a principal component of the closed-loop functions that Management and Orchestration comprise to ensure continuous optimization of infrastructure, services, and applications based on monitored data.	

CNIT

Innovation (1)	TRL M01	TRL M36
The innovation revolves around a meta-learning method for selection and deployment of machine learning models in distributed mobile networks. This method is particularly effective in distributed environments where data are collected at different locations in the network and computational resources are limited, and it allows for the exploitation of the resources offered by heterogeneous nodes (e.g., edge servers and end-devices). Additionally, the approach can cope with the dynamicity of network, computing, and data resources as	TRL 2 At the beginning of the project, the key ideas have been refined and used for the definition of a new methodology and algorithm for the selection of machine learning models. This has included the definition of the architectural entity where the created algorithm should run. Some preliminary results have been derived in a small-scale distributed network scenario.	TRL 3 By the end of three years, the technology is expected to have advanced significantly. The methodology will be tested using different types of machine-learning models, including deep neural networks as well deep reinforcement learning models, used for different network functions.

well as, notably, with different types of machine learning models. Meta-learning for Machine Learning Model Tailoring in Distributed and Resource-constrained Networks. The proposed method and approach go beyond traditional transfer learning or distributed learning since it combines nodes cooperation and knowledge sharing with machine learning model compression. By doing so, it allows building new machine learning models that inherit the knowledge acquired by the different network nodes while tailoring the model size (hence complexity) to the memory and computational capability of the nodes where the machine learning model has to be deployed and used. Furthermore, the proposed approach can cope with dynamic scenarios, as it adapts to time and location-varying resource availability as well as to data availability and learning requirements.		Additionally, larger-scale scenarios will be considered and the performance evaluation will address several metrics relevant to the project, namely, overhead and energy consumption, besides the quality level of the decisions made through the machine learning models created through the proposed method.
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
This model competes with conventional machine learning approaches that rely on centralized data collection and unconstrained computational capabilities at the network nodes. It offers a significant advantage in scenarios where data cannot be shared due to privacy, isolation, or bandwidth, constraints.	The innovation will leverage existing technologies such as machine learning models, distributed network architectures as O-RAN, and distributed computing capabilities (e.g., those owned by edge servers or far-edge devices). By leveraging these technologies, the project will enhance the TRL as follows: • Developing algorithms that enable effective (i) knowledge sharing and (ii) machine learning model compression, in distributed network scenarios. • Evaluating the performance numerically and testing the approach using different reference machine learning models that have been proposed for the implementation of different network functions in virtual radio access networks. • Defining the information workflow to be implemented between the entities composing the AI/ML architectural framework developed within the project. This strategy of extending existing technologies to foster a cooperative, distributed machine learning framework represents a realization of the concept of CrowdSourcing AI put forward by this project and a substantial innovation with respect to the current state of the art.	

CYENS

Innovation (1)	TRL M01	TRL M36
The innovation described revolves around Cooperative Transfer Learning, a sophisticated machine learning strategy that emphasizes knowledge sharing among various models or systems to enhance learning efficiency and performance. This method is particularly effective in environments with limited data, computational resources, or where data is geographically dispersed. The Cooperative Transfer Learning approach can be aptly titled "Synergistic Machine Learning for Distributed Networks." It goes beyond traditional transfer learning by incorporating multiple entities in a collaborative effort, thereby enabling a more efficient use of distributed data and computational resources. This addresses the constraints of traditional centralized models and introduces a new paradigm in machine learning that respects privacy and reduces bandwidth consumption.	At the beginning of the project, the core technology would involve setting up the foundational structures for Cooperative Transfer Learning. This includes developing the initial algorithms, testing prototype models on limited data sets, and establishing the centralized authority for overseeing the process.	By the end of three years, the technology is expected to have advanced significantly. The models would be well-developed, having been trained and refined with aggregated data from various entities. They would be capable of effective parameter sharing across different systems, showing substantial improvements in learning efficiency and model performance in diverse environments.
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
This model competes with conventional machine learning approaches that rely on centralized data accumulation and extensive computational power. It offers a significant advantage in scenarios where data cannot be centralized due to privacy, security, or logistical constraints. This makes it particularly competitive in fields like telecommunications, where distributed learning is crucial.	The innovation will leverage existing technologies such as machine learning models and distributed computing infrastructures. By refining these technologies with the principles of Cooperative Transfer Learning, the project will enhance the technology readiness level over time. This includes: • Developing algorithms that enable effective knowledge sharing without needing extensive data centralization. • Establishing a centralized authority that optimizes hyperparameters and manages computational loads, ensuring balanced and efficient learning across diverse environments. • Implementing the technology in real-world scenarios to validate and refine the approach, leading to higher TRLs by showcasing practical improvements in efficiency and performance.	

	This strategy of extending existing technologies to foster a cooperative, distributed machine learning framework represents a significant leap in addressing the challenges posed by the modern data landscape, marking a notable advancement beyond current state-of-the-art methodologies.

