



This deliverable has not yet been externally reviewed and approved by the European Commission.

Project no.:	101095738		
Project full title:	6G SHort range extreme communication IN Entities		
Project Acronym:	6G-SHINE		
Project start date:	01/03/2023	Duration	30 months

D6.1 - REFINEMENT AND UPDATE OF DISSEMINATION, EXPLOITATION AND COMMUNICATION PLANNING

Due date	31/08/2023	Delivery date	31/08/2023
Work package	WP6		
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Version	V1.0		
Reviewer(s)	Gilberto Berardinelli (AAU), Giulia Torcolacci (CNIT)		
Dissemination level	Public (PU)		

VERSION AND AMENDMENT HISTORY

Version	Date (MM/DD/YYYY)	Created/Amended by	Changes
V0.1	06/30/2023	Frank Burkhardt	First version
V0.2	08/15/2023	Frank Burkhardt	Update of the entire document based on reviewer's comments to v0.1
V0.3	08/16/2023	Frank Burkhardt	Update document based on reviewer's comments to v0.2
V0.4	08/21/2023	Davide Dardari	Review
V.05	08/28/2023	Gilberto Berardinelli	Review
V1.0	08/31/2023	Frank Burkhardt	Update document based on reviewer's comments to v0.3

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ABBREVIATIONS

Abbreviation	Explanation
3GPP	3rd Generation Partnership Project
6G SNS	6G Smart Networks and Services
AAU	AALBORG UNIVERSITET
Apple	Apple Technology Engineering B.V. & Co. KG
BOSCH	ROBERT BOSCH GMBH
CNIT	CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LE TELECOMUNICAZIONI
COGNIN	COGNITIVE INNOVATIONS PRIVATE COMPANY
EC	European Commission
ETSI	European Telecommunications Standards Institute
ESoA	European School of Antennas and Propagation
eURLLC	Extreme Ultra Reliable Low Latency Communication
FHG	FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG EV
IEEE	Institute of Electrical and Electronics Engineers
IMEC	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM
Interdigital	INTERDIGITAL EUROPE LTD
ITU	International Telecommunication Union
JU	Joint undertaking
Keysight	Keysight Technologies Finland Oy
ML	Machine learning
Nokia	NOKIA DENMARK AS
RIS	Reconfigurable intelligent surfaces
Sony	Sony Nordic (Sweden), branch of Sony Europe B.V. (NL)
UMH	UNIVERSIDAD MIGUEL HERNANDEZ DE ELCHE
UK	United Kingdom

EXECUTIVE SUMMARY

This document presents the communication and updated exploitation plan of the 6G-SHINE project. The purpose of this plan is to maximize the impact of the overall project. This is done by defining and planning the relevant topics of communication, dissemination, standardization, and exploitation.

The specific addressed topics are:

- Issuing the right information to the relevant stakeholders at the right time
- Providing sufficient reach to the scientific community as well as to the industrial and public sectors
- Creating and sustaining the interest of external stakeholders in the project and the project's achievements
- Ensuring future fitness and sustainability of the project

To achieve these objectives, an overall communication, dissemination, standardization, and exploitation plan has been established. This plan will be continuously reviewed and updated according to the project's progress.

This document includes the revised version of the plan published originally in the project proposal. The updates consider the results of the project during the first months. It takes into account the definition of the communication channels, their usage, and the addressed stakeholders as well as concrete dissemination activities and their planning. Standardization activities are defined and the current plan for individual but also joint exploitation is provided. Additionally, to ensure a consistent presentation of the project in reports as well as social media and further presentations, a project branding has been defined and is provided in this document.

1 INTRODUCTION

The 6G-SHINE project is centred on the development of new technology components for short-range wireless communications with the purpose of providing ground-breaking research towards future 6G wireless networks. In order to maximize the project impact, it is of utmost importance to communicate the project's achievements to the relevant stakeholders, as this guarantees the practical application of the research findings in the future. Therefore, meticulous planning is essential for all endeavours related to communication, dissemination, and exploitation of the project's achievements, just as it is for the actual research process.

This document describes the plan for communication, dissemination, and exploitation of the 6G-SHINE project, based on the submitted proposal, updated by the input of the first months of the project. Nevertheless, this plan only acts as a starting point, provides guidelines for the project communication, dissemination, and exploitation, and is continuously updated throughout the course of the project.

The document is structured in the following main sections:

- **Communication**
The purpose of communication is keeping the different stakeholders of the project informed about the project's current status. This section describes the required communication channels of the project and their content.
- **Dissemination**
The purpose of dissemination is to distribute the knowledge achieved during the project to the different stakeholders of the project. This section describes the required dissemination activities required to achieve an optimum transfer of the achievements to the relevant stakeholders.
- **Standardization**
The purpose of standardization is to align with the ongoing and future standardization process and to transfer the projects achievement into these processes. This section describes which (pre)standardization bodies will be addressed.
- **Exploitation**
The purpose of exploitation is to ensure the sustainability of the project research activities by relating them to exploitation plans of individual or multiple partners. This section describes the exploitation plans of the different partners.

2 COMMUNICATION

2.1 KEY MESSAGES

The key messages of the 6G-SHINE project are:

- 6G-SHINE technology components can make wireless communications as fast and reliable as the wired counterpart.
- 6G-SHINE will develop solutions that enable efficient wireless communication inside of industrial, vehicular, and consumer entities.
- 6G-SHINE technologies provide the connectivity for tangible virtual interaction.

These messages are based on the facts that 6G-SHINE conducts research on multiple technology enablers that have the common goal of enabling wireless communication for use cases and applications with requirements in terms of data rate, latency, and reliability which are significantly more demanding than what is supported by current radio technologies.

2.2 TECHNOLOGY MAP

Important technological aspects and their relevance to 6G-SHINE are provided in this technology map that is meant to characterize the project and help to relate it to the stakeholders' interests and further SNS JU projects for potential cross-project dissemination.

Table 1 6G-SHINE technology map

Item Nr	Topic	Description
1	AI	Channel and activation pattern prediction for scheduling and resource management, which may rely on context information like position, heading and speed. Explore reinforcement learning methods for both detection and mitigation of jamming attacks
2	Beamforming	Fast analog/hybrid beamforming solutions exploiting the peculiarities of in-X subnetwork scenarios.
3	Channel model	New radio propagation models tailored to specific short -range characteristics of subnetwork
4	Coexistence	Nearfield communication for interference reduction
5	eURLLC	Enhanced channel estimation and low-latency feedback mechanisms
6	Full Duplex	Scheduler design able to multiplex services with extreme requirements with other services with best effort data rates for very close distance communication.
7	Macrodiversity	Multilink PHY implementation supporting frequency diversity and novel network coding approaches.

