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SNS OPS – Supporting the SNS JU Operations

D1.1: Analysis Framework

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Abstract

This deliverable defines a "monitoring and analysis framework" of the technological KPIs, societal KVIs, and other relevant work aspects targeted at the SNS projects. This framework will be promoted to the SNS projects (starting with Phase 1 projects) early in the process so that they know what they would be needing to report in a structured way. The information to be collected based on this framework will be analyzed to produce meaningful results and insights regarding the projects' progress, their outcomes and their conclusions.

This deliverable presents the agreed structure, scope and focus of the monitoring and analysis framework that will allow for a good understanding of the ongoing work and results produced by the SNS projects. The methodology followed to construct the framework is explained, as well as implementation details regarding its application throughout the SNS timeline (e.g., recurrence, timelines, update procedures, etc.). Moreover, the Questionnaire used to collect information from the SNS Phase 1 projects, which constitutes the key element of the framework, is presented, and its various sections explained.

Even though the goal of this deliverable was to present the monitoring and analysis framework (not results), the SNS OPS partners embraced the opportunity of having the questionnaire answers available just before the submission deadline, to provide an initial high-level analysis of the received responses. Some very high level, preliminary insights are also presented, providing an initial view of the projects to key questions. A full-fledged analysis will be performed in the following months and will be reported in the next WP1 deliverable.

[End of abstract]

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Executive Summary

One of the objectives of the SNS OPS is to monitor, evaluate and report the progress of the SNS JU projects. In order to achieve this, the consortium has developed a comprehensive monitoring and analysis framework that serves to systematically monitor, analyse and document the technological Key Performance Indicators (KPIs) and societal Key Value Indicators (KVIs), as well as other relevant work aspects of the SNS projects. The KPIs and KVIs of the SNS phase 1 projects were the basis to build the framework.

Understanding the existing work on KPIs, KVIs, technological focus, vision and market aspects was fundamental. An in-depth review of relevant work was carried out on the subject of KPIs and KVIs (e.g., as submitted to ITU-R WP5D, KPIs white papers from 5GPPP, KVIs white paper from Vision WG, etc.). Based on this, a questionnaire was prepared to gather specific data about the work planned in each of the projects. This information will be highly valuable to the SNS JU Office and the SNS OPS and SNS ICE CSAs, as well as to the SNS Steering Board (SB), Technology Board (TB) and Working Groups (WGs), to assist with project results tracking and grouping of relevant projects, according to interest.

The questionnaire has a total of 29 questions and is structured in three sections, namely: technical, vision and market. It was sent to all 33 SNS JU Phase 1 R&I projects at the end of April 2023.

- **Technical** section focuses on technical questions such as the uses cases, enabling technologies, KPIs, validation methods and more.
- **Vision** section focuses on societal challenges, 6G values and respective KVIs and more.
- **Market** section focuses on innovative 6G technologies in the markets, vertical sectors, obstacles, and challenges at deployment and more.

The results of the analysis of the received input (based on the questionnaire) will be shared with all SNS projects and will be reported in detail in the follow-up WP1 deliverables, while the key findings and insights will be presented in a dedicated webinar. This is an extremely important input for the SNS programme as a whole, and this will be repeated during the life cycle of the projects in order to closely monitor the achievements of the different projects (framework methodology).

This framework will further contribute to the building of the SNS momentum as it is tracking the progress of technical activities and progress of the project inputs, as well as their progress and contribution to a wider understanding of their vision and markets potential.

The SNS OPS project is committed to disseminating and promoting this work using various promotion tools & materials to disseminate the exploitation of the results and main achievements of SNS projects and ensure the growth of the SNS JU initiative and sustainability of its results.

Due to the sheer amount of data gathered by the questionnaire, D1.1 contains only an initial analysis of the results. A deeper analysis will be presented in SNS OPS D1.2.