Innovation (2)	**TRL M01**	**TRL M36**
The innovation revolves around the use of BDIx agents within a Distributed Artificial Intelligence (DAI) framework. BDIx agents are advanced versions of Belief-Desire-Intention (BDI) agents, enhanced with machine learning capabilities to efficiently tackle complex communication challenges in mobile and telecommunication networks. These agents are designed to be modular, like LEGO-building blocks, allowing for the flexible assembly of diverse machine learning methods tailored to specific objectives and environments. The project can be titled "Autonomous Network Management with Enhanced BDIx Agents." It advances beyond the traditional state of the art by incorporating machine learning into the BDI framework, thus significantly enhancing the agents' ability to respond to and manage real-time network dynamics autonomously. This integration represents a leap in the capabilities of distributed artificial intelligence applied to network management, particularly in adapting to evolving 5G and upcoming 6G environments.	At the onset of the project, the focus would be on the conceptual validation of BDIx agents. This includes the initial design of these agents, setting up basic machine learning integration, and testing their effectiveness in simulated or small-scale real environments.	By the end of three years, the technology would have matured through iterative development and integration into larger and more complex network environments. The agents would be capable of autonomous decision-making, real-time communication, and effective network control within a fully functional DAI framework, demonstrating high adaptability and efficiency in dynamic network conditions.
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	

This approach competes with traditional network management systems that often rely on centralized control and static configuration. BDIx agents offer a decentralized, dynamic solution that reduces latency, enhances network flexibility, and improves scalability by allowing real-time, localized decision-making processes at the network's edge.	The innovation will be accomplished by leveraging advancements in both artificial intelligence and telecommunications technology. Specifically: Developing and refining BDIx agents to incorporate sophisticated machine learning algorithms that enable them to learn from the network environment and make informed decisions autonomously. Integrating these agents into a modular and scalable DAI framework that allows for flexible deployment across various network scenarios, enhancing their utility in managing complex network tasks. Conducting extensive testing and optimization in real-world network settings to ensure that the agents can effectively manage network traffic, resolve conflicts, and adapt to changing network conditions without human intervention. By focusing on these areas, the project aims to enhance the operational capabilities of mobile networks, making them more autonomous, efficient, and capable of handling the demands of modern telecommunication infrastructures.

Innovation (3)	**TRL M01**	**TRL M36**
The innovation centers on the concept of UE-VBS (User Equipment - Virtual Base Station) computing resources, a paradigm where mobile devices are utilized as dynamic nodes within a network. These devices serve multiple roles, including acting as miniaturized base stations (mBS), relay stations (RS), and computing and storage hubs (CSH). This approach leverages the inherent ubiquity and capabilities of mobile devices to augment the cellular, storage, and computational capacities of networks, particularly in addressing the challenges posed by 5G and 6G networks. The project could be titled "Dynamic Network Augmentation with UE-VBS Technology." This initiative goes beyond the traditional state of the art by transforming the static use of mobile devices into active, multifunctional network components. Unlike conventional approaches that utilize fixed infrastructure or static nodes, UE-VBS enables a fluid,	At the beginning of the project, the focus would be on conceptualizing and initiating the basic functionalities of UE-VBS. This would involve developing the initial software to enable mobile devices to act as part of the network infrastructure, conducting small-scale tests to assess feasibility, and setting up preliminary protocols for device transformation into network nodes.	After three years, the UE-VBS technology would be expected to have advanced to full-scale deployment. The technology would be refined to allow seamless integration and role switching of mobile devices within the network, with extensive field testing to ensure reliability and effectiveness across various network scenarios. Devices would be capable of dynamically adjusting their functions based on real-time network demands, significantly enhancing network flexibility and responsiveness.

adaptable infrastructure that evolves in real-time according to user movement and network demand, thereby maximizing network efficiency and resource utilization.		
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
This innovative approach competes with traditional cellular network infrastructures that rely heavily on fixed base stations and centralized data processing centers. UE-VBS offers a more distributed, user-centric alternative that not only reduces the need for extensive physical infrastructure but also enhances the network's ability to adapt to fluctuating demands and extend coverage dynamically.	The innovation will be realized through several strategic steps: • Developing sophisticated algorithms and software that enable mobile devices to take on various network roles (mBS, RS, CSH) as needed, based on real-time assessments of network conditions. • Implementing a decentralized framework that supports the dynamic reconfiguration of network resources, allowing devices to switch roles seamlessly without disrupting the user experience. • Conducting robust testing and optimization to ensure that the technology operates efficiently under diverse and changing conditions, and integrating feedback mechanisms to continually improve functionality and user satisfaction. This approach leverages existing mobile device capabilities and extends them through innovative software solutions and network protocols, paving the way for a more adaptable, resilient, and efficient network infrastructure suitable for the demands of next-generation telecommunication systems.	

eBOS

Innovation (1)	TRL M01	TRL M36
Title: Distributed AI for BDIx agents (in collaboration with CYENS) Innovation: Distributed AI for BDIx agents represents a significant innovation in creating autonomous, scalable, and resilient systems capable of complex decision-making and coordination. The success of these systems depends on their ability to efficiently manage resources, adapt to dynamic environments, and coordinate actions across distributed agents. Those will be developed in alignment with native-AI telecom networks.	2	4

Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**
The competition in this market is fierce, with established tech giants, telecommunications companies, and innovative startups all vying to develop and deploy advanced AI-driven solutions across various domains.	The role of this technology in this scenario is two-fold: (i) Used for selecting the far edge and end user devices, embedded in the UE-VBS computing framework, and enabling them with the appropriate role (i.e., computing, storage, networking) for either undertaking computing requests and/or establishing end-to-end communication links in minimal time, achieving thus the demanded computing and wireless capacity for a truly immersive XR/Holographic experience; (ii) Via BDIx agent collaboration (with the use of agent communication language such as FIPA ACL) between the devices provide self-organized network operations. ADROIT6G aims to use the knowledge gained in previous research conducted on the definition of the DAI Framework and BDIx agents to tackle the envisioned extreme 6G use cases. eBOS along with CYENS will contribute by extending the framework to cover the CrowdSourcing AI and Green AI requirements.