		Multi-connectivity and multi-hop links among subnetworks in a same entities, and devices in a subnetwork.
8	Resilience	PHY mechanisms that are natively able to achieve robustness to jamming and malicious attacks, while keeping complexity low.
9	Resource Management	<p>Methods for enabling seamless interaction between centralized and distributed radio resource management modes.</p> <p>Methods for computation resource profiling as well as the dynamics of the wireless medium for offloading decision making, and system configuration adaption</p>
10	RIS	Extended coverage and reliability communications aided by reconfigurable intelligent surfaces (RISs).
11	subTHz	Models for characterizing each component of a sub-THz transceiver.
12	Unlicensed Spectrum Access	Alternative to LBT + backoff probabilistic based strategies, for the sake of minimizing the medium access delay while ensuring fairness

2.3 PROJECT BRANDING

The project branding consists of the 6G-SHINE logo and the associated colours and fonts. An insight of the selected project layout is visualized in the following.



2.4 COMMUNICATION STRATEGY

The communication strategy of 6G-SHINE follows the principle of reaching external stakeholders at the right time. Consequently, various communication channels have been established to cater to the specific stakeholders that need to be addressed. Furthermore, stakeholders are promptly notified in advance about significant upcoming events pertaining to the project and are subsequently reminded of the event's occurrence. Additionally, a summary is provided to stakeholders after the event, ensuring that the key messages conveyed during the event are reinforced and retained. To facilitate this process, a comprehensive communication plan is devised, outlining the design of the communication channels, and specifying their intended usage.

For a coherent public presentation, the external communication needs to have a single point of contact through which all external communication is directed. Within the 6G-SHINE Consortium AAU acts as this single point of contact and is responsible for the projects' communication activities.

2.5 STAKEHOLDERS AND TARGET GROUPS

The first step of setting up the project communication is to clarify whom the communication wants to address, why the project wants to address them and what the related communication channels are. This is summarized in Table 2.

Table 2 List of stakeholder/target group types and related communication channels

Stakeholder/ Target Group	Communication Purpose	Related Communication Channels/Materials
Equipment and device/IoT manufacturers	<p>Information on the current project achievements for the sake of keeping the stakeholder interested in the project's results.</p> <p>Raising the stakeholders' interest to join follow-up projects and activities.</p> <p>Receiving feedback from stakeholders regarding the project's research relevance to them.</p>	<ul style="list-style-type: none"> - Booth/presentations at fairs - Presentations at Industrial Conferences and associations - Journal Papers - Leaflets - Newsletters - Press Releases - Social media - Videos - Webpage - Whitepapers
Industry-led alliances and initiatives	<p>Information on the current project achievements for the sake of keeping the stakeholder interested in the project's results.</p> <p>Providing the stakeholder with information so they can act as a proxy and distributor for the project key results to lead manufacturers and verticals.</p> <p>Raising the stakeholders' interest in supporting the project's results in the upcoming standardization process.</p> <p>Receiving feedback from stakeholders regarding the project's research relevance to them.</p>	<ul style="list-style-type: none"> - Booth/presentations at fairs - Presentations at Industrial Conferences and associations - Journal Papers - Leaflets - Newsletters - Press Releases - Social media - Videos - Webpage - Whitepapers
Large national 6G initiatives	<p>Information on the current project achievements for the sake of keeping the stakeholders interested in the project results.</p> <p>Receiving feedback from the stakeholders on potential synergies and upcoming collaboration opportunities.</p>	<ul style="list-style-type: none"> - Presentation at events of National initiatives - Journal Papers - Leaflets - Newsletters - Press Releases - Social media - Videos - Webpage - Whitepapers
Operators and vertical end-users	<p>Information on the current project achievements for the sake of keeping the stakeholders interested in the project results.</p> <p>Raising the stakeholders' interest to join follow-up projects and activities.</p>	<ul style="list-style-type: none"> - Booth/presentations at fairs - Presentations at Industrial Conferences and associations - Journal Papers - Leaflets

	Receiving feedback from stakeholders regarding the project research's relevance to them.	<ul style="list-style-type: none"> - Newsletters - Press Releases - Social media - Videos - Webpage - Whitepapers
Public interest	<p>Information on the current project goals and achievements.</p> <p>Mitigating doubts of the stakeholder regarding the advances in the technology and potential associated risks and promoting the long-term societal benefits of the designed technologies.</p>	<ul style="list-style-type: none"> - Popular-science magazines - Press Releases - Social media - Videos - Webpage
Policymakers and regulators	Information on the current project achievements, raising and keeping the stakeholders interested in the project's results.	<ul style="list-style-type: none"> - Lobbying - Presentations at political events - Press Releases - Videos - Whitepapers
Scientific community	<p>Information on the current project achievements for the sake of keeping the stakeholder interested in the project's results.</p> <p>Receiving feedback from the stakeholders on the quality and validity of the research conducted.</p> <p>Receiving input from stakeholders regarding the project research's relevance to them.</p>	<ul style="list-style-type: none"> - Papers at Scientific Conferences - Journal Papers - Leaflets - Newsletters - Press Releases - Social media - Videos - Webpage - Whitepapers
SNS JU management and further SNS JU projects	<p>Information on the current project achievements for the sake of keeping the stakeholders interested in the project results.</p> <p>Receiving feedback on potential synergies and collaboration opportunities.</p>	<ul style="list-style-type: none"> - Leaflets - Newsletters - Press Releases - Social media - SNS communication taskforce - Videos - Webpage - Whitepapers
Standardization bodies	<p>Information on the current project achievements for the sake of keeping the stakeholder interested in the project's results.</p> <p>Raising the stakeholders' interest in supporting the projects results in the upcoming standardization process.</p> <p>Receiving feedback on the project research relevance for the stakeholder.</p>	<ul style="list-style-type: none"> - Technical input - Whitepapers

The most relevant potential stakeholders are listed in Table 3.

Table 3 List of stakeholders associated with a target group.

Target Group	Relevant Stakeholders
Equipment and device/IoT manufacturers	Equipment and device/IoT manufacturers that are concerned with producing devices and infrastructure equipment, as well as companies that are integrating wireless modems into their devices and machinery to enable them with wireless connectivity.
Industry-led alliances and initiatives	5G-ACIA https://5g-acia.org 5GAA http://5gaa.org/ 6G-IA https://6g-ia.eu/ NextGA https://nextgalliance.org/ NGMN https://www.ngmn.org/ O-RAN https://www.o-ran.org/ Small cells forum https://www.smallcellforum.org/ Sparklink alliance http://www.sparklink.org.cn/en
Large national 6G initiatives	Finland: 6G Flagship (http://6gflagship.com) Germany: 6G Platform (https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/6g-plattform) 6GEM (https://www.6gem.de/de/) 6G-life (https://6g-life.de/) 6G-RIC (https://6g-ric.de/) Open6GHub (https://www.open6ghub.de/) France: France 2030 Netherlands: Future Networks Services UK: Wireless Infrastructure Strategy Italy: RESTART (https://www.fondazione-restart.it/)
Operators and vertical end-users	The communication service providers and the companies using these services
Public interest	The generally interested public
Policymakers and regulators	European Commission (EC) and national policymakers like members from the national ministries responsible for research as well as members of the national frequency regulation bodies
Scientific community	Universities, research institutes, individual scientists

SNS JU management and further SNS JU projects	6G SNS https://smart-networks.europa.eu/ 6G SNS project portfolio https://smart-networks.europa.eu/project-portfolio/
Standardization bodies	3GPP https://www.3gpp.org/ ETSI https://www.etsi.org/ IEEE https://www.ieee.org/ ITU https://www.itu.int

2.6 COMMUNICATION CHANNELS

The communication channels to be established are defined by what type of content they need to distribute to finalise the communication picture. This is summarised in Table 4.