Table of Contents

List of Figures

List of Tables

Abbreviations

Term	Abbreviation Definition
3GPP	Third Generation Partnership Project
5G	5th Generation Wireless Systems
5G PPP	5G Public Private Partnership
5GAA	5G Automotive Association
5G-ACIA	5G Alliance for Connected Industries and Automation
BSCW	Basic Support for Cooperative Work
CEF	Connecting Europe Facility
CEPT	European Conference of Postal and Telecommunications Administrations
CSA	Coordination and Support Action
DIH	Digital Innovation Hub
EC	European Commission
ETSI	European Telecommunication Standards Institute
EuCNC	European Conference on Networks and Communications
G5GE	Global 5G Event
GDPR	General Data Protection Regulation
HEU	Horizon Europe
H2020	Horizon 2020
IETF	Internet Engineering Task Force
IM	Innovation Manager
ITU	International Telecommunications Union
KER	Key Exploitable Result
KPI	Key Performance Indicator
KVI	Key Value Indicator
MWC	Mobile World Congress
NTN	Non-Terrestrial Networks
PC	Project Coordinator
PCG	3GPP Project Coordination Group
PN	Public Networks
PSM	Pre-Structuring Model
R&I	Research and Innovation
SB	Steering Board
SCoDIHNet	Smart Connectivity Digital Innovation Hub Network
SDG	Sustainable Development Goal
SDO	Standards Developing Organizations
SNS	Smart Networks and Services

SNS JU	Smart Networks and Services Joint Undertaking
TB	Technology Board
TM	Technical Manager
TN	Terrestrial Networks
TRL	Technology Readiness Level
UN	United Nations
WG	Working Group
WP	Work Package

1 Introduction

One of the objectives of SNS OPS project Work Package 1: “Assessment and Planning” is to contribute to SNS strategic R&I orientations. The monitoring, evaluation and reporting on the progress of the SNS JU Phase projects constitutes one of the main pillars to accomplish such objective.

To reach the above-mentioned target, Task 1.1: SNS progress assessment will work on the development of an appropriate framework to monitor and analyse the technological KPIs and societal KVIs that SNS phase 1 projects will achieve and as a result of this task D1.1 Analysis Framework document is developed and released at M6.

1.1 Purpose and scope of the deliverable

The present presents the developed monitoring and analysis framework for the SNS JU which is intended to be used during SNS OPS lifetime and beyond, so that consistent input may be collected by the projects, allowing for progress tracking, comparability and cumulative insights. Moreover, the developed framework should allow for regular updates to better reflect the new subjects and research focus of new SNS projects. An early implementation was essential to help the SNS JU Phase 1 projects have a clear understanding of the information required. Since the framework is established, the input from the projects will be captured and collected periodically for the progress reporting.

Since this data collection will be done periodically, in the longer term an online tool to collect the necessary information for analysis will be considered.

The results of the work presented in this deliverable will be used to promote the achievements of SNS JU at European and global level, while at the same time it will help identify potential blocking points where additional research efforts or alternative approaches will be needed.

1.2 Context and background

This is the first deliverable of WP1 and Task 1.1 which is led by Ericsson, while all other SNS OPS partners are also contributing. The outcome of this report will be promoted to the SNS Phase 1 projects early in the process so that the ongoing projects and the upcoming new projects will know what they would be needing to report in a structured way so that this information can be analysed and produce meaningful results.

As a first step, a comprehensive questionnaire covering technology, vision and marketing aspects of the projects was generated by the consortium, which constitutes the main element of the framework. This questionnaire was sent by the SNS OPS CSA project to the 33 ongoing SNS JU Phase 1 R&I projects. The goal of this questionnaire is to obtain a better understanding of the work planned to be performed in each of the projects, the challenges being addressed and the expected outcomes. The information gathered from the projects will be used to assist with the dissemination of the Phase 1 project results, liaise with appropriate external stakeholders, and host/organize relevant events. This information will be also provided to the SNS Steering Board (SB), Technology Board (TB) and Working Groups (WGs), to assist with project results tracking and grouping of relevant projects (according to interest). The results of this questionnaire will be shared with all SNS projects, and the key findings and insights presented in a dedicated webinar. This input is crucial for the SNS programme and for its future management and success.

2 Methodology Overview

This section provides a description of the methodological approach used in the development of the monitoring and analysis framework of SNS OPS, including the methodology to collect and process the input received by the SNS JU projects, and to disseminate the outcome.

2.1 Monitoring and analysis framework approach

2.1.1 Framework Objectives

The objectives of the SNS OPS monitoring and analysis framework stem from the Description of Work of the project and more specifically WP1, where a clear and structured way to receive up to date information from the SNS projects is needed, as well as a systematic process to analyse, compare, present and promote the highlights of the projects' work. More specifically the specific objectives of this framework can be distilled as follows:

- Create a standardized methodology, that the projects may use to communicate their achievements, work focus, insights, etc. and inform the projects about it early on
- Create a Questionnaire as the key element of this framework that the projects will be requested to fill in on a yearly basis
- Provide the projects with the necessary tools and guidelines to properly follow the framework
- Create a methodology to collect, process and report the findings of the analysis, based on the received input
- Promote the insights gained by the analysis to all relevant stakeholders
- Receive feedback from all relevant stakeholders and instantiate a process to respectively update the new editions of the framework.