Innovation (2)	**TRL M01**	**TRL M36**
Title: AI Algorithms for joint resource management (in collaboration with CNIT) Innovation: Development of algorithms for scheduling and offloading actions across the edge and cloud domains, guaranteeing tight service delay constraints and minimum energy consumption.	2	3
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	

Competitors of the technology focused on developing algorithms for scheduling and offloading actions across edge and cloud domains, ensuring tight service delay constraints and minimal energy consumption such as Fog Computing, Cloudlets, Multi-Access Edge Computing (MEC), Distributed Computing Frameworks.	EBOS will contribute to the development of algorithms for scheduling and offloading actions across the edge and cloud domains, guaranteeing tight service delay constraints and minimum energy consumption. Intelligent Computational Offloading (ICO) is a powerful approach to enhance the computational and energy efficiency of Mobile-Edge Computing (MEC) networks. By placing MEC servers at the edge of radio access networks, like cellular base stations, edge devices can transfer resource-intensive computational tasks to nearby Edge Servers, thereby lowering energy consumption and latency. Unlike the basic strategy of offloading all tasks to the edge, ICO dynamically decides whether tasks should be processed locally (on the edge devices) or at the Edge Server. ICO has demonstrated significant performance benefits under varying network conditions, such as fluctuating energy levels, task-specific input-output requirements, and edge caching availability. Typically, this involves solving a Mixed Integer Non-Linear Programming (MINLP) problem that simultaneously addresses binary offloading and resource allocation decisions. Due to the high computational complexity, particularly in large networks, many studies have developed algorithms to reduce this complexity, such as local-search-based heuristics, decomposition-oriented methods, and convex relaxations of the binary variables. These algorithms can cause computational delays as they require numerous numerical iterations to find a satisfactory solution. Additionally, the MINLP must be frequently resolved when system parameters, such as wireless link quality, change. Thus, using traditional optimization algorithms in a highly dynamic MEC environment can be less effective, highlighting the need for more efficient solutions.

EURE

Innovation (1)	TRL M01	TRL M36
The key innovation involves the development of multi-modal generative models capable of synthetic cross generation of missing or corrupted modalities. The methodology developed allows to increase the resilience of the agents in the distributed mobile network. This approach systematically enhances the	TRL 2 – Technology concept formulated	TRL 4 – Technology validated in lab

coherence and integration of diverse data sources, ranging from visual to auditory inputs, within a unified analytic framework. By optimizing the interpretation and interaction among these different modalities, the methodology addresses complex variations in multimodal inputs and adapts dynamically to changes in the data environment. This capability is pivotal for applications requiring high reliability and adaptability in real-time decision-making processes, particularly in scenarios with fluctuating data characteristics. Traditional systems typically struggle with the integration and real-time processing of data from disparate sources, often halting operations when faced with lost or corrupted modalities. In contrast, the considered models utilize an advanced framework that maintains operational continuity and enhances decision-making accuracy through dynamic data integration. The classical methods in multimodal data processing, such as static multimodal fusion and decision-making algorithms, often require system pauses or complete shutdowns to cope with missing information. This approach is not only inefficient but also limits the potential applications in dynamic environments where data consistency is crucial, such as autonomous robotic operation and remote surveillance. The proposed method innovatively addresses these challenges by allowing for continuous system operation and real-time adaptation to changing data inputs, making it highly suitable for critical real-time applications. It facilitates a flexible integration of new modalities, enhances the robustness against data loss, and optimizes network resources, thus offering a novel application for efficient multi-modality (and multi-view) transmission.		

Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**
The novel method departs from classical solutions that typically require halting operations when modalities are lost or compromised. Traditional approaches generally lack the capability to dynamically adapt to missing data, leading to interruptions and inefficiencies in data processing workflows. In contrast, this new method utilizes robust multimodal information theory techniques to integrate and analyze data from various modalities without disruption. This ensures continuous operation even when certain data streams become unavailable, greatly enhancing system resilience and operational continuity in environments where data loss is a common challenge.	The innovation in the project will be achieved by strategically leveraging and enhancing existing technologies from platforms, which offers a diverse array of state-of-the-art pre-trained machine learning models. These models, initially developed for various applications ranging from natural language processing to complex image recognition tasks, will be adapted to operate efficiently within distributed and heterogeneous network environments typical of modern telecommunications frameworks. The adaptation process involves customizing these models to ensure optimal performance for the sources of interest, focusing on efficient data transmission and low-latency processing, crucial for edge computing scenarios. Enhancements will include algorithmic modifications that support effective data compression, essential for maintaining data integrity and operational continuity across dispersed network nodes. Furthermore, rigorous testing protocols will be established, involving both syhthetic and realistic evaluations, to validate the models' effectiveness in handling the specific challenges posed by heterogeneous networks.