Table 4 List of communication channels established by 6G-SHINE.

Communication Channel	Content
Booth/presentations at fairs	Graspable presentation of current achievements of the project centred around demonstrators for the achievements.
Leaflets	High-level summary of the project and its achievements
Newsletters	High-level short summaries of project's latest achievements and activities
Popular-science magazines	High-level publication, where scientific contents are presented in Layman's terms
Press Releases	High-level publication about specific achievements or general progress of the project
SNS communication task force telcos	High-level dissemination of project achievements
Social Media	Short current event reporting as a keep-alive
Videos	Videos of presentations, laboratory activities videos, and high-quality marketing videos
Webpage	The project in a nutshell with links to all publicly accessible communication channels, as well as to the public deliverables
Whitepapers	Vision statements of the project as well as an overview of the project's contents and achievements.

The website and social media links have been established in the project's initial phase.

Social media

6G-SHINE has launched the following social media channels:

- LinkedIn page: <https://www.linkedin.com/company/6g-shine-project>
- Twitter: <https://twitter.com/6gshine>
- Youtube: <https://www.youtube.com/@6gshine>

These social media channels will be used to promote the project's communication and dissemination activities, as well as the most relevant findings of the project, to reach a broad audience. At the end of August 2023, the 6G-SHINE LinkedIn page has already more than 240 followers.

Website

The 6G-SHINE website (<http://6gshine.eu>) was launched in the project's third month. The website will collect all the relevant information about the project, including the general background, an overview of the project's technical scope, and the appropriate dissemination and communication activities. The website will act as the main communication tool of the project.

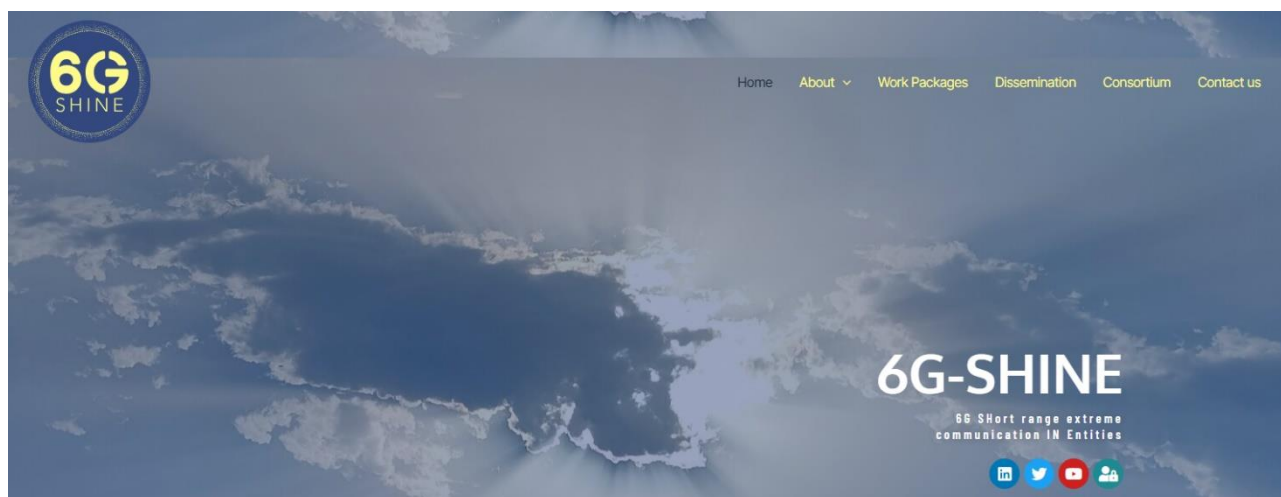


Figure 1 6G-SHINE website homepage

The project website will be constantly updated, and relevant statistics will be monitored.

2.7 COMMUNICATION PLAN

The communication plan outlines the specific times when the various communication channels should be utilised. The tentative schedule is provided in Table 5.

Table 5 Tentative communication plan (30.08.2023)

Time	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Leaflets		1								1
Press Releases	1			1		1		1		1
Newsletter		1			1		1		1	1
SNS Alignment	1 telco per month									
Social Media	2 posts per month									
Videos	2	1	1	1	1	1	1	1	2	2
Website	1	~2 updates per month								

This overview is detailed during the project with a forecast of at least six months showing the upcoming activities and months for which they are planned. The activities in the forthcoming two months also provide a fixed date for when the action is scheduled. We aim to collect information regarding the number of participants and established contacts for each communication activity.

Table 6 Detailed Communication Plan (30.08.2023)

Date	Status	Communication Activity	Description
21.03.2023	Done	First press release of the project	Press release of the project on the AAU website, introducing the project and the kick-off
22.03.2023	Done	First LinkedIn post	LinkedIn post linked to a press release
22.03.2023	Done	First Tweet	The tweet linked to a press release
23.03.2023	Done	First communication taskforce telco	SNS JU communication taskforce telco
27.03.2023	Done	Video of the SNS webinar	Video of the project introduction at the SNS webinar
27.03.2023	Done	LinkedIn post for the video	LinkedIn post linked to the project presentation video at the SNS webinar
27.03.2023	Done	Tweet for the video	Tweet linked to project presentation video at the SNS webinar

04.05.2023	Done	Communication taskforce telco	SNS JU communication taskforce telco
05.05.2023	Done	Post promoting the CNIT Ph.D. course	Post promoting the CNIT PhD course on short-range radio propagation
05.05.2023	Done	Tweet for the CNIT PhD course	Tweet promoting the CNIT PhD course on short-range radio propagation
26.05.2023	Done	Post promoting the keynote by Prof. Davide Dardari at ICC 2023	Post promoting the keynote by Prof. Davide Dardari at ICC 2023
26.05.2023	Done	A tweet promoting the keynote by Prof. Davide Dardari at ICC 2023	A tweet promoting the keynote by Prof. Davide Dardari at ICC 2023
31.05.2023	Done	Project Website	Release of project website with initial content
02.06.2023	Done	Post promoting 6G-SHINE at EuCNC	Post promoting 6G-SHINE at EuCNC
02.06.2023	Done	Tweet promoting 6G-SHINE at EuCNC	Tweet promoting 6G-SHINE at EuCNC
02.06.2023	Done	Contribution to the first SNS journal	Description of the project in the first SNS journal
06.06.2023	Done	First project Leaflet	Project leaflet for the EuCNC
08.06.2023	Done	Youtube video	Youtube video at EuCNC
08.06.2023	Done	Linked in post	Linked in post for EuCNC
09.06.2023	Done	Video	Short statement Video for SNS JU
08.07.2023	Done	Video	Poster video from EuCNC
25.08.2023	Planned	LinkedIn post and tweet for the video	Social media support for the poster video
29.08.2023	Done	Newsletter	Newsletter summing up the first five months of the project
30.08.2023	Done	LinkedIn post and tweet	Social media support for the newsletter
22.08.2023	Planned	LinkedIn post and tweet	Post for release of communication plan

3 DISSEMINATION

3.1 DISSEMINATION STRATEGY

The dissemination strategy of 6G-SHINE follows the principle of creating an impact on the various stakeholders of the project. This means that different levels of dissemination content are defined that are fitting to the stakeholder that is to be addressed and empower the stakeholder to react to the project in a well-informed way that is helpful to reach the project's goals.