These objectives, can be further broken down to specific steps, taken by the SNS-OPS partners, as is detailed in the following chapters.

2.1.2 Framework breakdown

The implementation of the monitoring and analysis Framework consists of the below steps:

1. **Step 1: Prepare a tool for data collection:** Define (revise) a questionnaire to be shared with SNS-JU projects to collect the required information and design a respective template.
2. **Step 2: Data Collection:** Request SNS-JU projects to provide their input into the defined template.
3. **Step 3: Analysis:** Analyse the input collected.
4. **Step 4: Report:** Prepare a respective outcome report after every time the questionnaire has been sent out. It shall compare target KPIs / KVIs of the SNS-JU or other metrics, assess progress on goal achievement, and identify gaps.
5. **Step 5: Disseminate:** By following the steps defined in the next chapters of this deliverable, make sure the report reaches the relevant stakeholders in the ecosystem.

The whole process will be repeated in several iterations, most likely annually, in order:

- to collect the same type of information from all new projects that will start at a later phase of the SNS-JU, using the same or an improved questionnaire, or
- to collect additional input from the same set of projects initially addressed but now with a questionnaire containing different questions (follow-up, clarifications, etc.).

Regarding above **Step 1** (Prepare a tool for data collection), a questionnaire has been defined. Details on its design and structure are provided further down in section 3 of this deliverable. There could be various formats in which the questionnaire can be presented to the projects to collect the necessary

information, e.g., by creating an online form or by designing an Excel or Word template. The most appropriate and suitable format can be flexibly decided at each instance.

In **Step 2** (Data Collection), the target projects are contacted via the coordinator, explaining the context and purpose of the questionnaire, and providing clear instructions, including the timeline. It should be emphasized that all key stakeholders and lead roles in the projects should be involved in preparing the input to the questionnaire so that the information obtained is as comprehensive and as detailed as possible. The questionnaire answers are stored in the SNS OPS project repository.

In **Step 3** (Analysis), the responses from the projects are analysed. As a preparatory action the information provided by the projects will be aggregated without assessing or judging on their quantitative or qualitative content. What then follows is the actual analysis. The analysis will be quite straight forward for multiple-choice questions or when numerical figures are collected. For the questions however that should be answered in free text format a more thorough analysis of the content will be required. The systematic approach and criteria defined in the next sections for the analysis assist in the delivery of conclusions and insights in a systematic and meaningful structured way. This will also enable making individual responses comparable between each other, and to assess their individual contribution to the respective KPIs and KVIs.

With the outcome of the analysis in above step 3, in **Step 4** (Report), the state of play in the monitored projects can be cross-checked and compared against target parameters, most notably the target KPIs / KVIs of the SNS-JU, but also other metrics of interest that emerge. The outcomes will also allow to benchmark the SNS JU project activities against those being conducted in other regions of the world. With that information, it will also be possible to identify any gaps in the activities, i.e., areas that are not yet addressed at all or not with the required volume or where target results are not achieved. The outcome of this assessment will be documented in a respective report.

As a last step, **Step 5** (Disseminate), the results will be disseminated. This should help in particular the SNS JU office and the CSA projects (SNS OPS & SNS ICE) to get a better understanding of the work planned to be performed in each of the projects, and the SNS SB, TB and WGs, to assist with project results tracking and grouping of relevant projects (according to interest).

2.2 Framework timeline and updates

The timeline for the development and refinement of the framework is described below.

- **Initial Planning**: January 2023. During this phase, the team established the goals, objectives, and strategies for the task, organizing the first WP1 calls and sketching a draft of the first version of the framework including preliminary questions for the questionnaire.
- **Development of Framework**: February 2023 - April 2023. In this phase, the team developed an appropriate framework to monitor and analyse the technological KPIs and societal KVIs, mainly focusing on those that SNS phase 1 projects aim to achieve. A questionnaire was created (alongside the structure, timelines and format of the framework) to collect information using MS Excel. It was divided into three sections: Technical (technological improvements, KPIs, 5G-6G functionalities, enablers, use cases and applications, standardization bodies, verticals, energy efficiency), Vision (societal challenges, sustainability, KVIs) and Market (market challenges, business opportunities, KERs, etc.).
- **Feedback and revisions**: The first draft of the framework and the questionnaire were shared with a number of key stakeholders, such as the SNS JU office, the SB, TB and WG chairs[2], the 6G-IA Governing Board and more. The received feedback resulted in the final format of the framework and questionnaire.
- **First analysis & further feedback**: May 2023 – October 2023. During this phase, the team will analyse the results and present its findings. Follow up questions may be issued towards projects whose answers may not have been clear. Further feedback will be collected from the SNS phase