ORO

Innovation (1)	**TRL M01**	**TRL M36**
To enhance the level of network automation in the control and management of 6G networks, several key strategies and technologies need to be implemented. Here's a more detailed look at the components and concepts involved: 1. Closed Loop Automation Based on Service Triggers - Closed loop automation refers to a system that can automatically adjust and optimize network performance without human intervention. In the context of 6G networks, this involves using advanced algorithms and AI to monitor network conditions and service requirements in real-time. Service Triggers:	TRL 2 – Technology concept formulated	TRL 4 – Technology validated in lab

These are specific conditions or events that prompt the network to perform adjustments. For example, a sudden increase in data traffic in a particular area might trigger the network to allocate more resources to that location. Machine learning and artificial intelligence can analyze vast amounts of data to predict and respond to network demands dynamically. This includes adjusting bandwidth, rerouting traffic, and changing quality of service parameters to ensure optimal performance. 2. The Ultra-Reliable Low-Latency Communications (URLLC) Slice is a critical component of 6G networks, designed to support applications that require extremely reliable and low-latency communication, such as autonomous vehicles, industrial automation, and remote surgery. Network Slicing in this case involves creating a dedicated virtual network tailored to the specific requirements of URLLC applications. It ensures that these applications receive the necessary bandwidth, low latency, and high reliability. Automated network management can dynamically allocate resources to URLLC slices based on real-time demand, ensuring that critical applications are always supported with the highest priority. 3. Massive Machine-Type Communications (mMTC) Slice supports a large number of connected devices, typically sensors and IoT devices, that require low data rates but need to be highly reliable and energy-efficient. Network Slicing for mMTC implies slices that are dedicated virtual networks optimized for handling a high density of devices with minimal latency and bandwidth requirements. Automated management ensures that these slices can scale efficiently as the number of connected devices increases, and it optimizes the network for energy efficiency and cost-effectiveness. 4. End-to-End (E2E) Dynamic Slicing refers to the ability to create and manage network slices that span the entire network infrastructure,		

from the core to the edge. Unlike static slices, dynamic slices can be adjusted in real-time to meet changing demands and service requirements. This means the network can respond to varying loads, user mobility, and service types. Automation requires sophisticated orchestration platforms that can automatically create, modify, and terminate slices as needed. AI and machine learning algorithms play a crucial role in predicting demand and optimizing the allocation of network resources.The successful implementation of closed-loop automation based on service triggers, dedicated slices for URLLC and mMTC and E2E dynamic slicing, 6G networks can achieve better levels of efficiency, reliability, and flexibility, meeting the diverse and demanding needs of future applications and services.		
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
Enhancing network automation in 6G networks provides a significant competitive edge by improving operational efficiency, performance, reliability, and scalability. It enables faster innovation, better user experiences, and positions companies as leaders in a highly competitive market. The ability to dynamically adapt to changing demands and maintain high service quality ensures that automated 6G networks can meet the diverse and growing needs of future applications, securing a strong market position for those who invest in and implement these advanced technologies.	A highly automated 6G network implies the proper implementation and functioning of multiple modules, such as AI and Machine Learning technologies, Orchestration Platforms and different Network Components must work together seamlessly. AI and Machine Learning technologies are central to analyzing data, predicting network conditions, and making real-time adjustments. Orchestration platforms manage the creation and maintenance of network slices, ensuring that resources are allocated efficiently across the network. Interoperability is also important, ensuring that different network components can communicate and work together is crucial for the success of automated network management. Achieving Closed Loop Automation Based on Service Triggers in 6G networks involves several steps, incorporating advanced technologies and methodologies to ensure the network can monitor, analyze, and optimize itself in real-time. Such steps are listed below: 1. Deploy Network Monitoring Tools: Install sensors and telemetry systems across the network.	

	2. Train Machine Learning Models: Use historical data to train models for predicting network behaviour. 3. Set Up a Policy Engine: Define rules for various service triggers. 4. Integrate AI Algorithms: Implement AI for decision-making based on real-time data. 5. Utilize Orchestration Platforms: Automate resource allocation and network slicing. 6. Establish Feedback Loops: Continuously monitor outcomes and adapt the system accordingly.