The project’s key dissemination goal is to make the project's results impactful.

- Making the project achievements common knowledge.
- Inspiring other scientists in their research.
- Paving the ground for follow-up research, advancing the project even further.
- Preparing the adaption of the achievements from research into the commercial world.

To ensure this, a dissemination plan is established that provides the dissemination activities regarding the dissemination level and target audience.

The dissemination plan is managed by the dissemination manager (Frank Burkhardt from Fraunhofer IIS) in cooperation with the overall project management team.

3.2 DISSEMINATION CHANNELS

To fulfil the dissemination strategy, the relevant dissemination channels and their expected audience need to be defined. This is completed by clarifying the scientific level of the dissemination and a clear view of the intended target number, which is the number of usages of a certain dissemination channel. This is defined in Table 7.

Table 7 List of communication channels established by 6G-SHINE

Dissemination Channel	Target Audience	Dissemination Level	Target Nr.
Booth/presentations at the event	Scientific community, equipment and device/ IoT manufacturers, operators and vertical end users, industry-led alliances and initiatives, policymakers and regulators	Management to a deep scientific level, depending on the level of the event	3
Data Sets and open implementations	Wireless and AI scientific community	Deep scientific level for detailed analysis and evaluation	3
Demo Days	Scientific community, equipment and device/IoT manufacturers, operators and vertical end users	Management and technical-level demonstrations	1
ITU/ML contest	The scientific community (wireless and AI)	Scientific level contest	1

Journal Articles*	Scientific community	Scientific publications on individual topics	8
Joint Articles*	Scientific community	Scientific publications on broader topics	6
Papers at Scientific Conferences*	Scientific community	Deep-dive scientific publications on individual topics	20
Popular-science magazines*	The general public	Scientific contents presented in Layman's terms	3
Presentation at events of national initiatives	Scientific leaders	The scientific level depends on the format of the event.	3
Presentations at Industrial Conferences and associations	Industrial leaders	The scientific level depends on the format of the event	3
Special issues*	Scientific community	Scientific publications providing generic to deep dive content of a singular topic	2
Whitepapers*	Scientific community, equipment and device/ IoT manufacturers, operators and vertical end users,	Vision statements and project achievements	3
Workshops and Training	Scientific community, equipment and device/ IoT manufacturers, operators and vertical end users	Tutorials/trainings starting from overview level to scientific deep dive	2

*All scientific papers by all partners will also be published in an open-access repository.

The rationale for the different dissemination activities is provided in the following.

- Scientific publications:** 6G-SHINE partners aim to publish its main technological and academic results in top-quality IEEE conferences, magazines, and journals. Possible conferences of interest are ICC, Globecom, WCNC, and PIMRC VTC. Possible magazines of interest are IEEE Communication Magazine, IEEE Wireless Communication Magazine, and IEEE Vehicular Technology Magazine. Possible journals of interest are IEEE Transactions on Wireless Communications, IEEE Transactions on Communications; IEEE Access, IEEE Open Access Journal of the Communication Society, IEEE Journal on Selected Areas in Communications; IEEE Transactions on Cognitive Communications and Networking; IEEE Transactions on Signal Processing; IEEE Transactions on Industrial Informatics; IEEE Transactions on Vehicular Technology. Scientific publications will be made open access via pre-print repositories. Participation in conferences also entails presentations to the scientific community. 6G-SHINE members will also contribute to the review of scientific papers in their respective fields, therefore ensuring the influence of the 6G-SHINE vision on the research community.

- **Open datasets:** 6G-SHINE offers to the research community synthetic datasets related to interference traces in hyper-dense mobile subnetwork scenarios generated via system-level simulations; also, it will show traces of the data traffic in a realistic in-vehicle data traffic emulator. Synthetic radio propagation data will also be offered. Such open datasets can be used by the research community for AI-related studies. In addition, in the 6G-SHINE publications, all required information and guidance on the public data for third parties to be able to reproduce the project's work will be provided.
- **ITU machine learning (ML) challenge:** In the annual ITU ML challenges (<https://aiforgood.itu.int/about-ai-for-good/aiml-in-5g-challenge/>) problems will be proposed that are focused on the usage of ML methods for solving relevant problems in wireless networking. Challenges in this context that are proposed will be related to radio resource management in hyper-dense subnetworks. The purpose of these challenges is to further the usage and cross-checking of the open data sets by the scientific community.
- **Booths at events, technical presentations, and demonstrations.** Besides conference paper presentations, technical presentations (including invited talks) in relevant IEEE events or workshops on the scope of the 6G-SHINE research and its progress will be given, with the objective of reaching academic and industry audiences. Also, presenting our developed PoCs, including the initial version and the refined version, in proximity to the end of the project, is planned to take place in expositions connected to such events. For this, we plan to participate in the annual EuCNC/6G summit or the European Research and Innovation Days. For an even wider and commercially more impactful presence, we are committed to showing our demos at least once at some larger venue, such as the Mobile World Conference (MWC), the Hannover Fair or similar.
- **Workshops and special sessions:** Additionally, it is planned to organise at least two 6G-SHINE-related workshops or special sessions and disseminate the outcomes to the main stakeholders and end-users of the industry and research community. To increase the effectiveness of the dissemination, the workshops will be held in conjunction with international IEEE conferences and/or ITU events or at least as a cross-dissemination workshop with other SNS-JU projects.
- **PhD courses:** It is planned to contribute to at least one ESoA PhD course to disseminate the project's findings directly to next-generation PhDs. The planned event will be the ESoA course on Short Range Propagation Theory, which will take place in Bologna in September 2023. <https://padlet.com/mylink/esoa-course-website-2023-short-range-radio-propagation-theor-zi79g5cjpkrbwwlp>
- **Demo event:** It is planned to organise a demo event where a wide range of audiences will be invited to demonstrate the 6G-SHINE technology advancements. Guests from various universities and industries, including interested parties in telecommunications supply-chain, verticals and the research community, are expected to attend the event.
- **Presentations to industry alliances and policymakers:** Many 6G-SHINE partners are members of relevant international industry alliances. Results of the project will be presented in such industry fora. Also, concepts and results related to spectrum aspects and new policies on using unlicensed spectrum will be presented to relevant policymakers. The presence of Ofcom in the project's advisory board may ease the establishment of further connections.
- **Alignment with other SNS projects:** 6G-SHINE will seek an active information exchange and collaboration with the other SNS projects, particularly with the stream B "6G Holistic Project". Such information exchange will be done via meetings scheduled at least twice a year. The goal of this alignment will be to promote the in-X subnetworks as a fundamental component of the 6G 'network of networks' and obtain relevant feedback on how technology components can be enhanced to ease such compatibility with the 6G 'network of networks'. Relevant SNS projects where information exchange and collaboration will be sought are CENTRIC, TIMES and PREDICT-6G. There are indeed common research interests with these projects; besides, potential collaboration is eased by the presence of some of the 6G-SHINE partners in the consortia of these projects. This collaboration is expected to deepen over the course of the project, and a detailed definition of planned and carried out collaboration will be included in an additional chapter.