[2] The framework was shared with the 5G PPP SB, TB and WG chairs, as the respective SNS bodies were not operational yet at that time.

1 projects resulting in a new improved version of the questionnaire (to be used in the following year).

- **Refinement and integration in online tools**: November 2023 - December 2023. Based on the feedback received, the team will refine the questionnaire and plans its implementation in an online tool, if suitable. The team will also communicate the information requirements to the SNS projects so that they understand the information that they will be asked to provide. The results of this task are also related with the Standards Tracker as per Task 4.2 of the SNS OPS project and the Vertical Engagement Tracker as per Task 3.2 of the SNS ICE project. The Standards Tracker will provide a comprehensive view of the SNS contributions to standardization bodies, while the Vertical Engagement Tracker will track the engagement of stakeholders in the vertical sectors addressed by SNS. Together, these trackers will allow for a holistic evaluation of the SNS progress and its impact.
- **Periodic Data Collection and Analysis**: January 2024 – December 2024. The SNS JU CSA support actions should periodically collect and analyse the information provided by the SNS projects using the established framework and updating the online tool. This will allow for progress reporting and the identification of potential blocking points where additional research efforts or alternative approaches will be needed.

  As indicated in section 3.1.2, although specific dates have yet to be officially set up, the questionnaire is planned to be issued on a yearly basis to obtain updates from Phase 1 projects and gather new inputs about new projects that will be launched in the following phases. Given the project end date of SNS OPS in 03/2025, SNS OPS plans do perform one more iteration within the time frame of Q2-2024 (April-May 2024) in order to allow newly launched projects to establish themselves and previously started ones to give updates. Also, modifications to the questionnaire are envisioned based on the project's needs, received feedback or progress.

It is envisioned that the refined and improved framework that SNS OPS will have created by its project end in 03/2025 will be handed over to the next CSA project, to carry on the monitoring and analysis of the SNS projects from 2025.

2.3 Interaction with SNS SB, TB and WGs

The Framework and the analysis of the questionnaire responses will be shared with SNS SB, TB and WGs before and after all iterations. The expectation from SNS SB, TB and WG's interaction is to get their feedback and comments about the questions that will be sent out to SNS projects. Since the overall objective of this activity is to monitor and analyse the technological KPIs and societal KVIs of the SNS-JU projects, the KPIs and KVIs can be further developed based on the SNS ambitions and achievements, in tight coordination with the SNS SB, TB and relevant WGs.

3 SNS Project Input / Questionnaire

To support data collection from the SNS projects for the presented framework, the SNS OPS partners have devised a comprehensive questionnaire and addressed it to all 33 SNS Phase 1 R&I project coordinators (the two CSA projects of Phase 1 were of course not within the target audience). The goal of this questionnaire is to gather the input from the SNS Phase 1 projects in a straightforward and easy to process manner, in order to gain cumulative insights about the SNS JU programme and feed all the other activities of the two CSA projects (analysis/monitoring framework, results promotion, SNS momentum building, etc.). The data collected from the projects, will be processed to generate knowledge and insights regarding:

i. The current focus of work of each SNS project/stream.
ii. The ongoing work and addressed issues/challenges/use cases per project/stream.
iii. The targeted technical results per project/stream.
iv. The technical aspects, technologies and KPIs per project/stream.
v. The 6G vision and relevant KVIs per project/stream.
vi. The expected market impact based on the expected outcome of each project/stream.

The Project Coordinators (PCs) were asked to involve all the key members of the project's team (e.g., Technical Manager (TM), Innovation Manager (IM), WP leaders, etc.) in order to respond to each question as accurately as possible. It is understood that the answers provided by the projects do not constitute a commitment on their side, but rather a best estimate of the expected results as well as a description of the current status. The project focus may shift and adjust according to the research findings, as the work progresses. It must be noted that Stream C and Stream D projects scope and coverage will also evolve according to the implementation of the contractual Open Calls, with 20% and 40% of the EC funded budget targeted for open calls, respectively.