UOULU

Innovation (1)	TRL M01	TRL M36
The innovation lies in the development of advanced second-order federated learning (FL) algorithms that significantly enhances energy efficiency, communication efficiency, and robustness to data heterogeneity. Our second-order distributed algorithms leverage a lightweight estimation of the Hessian, combined with other schemes that innovatively enhance FL learning process improving its convergence speed and accuracy. Consequently, they drastically reduce communication rounds required by FL, thereby minimizing energy consumption and bandwidth usage. Moreover, the innovation is robust to heterogeneous data distributions hence ensures reliable performance across diverse real-world applications, aligning with the sustainability goals of the ADROIT6G. **Energy and Communication Efficient Second-order Federated Learning for Next-Generation Networks** The innovation of the proposed methods surpasses the state of the art in several keyways: Enhanced Communication Efficiency: Unlike traditional first-order methods that use methods that rely on full Hessian matrices, we propose algorithms that share a lightweight representation of the descent direction or of the Hessian itself. This reduces communication overhead significantly, as only vector size	2- Technology concept formulated	4- Technology validated in lab

parameters and/or periodic lightweight Hessian estimations are shared, minimizing the bandwidth required for distributed learning. Improved Energy Efficiency: The design of our proposed algorithms accelerates significantly the convergence of the learning process resulting in energy conservation, making it highly suitable for large-scale and resource-constrained environments. Faster Learning: Unlike first-order methods, second-order methods rely on the Hessian's information to leverage the curvature information of the loss function. Hence, this results in guiding and expediting the convergence process much faster. Robustness to Data Heterogeneity: By leveraging the Hessian's curvature information, the algorithm ensures stable and reliable performance across diverse data environments, reducing the drift in local updates and enhancing overall model accuracy. Overall, we propose innovative approaches that combine these enhancements to offer a scalable, efficient, and robust FL solution that outperforms existing state-of-the art methods.		
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
By addressing key limitations of current state-of-the-art and improving communication and energy efficiency, enhancing adaptability to heterogeneous data, and ensuring robust and scalable performance, our second-order algorithms demonstrate high competitiveness and leading solution in the realm next-generation 6G federated extreme learning environment.	The innovation of our proposed algorithms leverages and extends existing technologies in FL and optimization methods including first and second-order methods introducing lightweight adaptive, efficient, stable, and accurate learning scheme. Rendering to its standout features, these methods enhance the TRL of FL. It moves beyond theoretical constructs to practical, scalable, and efficient applications, demonstrating improved communication and energy efficiency, robustness, and adaptability in diverse and large-scale settings. Our solutions align well with ADROIT6G use cases and hence it will be implemented in testbeds and/or emulators offered by other industrial partners allowing to examine its ability to integrate with other innovations within ADROIT6G architecture. This step would certainly provide valuable feedback and identify any practical challenges allowing for	

	customized optimization ensuring competitive performance and hence advancing the innovation technology readiness level higher.

SIE

Innovation (1)	TRL M01	TRL M36
NTN computing and communication Satellite based NTN communication is not a new topic since satellites exist since many decades. Future 6G will tightly integrate upcoming satellite systems and constellations. Still, 6G will not be able to provide a full solution to all problems. Satellites may be unreachable for certain times, bandwidth restrictions compared to terrestrial cellular exist, and delays and scalability can also pose a challenge. A Space-based edge-cloud concept can mitigate such problems, which allows, for example, to apply caching and pre-processing of data, run AI, messaging systems, or protocol converters close to terrestrial devices. The edge-cloud consists of constraint compute resources in the devices (e.g., in trains, vehicles, robots) but also in-satellite computing resources, which may allow short control loops, thus reducing further end-to-end delays. An important challenge to tackle in ADROIT6G is the management, configuration, and deployment of cloud services in such a distributed fog-like system. Space-based edge cloud solution is expected to mitigate interruptions or general communication flaws of satellite networks. Such principles can also be applied in terrestrial 6G networks, thus enabling resilient services, such as those required for critical infrastructure or services during in catastrophes or otherwise seriously impacted networks. This will open a new window of opportunity for emerging extreme 6G applications.	**TRL 3: Experimental proof of concept**	**TRL 4: Technology validated in lab**

Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**
Existing solutions are lagging behind with respect to this innovation, showing to be incomplete with respect to one or more of the following aspects: *(i)* time-varying topology with real-time mobility and update of link characteristics; *(ii)* inadequate inter-connection options with external environments; *(iii)* disregard support of Edge computing capabilities.	This innovation will be achieved as emulation framework for NTN testbeds, either in terms of Satellite communications (SatCom) and Satellite computations (SatEdge), serving as a tool for systematic validation of their readiness for distinct application scenarios. This innovation will depart from the existing SIEMENS NTN testbed and expand it from TRL 3 to TRL 4 towards more flexibility and robustness of the emulations.

MLNX

Innovation (1)	**TRL M01**	**TRL M36**
P4 Open Programmability Advanced Open Source P4 Libraries for 6G Networks contributing to advanced open-source P4 libraries MLNX contributes to advanced open-source P4 libraries combining telemetry technology and network slicing concepts tailored for heterogeneous 6G systems. This innovation surpasses current state-of-the-art in terms of programmability and adaptability in diverse network environments.	TRL2	TRL3
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
This innovation competes with traditional network programming approaches that lack the flexibility and integration of telemetry and network slicing. Its edge lies in enhanced programmability and real-time adaptability.	The innovation builds on existing P4 programming frameworks, extending them with new telemetry and slicing capabilities. Steps include: • Development of new P4 libraries integrating telemetry and network slicing. • Validation through integration into the ADROIT6G framework. • Release to the open-source community, promoting widespread adoption and further enhancement. • Continuous performance evaluation and optimization in real-world testbeds	