- **Summary Whitepaper of research achievements:** It is planned to release whitepapers during the project's evolution summarising the main research achievements in a way that standardization organisations like 3GPP, IEEE, DECT, etc., or pre-standardization organisations like 5G-ACIA, 5GAA, etc. could adapt them. At the end of the project, all final achievements will be summarised within a comprehensive whitepaper to publicly underline the achievements of the overall project and highlight the scientific progress, especially to standardization bodies and industrial fora.

3.3 DISSEMINATION PLAN

The dissemination plan sums up when the different dissemination activities are expected to be completed. In this regard, a tentative overview has been created. This is intended as a general plan and can be updated according to specific circumstances (e.g., deadlines, call for papers and event schedule).

Table 8 Tentative dissemination plan

Time	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Booth/presentations at the event		1				1				1
Data Sets and open implementations										3 +1
Demo Days										1
ITU/ML contest							1			
Journal Articles*			1		1	1	1	1	1	2
Joint Articles*			1				1			1
Papers at Scientific Conferences*			2	2	2	2	2	2	4	4
Popular-science magazines*				1			1			1
Presentation at events of national initiatives		1				1				1
Presentations at Industrial Conferences and associations		1		1		1		1		1
Special issues*							1			1
Whitepapers*			1				1			1
Workshops and Training							1			1

This overview is detailed during the project with a forecast of at least 6 months showing the upcoming activities and months for which they are planned. The activities in the upcoming 2 months also provide a fixed date for when the activity is scheduled. All events even further in the future are added to the table to provide a pool for future dissemination activities. It must be noted that major dissemination events, especially workshops and booths at events, require support by social media communication and/or press releases that are released in advance to those dissemination activities.

Table 9 Detailed Dissemination Plan (30.08.2023)

Event Starting Date	Status	Dissemination Activity	Type of activity
08.02.2023	Done	ETSI meeting	Presentations Industry Forum
06.03.2023	Done	SNS webinar 4	Presentations Industry Forum
10.03.2023	Done	Poster at EuCNC2023	Presentations Industry Forum
31.03.2023	Done	IEEE Communication Letter (WP3)	Journal Article
01.06.2023	Done	Keynote at ICC 2023 (Workshop on Holographic MIMO)	Presentations Industry Forum
01.06.2023	Done	IEEE Open Journal of the Communications Society	Joint Articles
19.06.2023	Done	IEEE PIMRC (WP4)	Conference Paper
18.10.2023	Planned	International Conference on 6G Networking	Conference Paper
13.11.2023	Planned	IEEE Future Networks World Forum	Joint paper on 6G-SHINE vision
04.12.2023	Option	Globecom 2023 The path towards 6G: Standardization and Research Vision Workshop	Conference Paper
15.12.2023	Option	To be decided on by the consortium	Joint Article
21.04.2024	Option	WCNC 2024	Conference Paper
05.05.2024	Option	2024 IEEE International Conference on Machine Learning for Communication and Networking (ICMLCN)	Conference Paper

4 STANDARDIZATION

4.1 STANDARDIZATION STRATEGY

The standardization strategy is based on the continuous monitoring of the progresses in the relevant standardization and pre-standardization bodies. When the project has progressed far enough, the monitoring is complemented by also providing input to these institutions. In this manner, the project 's results may be integrated into the standardization process. The monitoring and standardization work is provided by the partners that are already involved in the different standardization bodies.

For more detail, Figure 2 shows the potential interaction of 6G-SHINE with particular releases of 3GPP and IEEE standards, as well as the World Radio Conference (WRC) events. The time span and deliverables of 6G-SHINE will be constantly monitored and disseminated at these venues to have the utmost impact on these standardization and specification events. It is important to mention that since 6G-SHINE ends before the 6G standardization is expected to start, the project focuses on pre-standardization activities that provide the basis for the actual 6G standardization process.

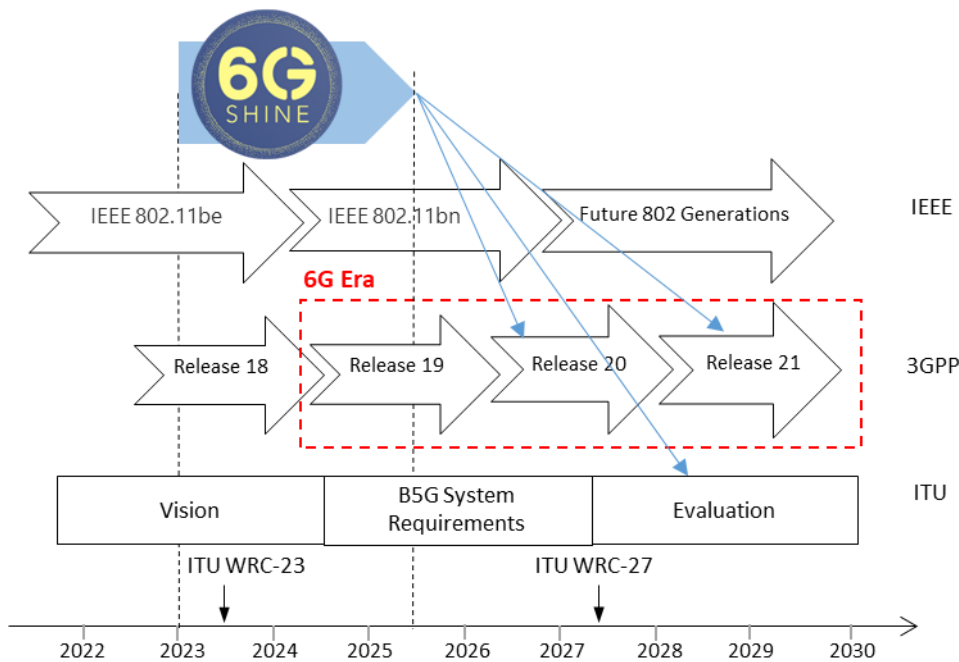


Figure 2 6G-SHINE alignment and contribution timeline to leading standards

4.2 CONSIDERED STANDARDIZATION BODIES AND ASSOCIATIONS

The considered standardization bodies and the partners already involved are provided in the following table.