The information collected will be used to assist with the dissemination of the Phase 1 project results, to liaise with appropriate external stakeholders, and to host/organize relevant events. This information will also be provided to the SNS SB, TB and WGs, to assist with project results tracking and grouping of relevant projects (according to interest).

The rest of this section describes the design and format selected for this questionnaire, discussed the periodicity and timing of it, explains the envisioned post-processing of the received data and outlines technical details with regards to data protection, storage and handling.

3.1 Questionnaire structure & processes

3.1.1 Design & format

This section describes the design, structure and format of the questionnaire, the methodology to process the inputs and the data storing and handling arrangements.

Questionnaire Format

The SNS OPS Questionnaire created for the SNS Phase 1 projects is in Microsoft Excel format for its first iteration (2023), as it was deemed as the more practical approach at this stage, by the SNS OPS partners. As the official project collaborative bodies of the SNS JU, i.e., the SB and TB have not been yet constituted, it was not possible to effectively interact with the projects during the preparation of the questionnaire. An additional obstacle to this cooperation was the fact that the collaborative workspace for all SNS JU projects was still under construction at the time of this exercise (May 2023). Moreover, it was understood from the SNS OPS partners that the project coordinators would like to share their tentative answers with the project core team (TM, IM, WP leaders) and ask for their contribution, in a straightforward manner, before submitting their final answers.

Based on the above, it was concluded that a Microsoft Excel sheet was the most effective format for the first iteration of this questionnaire, allowing for local processing and team sharing, without jeopardizing loss of information due to the non-existence of collaborative tools. Macro commands were enabled,

allowing for the autonomous collection and aggregation of all multiple-choice answers by each project, which significantly assists the post-processing of the received inputs.

Even though this is the format selected for the initial iteration of this questionnaire, it is not precluded that a different format may be selected for the next iterations (e.g., online form). The SNS OPS partners will discuss with the SNS collaborative bodies (SB and TB), once they have been established, to get feedback as to the projects' preferred way of providing input, and a decision for a transition to a different form will be taken according to the received feedback.

Questionnaire Design & Structure

The SNS OPS questionnaire is divided into three different sections based on the identified topics that the projects' feedback was required. The goal is to have a clear understanding not only of each project's current and ongoing technical activities, but also their view and expectations with regards to societal and sustainability challenges as well as their expected market impact. Table 1 provides an overview of all three questionnaire sections and their intended purpose.

Table 1: SNS OPS Questionnaire section overview

Section	Description of content	Questions
Technical section	Information about the technical work of the projects, the use cases, verticals, and KPIs they are addressing, the technological enablers and tools they are using and their planned standardization and trialling efforts.	15 questions (11 multiple choice and 4 free text)
Vision section	Information about the projects' vision for 6G development, the societal challenges they address, the KVIs they use and their sustainability efforts.	6 questions (4 multiple choice and 2 free text)
Market section	Information about the expected market impact of the projects, their business validation efforts and their expectations with regards to the upcoming 6G market.	8 questions (4 multiple choice and 4 free text)

The questionnaire is comprised of ***29 questions*** in total, across all three sections. There are two types of questions within the questionnaire, namely ***multiple-choice*** questions (19) and ***free-text*** questions (10).

The multiple-choice questions contain a set of pre-defined answers for the projects to choose those that apply to them. These questions allow to get some quick feedback, which is also easily comparable among projects and can immediately generate insights regarding general trends within the SNS JU programme. An additional "Elaboration text" field is provided for each multiple-choice question, where projects can provide additional information (e.g., when selecting the option "other") or clarify/elaborate on their selected answers. Figure 1 depicts an example of a multiple-choice question used in the questionnaire.