NXW

Innovation (1)	**TRL M01**	**TRL M36**
Closed-loop Governance • Full automation in terms of provisioning, configuration, runtime update, and termination of closed-loops used in network optimization • Supports integration of closed-loops with the ADROIT6G CrowdSourcing AI Framework for model management • Supports deployment and management of BDIx agents	2	4
Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**	
The Closed-loop Governance has two key innovations that go beyond the functionalities available, or being developed in current solutions. The first is expanding the principle established in Hexa-x-ii with innovative modules for the interaction with the ADROIT6G CrowdSourcing AI framework for full model automation for AI-based closed-loop functions. The Closed-loop Governance also extends the concepts in ETSI GS ZSM 009-2 to deploying and overseeing a diverse range of closed-loops including Beliefs – Desires - Intention extended agent (BDIx agents).	Leveraging work in Hexa-x-ii, which introduces closed-loop governance framework for full automation in provisioning, configuration, runtime updates, and termination of related closed-loop functions. The work in Hexa-x-ii, and the extensions provided by developing and implementing these innovations into the framework, follow the baseline set out by ETSI ZSM which provides an end-to-end operable framework, solutions and core technologies enabling AI-driven zero-touch automation of emerging and future networks and services.	
Innovation (2)	**TRL M01**	**TRL M36**
AI/ML Pipeline Manager and Catalogue framework to manage the deployment of training and runtime AI/ML functions defined through pipelines, using a service-based approach for on-demand and scheduled deployments over heterogeneous infrastructure in multi domain scenarios automation in the deployments of distributed and federated learning over multiple domains	2	4

Competition	**How Innovation will be accomplished (e.g., existing technology and how it was leveraged and extended to increase TRL)**
Baseline state of the art solutions include pipeline and workflow orchestrators such as Prefect, Argo, Apache Airflow, and Kubeflow. Leveraging on the available solutions, the functionality of the ADROIT6G AI/ML Pipeline Manager is enhanced beyond the state of the art by supporting deployment over diverse technologies throughout multiple technological domains to be able to assign pipeline deployments via agents deployed on physical/virtual infrastructure; with a flexibility that allows for the optimization of deployed services based on a variety of metrics not available in other solutions.	Prefect pipeline manager is an opensource solution aimed at the running of pipelines in multi-execution environments scenarios. The pipelines handled in Prefect use a task and flow approach to code management, allowing a broad range of training and deployment techniques. Prefect is leveraged and extended to provide a solution that automates the deployment of distributed and federated learning scenarios, abstracting the complexities of multi-domain management. MLFlow provides a cataloging service and model instance creation functionalities that in combination with the pipeline manager can be leveraged to deploy cloud-native model run-time instances attached to services that expose external interfaces for inference.

6.3 Filed Patents

At the present stage the following two patents were filed by SIE in September 2023:

1. “Method to configure a network for in-network computing of network data, method to operate a network device, function orchestration module for a network, network device for a network, network, computer program product and computer-readable storage medium”
2. “Method to configure a network for in-network computing, method to operate a network for in-network computing of network data, workflow orchestration module for a network, network, computer program product and computer-readable storage medium”

7 Conclusions

This document presents the public deliverable D6.2 "Dissemination, Communication, Standardisation, Exploitation, IPR, Clustering- Initial" of the ADROIT6G project within Work Package 6.

The delivery covers the Dissemination, Communication, Standardisation, and Exploitation activities undertaken in the project's initial 18 months. It outlines achievements in dissemination and communication, highlighting key performance indicators achieved so far. Additionally, it details the consortium's participation in public engagement events including conferences, invited talks, and exhibitions. Regarding standardisation, the deliverable discusses internal service results and partner engagement with standards. Lastly, it outlines each partner's exploitation plans and activities conducted during the reporting period.

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8 References

[1] ADROIT6G – Deliverable D6.1 “Project website and social media presence”
[2] ETSI GS ZSM 006 V1.1.1, “Zero touch network and Service Management (ZSM); Proof of Concept Framework”, 2018
[3] ETSI ZSM PoC Topics, https://zsmwiki.etsi.org/index.php?title=PoC_Topics
[4] ADROIT6G - DEMO on AI/ML framework and closed loops for automated service operation (youtube.com)