Table 10 Standardization bodies and respective contributing partner

Standard Body/Industry Forum	Contributing Partners
3GPP	Bosch, FHG, Nokia, Sony, Keysight, IDE, Apple
5G-ACIA	Bosch, FHG, Nokia, Sony
5GAA	Bosch, FHG
ETSI	FHG, UMH, IDE
IEEE (802.11, IEEE 802.15)	FHG, IDE
ITU	Bosch
NextGA	Nokia, Apple, IDE
NGMN	FHG
ORAN	Nokia

4.3 STANDARDIZATION ACTIVITIES

A tentative schedule for the standardization activities is provided in the following table.

Table 11 Standardization activities planning.

Time	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Standardization Monitoring	Continuous Monitoring during the complete projects									
Standardization Contribution								Contribution to standardization		

In particular, 6G-SHINE activities target at least 4 following possible sets of contributions to 6G (pre-) standardization. Relevant possibilities are the following:

- Proposal of 6G-SHINE subnetwork channel models in 3GPP standardization and test specifications. Contributions to 3GPP SA1 on the identified use-cases and their requirements to be part of 6G use-cases and requirements.
- Proposal of a new study item (SI) to 3GPP focusing on beam-based short-range communication for constrained complexity devices in vertical entities (e.g., vehicles or robots). This SI would cover enhanced initial beam alignment procedure for low-complexity devices; enhancements of beam management for static/low mobility with extreme communication requirements; device co-existence challenges for hybrid beam forming short-range communication; and near field beam focusing techniques.
- Contributions on jamming-robust PHY could trigger SIs on: 1) how short-range subnetworks could make use of dynamic scheduling upon parallel data transfer in several sub-bands to achieve ultimate robustness; and 2) how to learn the environment of short-range subnetworks and “build a digital twin” by means of combining CSI from different devices.

- Contributions to 3GPP (pre-) 6G standardization on RIS-enabled smart repeaters.
- Whitepaper contribution to 3GPP and ETSI on (technology agnostic) network coded cooperation.
- Contributions to 6G (pre-) standardization work and 3GPP RAN1/2/4 on flexible and full duplexing with new signalling procedures (e.g., for reporting CSI and cross-link interference measurements and low-overhead resource allocations); currently in scope 3GPP Release 18 RAN1 that is only looking at the feasibility of these schemes from a PHY perspective.
- Contributions to ETSI TC ITS (driving European standards on connected and automated driving) and industry-led forums such as C2C-CC, 5GACIA and/or 5GAA on the capabilities and design of In-X predictive scheduling. Target as well potential contributions to 6G (pre-) standardization activities under 3GPP RAN1 and RAN2.
- Contributions on MAC solutions for unlicensed bands to ETSI standardization enhancing any previous ETSI ISM requirements-related document, like, for instance, ETSI EN 300 328 (aiming to 2.4 GHz ISM band) that resulted from WI REN/ERM-TG11-011, and potential proposal on a standardization WI on the topic.
- Contributions to 3GPP RAN2 on centralised interference management, which requires new dedicated signalling for interference measurement reports from the devices to the AP in the subnetwork, as well as from the AP to the central controller, as well as new signal quality metrics tailored to the specific subnetwork and entities' capabilities.
- Possible contributions to 3GPP RAN1 for jamming detection and mitigation mechanisms for in-X subnetwork that require standardization of specific measurement reports or control signalling.
- Standard contributions may include ETSI ISG MEC for detailed architectural components and signalling procedures, 3GPP SA1 (Services) and SA2 (Architecture) for the service and application architecture and behaviour; and 3GPP SA6 (App. Enablement & Critical Communication Apps.) as per its involvement in verticals.
- Submission of a new SI to 3GPP RAN2 on the control signalling and data routing adaptation outcomes for collaborative subnetworks; 3GPP or IEEE standards do not currently cater for APs' collaboration, coordination and grouping.

5 EXPLOITATION

Exploitation is considered, on the one hand, as being an individual task as each partner of the project has its own individual plans to benefit from the project. In addition to this, there are some exploitation plans and goals common to all partners of the project. These first activities are tracked, while the latter activities are coordinated by the projects' dissemination and exploitation manager.

5.1 INDIVIDUAL EXPLOITATION

In the following, the individual exploitation plans per project partner are provided.

AAU will disseminate the scientific findings of 6G-SHINE in major IEEE journals (IEEE Transactions on Wireless Communications, IEEE Transactions on Industrial Informatics, IEEE Access, IEEE Communication Magazine) and conferences (IEEE Globecom, IEEE WCNC, IEEE ICC, IEEE VTC). 6G-SHINE will open up opportunities for master's and PhD projects. Further, the findings will also be presented to other university departments, such as the Department of Materials and Production and the Department of Computer Science, paving the way for future project collaborations involving cross-disciplinary expertise in the view of the next phase of the SNS work programme. AAU will openly provide simulator and synthetically generated datasets for radio resource management in hyper-dense subnetworks and will engage with the ITU ML challenge. The project findings may also be presented at Brains Business, a regional industrial cluster initiative bringing together all major forces within the North Denmark ICT environment through the interaction of industry and university and the link to public authorities. In that respect, AAU has the ambition of becoming a leading national academic institution in the area of wireless communication for 6G.

Nokia intends to exploit the research and findings from the 6G-SHINE project to further develop its position on the standardization of 6G in 3GPP. The collaboration between the partners in the consortium is a great opportunity to acquire valuable outside-in perspective. The technology components developed in 6G-SHINE, while being novel and disruptive, still set a target for the current standards development towards 6G and need to be considered together with other RAN technologies to a coherent 6G standard. Therefore, Nokia plans to use its connections to disseminate the key findings from 6G-SHINE into standardization bodies with the target of getting the technology components developed into the 3GPP 6G standard. Further, Nokia Denmark will target to disseminate the project findings to scientific conferences with a target of 2 scientific publications.

6G-SHINE will strengthen UMH research positioning in the field of connectivity for verticals, and in particular, connected and automated mobility. UMH will disseminate its scientific findings in leading scientific journals (IEEE Transactions on Vehicular Technology, IEEE Transactions on Intelligent Transportation Systems, Vehicular Communications, IEEE Wireless Communications) and conferences (IEEE VTC, IEEE VNC, EuCNC). UMH will contribute towards organising 6G-SHINE workshops (will lead 1) and journal special issues (will lead 1). UMH will train PhDs (at least one directly working on the project, but other PhDs from the lab will also benefit from the research) and master students. UMH will present 6G-SHINE findings in the standards ETSI Technical Committee on ITS, where UMH is actively contributing to standards for connected and automated driving (collective perception, manoeuvre coordination, DCC, and MCO), and C2C-CC industry forum. UMH will openly provide traffic datasets for in-vehicle domains (e.g., the ADAS domain) and generate models that will be openly provided to the community.

The 6G-SHINE project, its scope, and tasks will increase IDE's disruptive technology and innovation creation in the short-range and heterogeneous system deployment scenarios, where IDE already has a strong involvement in both IEEE 802, 3GPP, and ETSI standardizations and the working and study groups that are most relevant for the 6G-SHINE project. The technologies that IDE will create within the 6G-SHINE project will be disseminated to these standardization bodies whilst increasing the company's contributions to beyond-5G and 6G standardization and licensing opportunities to device and network manufacturers. Moreover, IDE will significantly benefit from the wide range of expertise that will be available in the 6G-SHINE consortium, i.e., from system integrators to device manufacturers, which will allow the company to broaden its knowledge base and also provide additional market and technology development opportunities.

Sony plans to identify the most promising technological solutions in 6G-SHINE and promote these for standardization in the next generation of wireless networks. It also plans to summarise and promote the key findings in major IEEE journals and/or conferences. As a leading user equipment contributor to future generations of wireless technology, Sony looks for such standards and results that can be implemented in Sony products and used to build equipment and services in the next generation of wireless communications networks.

As an institution for applied research, Fraunhofer IIS will exploit the results of the project on the scientific side as well as on the commercial side. On the scientific side, the findings will be published in relevant scientific transactions, journals and papers for technology-leading conferences and EU -project dissemination events initiated by the European Commission. This is done to enhance the IIS scientific profile and build the basis for further advanced research topics as well as follow-up research activities. It is flanked by introducing the findings of the project to standardization bodies like 3GPP, ETSI and IEEE so they may become relevant for the underlying concrete technologies, enhancing the currently existing standards. This also enhances the options for licensing the inventions of the project. Finally, based on its PoC, IIS will be able to offer state-of-the-art testing services to the industry, allowing the evaluation and qualification of further proof of concepts as well as commercial equipment in regard to the KPIs defined for 6G.

Keysight will exploit the outcome of the project in developing commercial channel emulation test solutions for typical in-X use cases. Keysight will also contribute to the channel model framework and parameters in 3GPP and potentially other standardization forums. Keysight plans to deliver at least two publications to academic forums.

As a research centre interfacing between university and industry, IMEC's exploitation of results achieved within this project is closely linked to its mission of creating and disseminating scientific knowledge in the field of wireless communications and associated applications. IMEC will strengthen its existing research programs and education program (in collaboration with UGent) and realize its exploitation to industry via 'Industrial Affiliation Programs', bilateral projects, IP transfer and licensing. In the affiliation program, IMEC teams up with leading companies across the value chain, in which they get early access to 6G technologies and can use IMEC's know-how and prototype modules to accelerate the development of their next-generation products. The outcome and accumulated experience acquired from this project will potentiate the participation in new related collaborative research projects, where the obtained results will be exploited, extended or adapted to new research challenges.

In addition to scientific expertise, CNIT's team has the capability to organise workshops and conferences (having chaired, among others, the IEEE ICUWB 2011, IEEE PIMRC 2018, etc.) and is active in the editorial and technical boards of several major journals and conferences. Members of CNIT were the organisers

of the IEEE International Conference on Communications (ICC) held in Rome in June 2023 and of the European Conference on Antennas and Propagation to be held in Florence in 2023. This will give the project the opportunity to organise special sessions and workshops on the topic of this project with an international audience. The project findings will be presented at the 5GItaly 3-day event, the biggest event in Italy dealing with 5G and beyond, organised by CNIT, involving public administration, service operators, manufacturers, and research body with keynotes, discussions, scientific sessions, which includes a PhD school. The radio propagation aspects will be disseminated at the European School of Antennas and Propagation (ESoA) biennial Course on “Short-range radio propagation” for PhD students and researchers. Moreover, project results will also be presented to the Propagation Working Group of the European Association on Antennas and Propagation (EuRAAP), currently chaired by a member of the CNIT team, which coordinates dissemination activity in Europe in the Antennas and Propagation field.

Bosch has been a main driver of 5G for vertical industries for many years, especially in the automotive and industrial domains. Therefore, Bosch has the ambition to actively shape and define also 6G from the very beginning and to ensure that it perfectly addresses the needs of the vertical domains Bosch is active in. Bosch will particularly exploit the results of the project in the design of future automotive E/E architectures and related components, as well as future products and solutions for industrial automation. In both areas, in-X subnetworks may unlock significant opportunities, and they may trigger significant changes in the market. Bosch also aims to bring in selected results in relevant industry associations and standardization bodies, such as 3GPP, 5G-ACIA, 5GAA and others.

Apple will use the findings from this project to support its ongoing wireless technology development, which will be used in its diverse portfolio of commercial product offerings enjoyed by many millions of consumer end users around the world. Furthermore, Apple plans to deliver at least three publications to scientific events over the course of this project.

COGN plans to develop in-X subnetworks and demonstrate them to industrial forums and investors to attract funding for further development of ultra-reliable and latency subnetworks for vertical applications. COGN is working on different radio access technologies addressing similar challenges with those of in-X subnetworks and especially in heterogeneous networks. Another exploitation element of COGN research is the corresponding AI-enabled wireless access, which is one of the major technologies developed within its own lab. In-X technologies provide the overall ecosystem so that future extreme communications 6G nodes are ready into the market of entities demanding ultra-reliable wireless connectivity.

5.2 JOINT EXPLOITATION

Joint exploitation is targeted in two directions. On the one hand 6G-SHINE targets 6G pre-standardization activities; on the other hand, a 6G development ecosystem for future collaboration on a mid- to long-term range will be established allowing to bring the project's results on the road from basic research to real-world application.

6G pre-standardization shall include study items promotion on the selection of 6G use-cases/requirements for identifying candidate 6G technologies under 3GPP Release 19 and Release 20. 6G-SHINE counts on industry partners for intensively participating in standardization and supporting the transfer of 6G-SHINE contributions to standardization bodies. These activities are covered by the standardization part of this document.

6G-SHINE focuses on basic research on technology components for short-range communication with extreme requirements, aided by connectivity with the broader 6G 'network of networks'. Given its nature of a basic research project (with a maximum achievable TRL equal to 4) the technological/economic outcome of 6G-SHINE is expected not to be addressed in the short term. Nonetheless, the project outcome will be fed into the holistic architecture project in the SNS work programme, as well as into the next phases of the SNS work program where a higher TRL is expected, and a coherent integration of the developed solutions will have a more explicit link to technological and economic impacts.