Annex I: Partners' Answers to Project Exploitation Tools

Market Analysis Questionnaire – Partners' Answers

Partner Name	Market Analysis Questionnaire
ATH	ATH/ISI is a public non-profit research institute, thereby it belongs to academic partners. Among the principles of ATH/ISI activities is to develop research programs and prepare market research for the commercial exploitation of research results. The ADROIT6G results that could be exploited by ATH/ISI are the numerous beyond SotA algorithms founded on the concepts of Artificial Intelligence, Deep Learning and Reinforcement Learning, system architectures, design concepts and technologies which are related to Algorithmic and Network and System innovation. ATH/ISI will exploit these results to disseminate the high impact of ADROIT6G technologies in vertical industry.
CYENS	CYENS is a research center that is collaborating with the University of Cyprus. Thus, we embrace sophisticated network infrastructures, particularly emphasizing the transition to 6G with ADROIT6G. Our target is to integrate RIS into our final system to enhance our research capabilities improve our localization functionalities, caching investigation, and examine additional AI/ML model integrations to the finalised system. Expand our collaboration with industries (i.e., OULU, SIEMENS, ORO, ISI, MLNX, NOVA, CAFA) and Universities (i.e., CNIT, EURE, ATH) in terms of research. Potential Users: PhD/Msc students that will investigate and extend the capabilities of the final ADROIT6G.
CNIT	CNIT as a scientific and academic community targets enhancements to the syllabus of its Master/PhD courses, training Master/PhD students during their thesis and early-stage researchers. The main exploitable ADROIT6G results within Master/PhD courses are: AI/ML-based network services, and network services orchestration. Enhancing the training offer at Master/PhD levels requires 2-3 years after the completion of the project. CNIT could collaborate with other academic partners within the ADROIT6G consortium, such as EURE, CYENS, and outside the consortium to improve the training of its Master/PhD students. CNIT is a partner of key associations and technology clusters, such as 6G-IA, SNS JU, one6G.
EURE	A research center and university with behaves as a non-profit organization. It is not linked to particular business markets. However, EURE will improve the content of its courses
OULU	There are various ADROIT6G results OULU can exploit including the innovative applications and services that can be leveraged based on the holographic supported education use case, as well as the other project use cases innovations including the AI-driven robotics applications. Potential customers: could target a range of end users from different industries including education, research and development organizations, health care, among others.

MLNX	MLNX/NVIDIA is a leading provider of network equipment, including network interface cards, switches, and cloud-edge computing solutions. In addition to its expertise in graphic processing units, the company offers end-to-end accelerated processing capabilities to a wide range of customers, such as hyperscalers, data centers, telecom and datacom operators, as well as specialized industries like gaming, automotive, healthcare, and government.
SIEMENS	Potential competitors could include other companies or research institutions working on similar aspects of 6G technology, IoT service providers/platforms, and in the Railway vertical domain. To gain a competitive advantage over these potential competitors, ADROIT6G needs to effectively disseminate and outreach the project results, while protecting developed ideas and/or solutions through IPR.
ORO	ORO is the Romanian leading provider operator, including fixed and mobile operation and also computing technologies and infrastructure. New 6G features will expand the MNOs capabilities in terms of novel services for B2B and B2C, with relevant impact also in the 5G/6G Network implementation, including novel Management and Orchestration techniques, AI/ML support and Path to Autonomous Level 4 implementation.
CAFA	CAFA is the Estonian robotics company, whose clients are both public sector and private companies. The control and communication applications of UGVs and UAVs developed within the ADROIT 6G project have a good market opportunity especially from the point of view of industrial and construction companies, because these scenarios are practiced within PoC #2a and #3. This provides good material that can be used to provide UGV/UAV/IoT sensor solutions to these sectors.
EBOS	Move towards advanced network architectures, especially focusing on the evolution to 6G. Expand 5G IoT testbed's capabilities to seamlessly fit the needs of new 6G features. Potential customers: Mobile Device Users that use mobile devices equipped with BDIx agents that have integrated AI/ML capabilities.
IQU	The knowledge gained from the integration of the developed solutions to the IQU's infrastructure will enhance IQU's network management solution, offering significant advantages comparing to their competitors. Also, as a software house, the development predictors for real-time VNF placement will strengthen IQU's position in the market, as it can be leveraged by telecom operators, increasing their market share and revenue.
NXW	NXW expects to increase its know-how on orchestration of vertical services using edge and extreme edge resources including satellite and UE-VBS, as well as model training and serving management of AI functions, specifically applied to zero-touch closed-loop applications. The software tools for AI/ML management and closed-loop orchestration that NXW develops in ADROIT6G will be used to enhance the company product portfolio of software solutions for service and network management and orchestration. The hands-on experience gained through participating in ADROIT6G strengthens NXW's position in the consultancy market as a third-party software developer and technology provider. This expertise will be leveraged to offer custom solutions in network management, control, and automation for vendors, small operators, and service providers.

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Joint Exploitation Questionnaire – Partners' Answers

Partner Name	Joint Exploitation Questionnaire
ATH	Currently, no joint exploitation opportunities can be reported.
CYENS	Our plans include joint patents with ADROIT6G partners and the creation of open-source solutions, which can be offered under a Licensing and Operation & Support scheme.
CNIT	The ADROIT6G Platform could provide competitive advantages to CNIT in efficient AI/ML model training and inference tasks for network services. It will also enable CNIT to extend the functionality of its 5G testbed and expand its R&D activities putting the basis for possible joint exploitation opportunities.
EURE	Don't have exploitation plans for the results. Do expect to build on the current work during future European Projects. The opportunities that have been born from interaction with CNIT and ORO are particularly interesting for future research.
OULU	The use of the ADROIT6G Platform could address needs and drive several markets, mainly from research perspective, among which could be: • Enabling providing ultra-reliable, massive connectivity, dynamic, privacy requiring, scalable and other possible heterogeneous and highly demanding services and various applications in the domain of telecommunications, computing, and robotics. • Meeting the growing demand for ultra-reliable educational services that could align with the use cases driven based on the platform including the holographic teaching. • Expediting the process of campus expanding the university is seriously considering, possibly again through utilizing the platform and relevant use cases such as collaborative construction robots and dynamic on demand services the non-terrestrial networks can provide. • Advancing research capabilities by providing access to state-of-the-art infrastructure for experimentation, validation, and facilitating even more technological innovations. Other exploitation opportunities including application licensing, or any joint activities including possibly standardization or marketing related ones have not yet been considered.
MLNX	MLNX expects to transfer the developments in ADROIT6G into its public software development kits, which are made available to developers. In ADROIT6G, the technical developments will be integrated with libraries related to data-processing units for the public We have not identified any joint exploitation opportunities to be reported on. However, the use of the ADROIT6G platform could potentially provide the following advantages: • Continuous updates and ongoing support securing that the technology stays compatible- with the latest advanceme-nts. • Optimization for applications in gaming, automobiles, healthcare, and gove-rnment sectors.
SIE	Currently, no joint exploitation opportunities can be reported.