Therefore, we are considering here the long-term expected technological/economic impact of 6G-SHINE when its contributions will be fed into the next phases of the SNS work programme. In the long term, the technologies developed in 6G-SHINE will empower vertical domains (e.g., mobility and manufacturing) with capabilities superior to those of 5G by embedding 6G-native IoT connectivity in vertical entities and devices and ensuring their boundary-less integration and coordination with 6G wider area networks. Major electronic companies will develop devices supporting the PHY/MAC technology components. Device and networking manufacturers can incorporate the developed protocols in new subnetworking products, such as collaboration-enabled devices and IoT nodes. This will provide a complete end-to-end 6G digital backbone connecting devices, entities and the cloud native access to devices within an entity. 6G-SHINE will enable in the long term the support of manufacturing digital twins with advanced connectivity solutions that can reliably interconnect the physical (up to the device inside robots or machines) and digital worlds with very low latency for quasi real-time bundling of the physical and digital worlds. This is because subnetworks bring 6G connectivity to very low end device (e.g., sensors/actuators) in an entity, and therefore overcomes delays associated to protocol translation as in the case information transferred from such devices had to be obtained via wired standards. In summary, 6G-native short range embedded in smart entities will: 1) address a clear technological gap in the vision of 6G as a 'network of networks'; 2) will provide new connectivity solutions that will help digitalize industries by providing a complete connectivity continuum between physical and digital domains; and 3) will expand the capabilities of previous APs by transforming them into smart entities with deep edge capabilities.

Figure 3 illustrates the current view on the development of the 6G-SHINE ecosystem to an envisioned grown-up, 6G development ecosystem named 6G-GROWTH. This grown ecosystem shall act as the basis for the next future steps to bring the project's research outcomes into real applications.

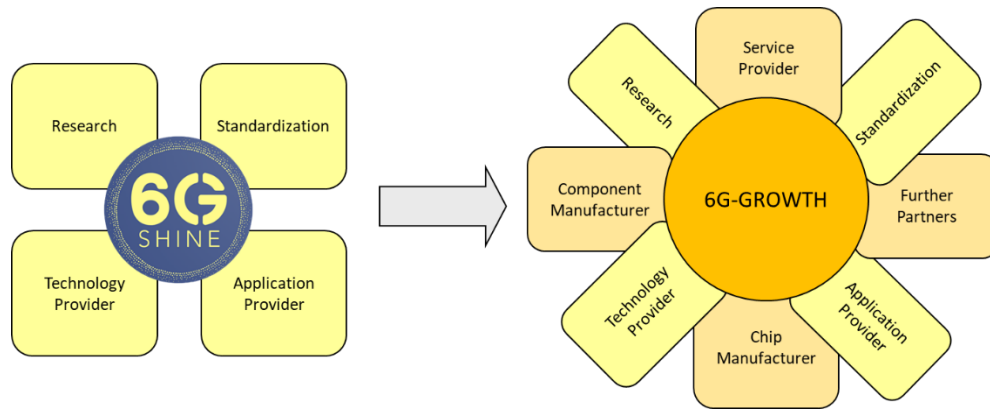


Figure 3 Illustration of the 6G-SHINE long term ecosystem evolution

To support this an exploitation roadmap for common exploitation is provided, highlighting how the partners can interact and support each other.

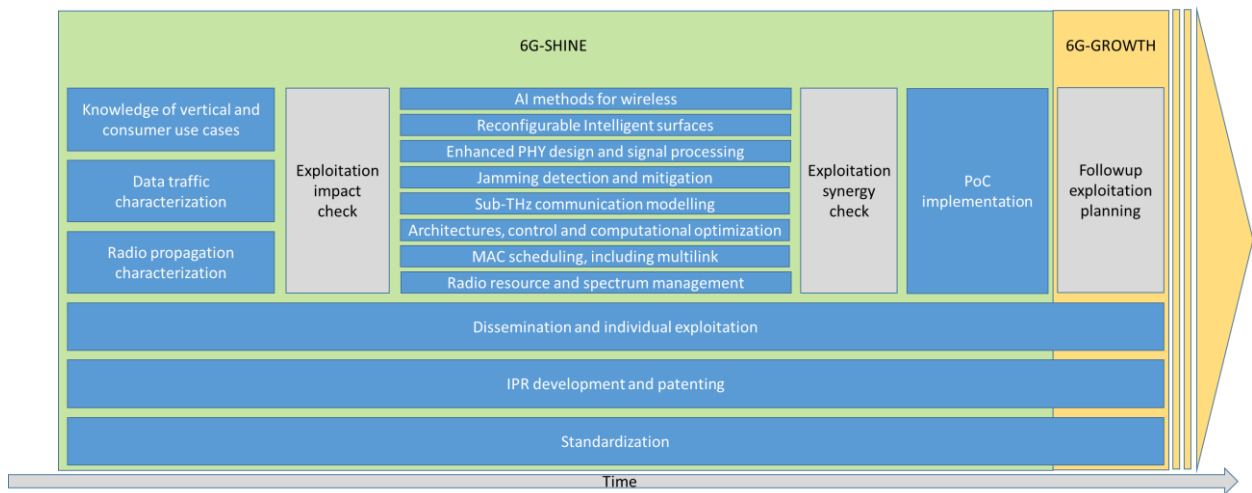


Figure 4 Common exploitation roadmap

Figure 4 shows the timeline of the project and highlights the main important decision and interaction points for a common exploitation in reference to the project work. The exploitation impact check is the first stage of the common exploitation process. At this checkpoint the results from use case analysis, traffic characterization, and propagation characterization are used to identify their expected exploitation impact. By this it shall be ensured that the followed use cases are relevant for future exploitation, and it is defined, which partners may be involved in the selected exploitation relevant paths.

The second relevant gate for exploitation is the exploitation synergy check. The purpose of this check is to explicitly analyse which of the developed technology components benefit the most from each other so that in the PoC implementation already the most attractive components in relation to the high-impact use cases are included.

The next piece of the common exploitation is to take the results of the PoC implementation and identify the required partners for taking the next steps from a PoC in the lab to a PoC that is able to fulfil the use case in its real environments. This is the starting point for a potential 6G-GROWTH project, built up on the findings of 6G-SHINE.

IPRs

One special topic of exploitation is the provision of IPRs which are submitted during the course of the project. It is planned to submit at least 20 IPRs during the course of the project, creating a sound basis for licensing-based exploitation models. The details of the IPR will not be disclosed publicly, but only their topics.

The IPR plan is to file IPRs on the following topics.

Table 12 Standardization activities planning.

Exploitable result	Targeted IPRs
Methods for advanced feedback mechanism in ultra-short transmissions	≥ 2
Beam-based short range communication	≥ 3
Multi-link PHY for ultra-low latency	≥ 2
Signaling methods for centralized interference management	≥ 2
Methods for distributed and hybrid radio resource management	≥ 2
Methods for detection and mitigation of jammers	≥ 2
Methods for splitting traffic and computational effort across subnetworks and between subnetworks and broader 6G network	≥ 4
Methods for spectrum sharing between subnetworks and broader 6G networks	≥ 3

6 CONCLUSIONS

By following the here presented communication, dissemination and exploitation plan, the impact of the project will be maximized. The most important fact is that the relevant communication, dissemination, and exploitation are defined and can be tracked by relying on the plan. It helps to ensure that the important activities and the required communication measures are pre-planned and carried out in time. This leads to a convincing and comprehensive presentation of the project and its achievements to the external stakeholders and eases exploitation of the results as well as the acquisition of follow-up activities.