ORO	Identified enhanced user experience and operational efficiency drives, telecom operators to implement closed-loop systems. These systems enable automatic optimization of network resources, ensuring service quality and reducing operational costs, Green Networking and Sustainability and enhanced management.
EBOS	Identified joint exploitation opportunities with IQU and CYENS. Specifically, one project's KER will be utilized by eBOS and IQU, focusing on DRL-based Zero-Touch Resource Management. The second KER, involving both eBOS and CYENS, revolves around the control of AI model selection and refinement.
IQU	IQU will seek joint exploitation opportunities with eBOS by considering the DRL-based Zero-Touch Resource Management.
NXW	Currently no specific joint exploitation opportunity has been identified. As the project will progress with the WP5 integration and PoC implementation and validation activities, opportunities may arise in network and service automation through closed loops functions implemented by PoC partners and governed and orchestrated by the NXW closed loop governance.

Outcomes Register – Partners' Answers

Partner Name	Outcomes Register
ATH	The first outcome in the project focuses on predictors design for the correct placement of the services at MEC nodes, as well as deciding their live migration and scale-out when needed, with energy optimization being one of the main objectives. The second outcome in the project relates to elements of the M&O and control frameworks of ADROIT6G, implementing the lifecycle management and resource control of end-to-end network slices spanning multiple administrative domains in the cloud, edge, and far edge network segments.
CYENS	BDIx agents and UE-VBS showcase and implementation code that can be shared via GitHub along with the code for the cloud rendering and the showcase of a 3D live broadcast in the classroom using hologram and/or VR glasses. Additionally, the progression of artificial intelligence and machine learning techniques to effectively control and use extensive collections of distributed devices.
CNIT	Hands on training approach - Advance SOTA in the areas of distributed and collaborative AI/ML techniques for network services and applications. Provide opportunities for Master/PhD students and young researchers to experiment with 5G/6G technologies. Enhance courses for Master/PhD students and young researchers for implementation of some stages of the AI/ML pipeline. Release open-source SW for the implementation of some of the AI/ML pipeline stages.
OULU	Development of crowdsourcing AI models for 6G networks-We have developed advanced AI models tailored for 6G network optimization. These models enhance energy and communication efficiency, scalability, fairness, and robustness capabilities of collaborative learning, significantly improving network efficiency and performance.
MLNX	Advancement of Open Source P4 Libraries - Contribution of open-source P4 libraries with telemetry technology and network slicing concepts for heterogeneous 6G systems

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	Advancement of AI/ML tools for managing and exploiting large sets of distributed devices - Integrating enhanced AI/ML capabilities into the ADROIT6G platform for managing distributed devices, our company aims to strengthen its market position and create revenue streams through licensing. This requires bolstering the AI/ML team's knowledge to become a leading provider of AI-based device management technologies.
SIE	Key exploitable results include 6G NTN testbed, providing a platform to evaluate technology concepts, products, and customer solutions regarding feasibility and viability.
ORO	Expand ORO5G testbed's capabilities to seamlessly fit the needs of new 6G features, Network automation through zero-touch management and Closed Loop Dynamic Slice Reconfiguration for Self-driven 6G Infrastructures.
CAFA	The main outcomes are proof-of-concepts of Command-Control cloud native MEC applications for UGV/UAV/IoT sensors via 5G/6G, which can be used for further product development.
EBOS	Exploitable ADROIT6G results with commercial potential, 3-4 years after the completion of the project include: DRL-based Zero-Touch Resource Management. Control AI models' selection & refinement.
EURE	Improve existing software laboratories in the Master and PhD programs courses, including the possibility for students to investigate the new 5G/6G technologies and their interaction with modern machine learning paradigms. Curation of a public software code-base which includes the details to reproduce and utilize the machine learning models which have been developed for the project.
IQU	The main outcome from this project is related to the development of the decision engine framework, which utilizes AI-driven techniques in multiple ways, including the augmentation of its capabilities and its efficiency, and the optimization of its operations.
NXW	Two main relevant outcomes are planned to be delivered and contributed by NXW: • The advancement beyond SoTA in the governance of AI-driven closed-loops for automated network control with a solution for diverse distributed closed-loop functions, placements, and control structures, as well as integration with AI/ML management to deploy and manage solutions for inference needed by AI-enabled closed-loop functions. • The creation of a framework for the lifecycle management and optimal placement of training and deployment pipelines for AI models, including scalable model and metadata tracking.