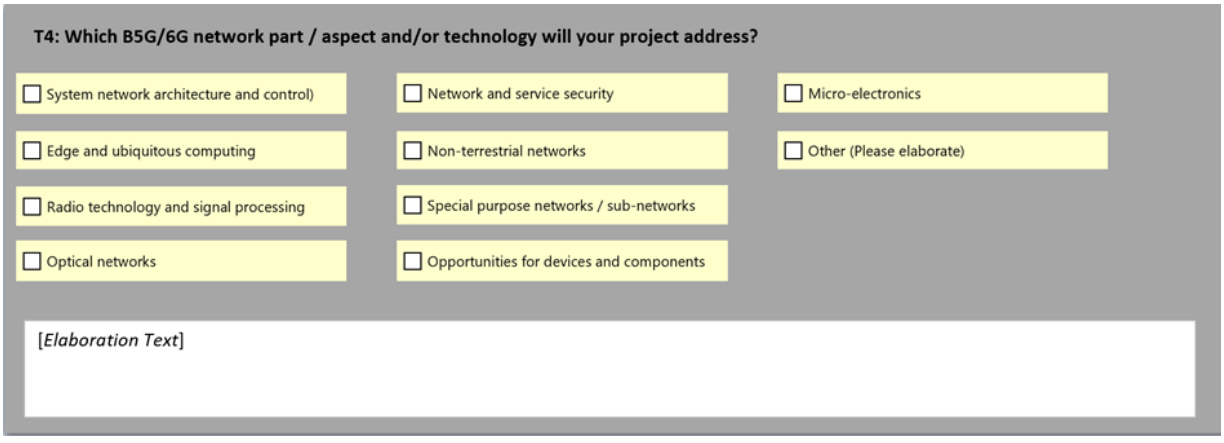


Figure 1: Example of a multiple-choice question from the SNS OPS Questionnaire

The free text questions on the other hand, are open and offer the possibility to expand in more detail regarding certain project aspects, where the response-space cannot be defined or is not easily limited. These questions target the deeper understanding of each project's approach towards certain key issues; however, they do not offer the possibility for easy cross-comparison across projects, and require an in-depth analysis to be able to extract useful insights on a programme level. Figure 2 depicts an example of a free-text question used in the questionnaire.

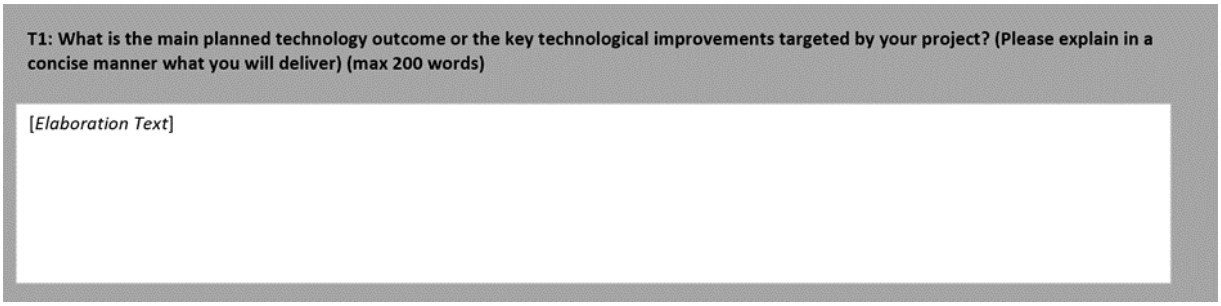


Figure 2: Example of a free text question from the SNS OPS Questionnaire

The entire questionnaire, with all three sections, that was used for the first iteration of this framework in 2023 and targeted the SNS Phase 1 projects, can be found in Appendix A of this document.

3.1.2 Questionnaire Iterations & update procedure

As mentioned before, the purpose of this questionnaire is to gather the necessary input from the projects towards the monitoring and analysis framework and to enable the fulfilment of the other CSA activities. As such, the questionnaire will be repeated on an ***annual basis***, not only to obtain updates on current work progress from existing SNS projects, but to also collect the relevant information from the new SNS projects that will be launched every year. Since the SNS JU programme is based on annual "call for actions" and awarded projects are set to commence their operation at the beginning of each year, engaging them is critical to get a better understanding of their focus, challenges and goals.

As it takes some time for new projects to find their "footing", i.e., establish their internal rules of operation, delegate work, get their WP and tasks up and running, it is not considered wise to ask for this information at the very beginning of the projects, i.e., in the first couple of months. A timeframe within ***Q2 of each year***, is considered optimal from the SNS OPS partners view, to solicit such information from old and new projects.

Moreover, the needs of the SNS JU programme will be re-evaluated every year by the SNS OPS partners, in close cooperation with the SNS JU collaborative bodies, and the questionnaire will be ***updated*** accordingly before inviting the projects to complete it. For instance, additional questions may be added, that will help track the progress of existing progress (i.e., offer comparative insights with regards to their previous answers) or will better reflect the focus of new projects, which may not be covered by the call topics of previous projects. The SNS OPS WP1 team will be responsible for the revaluation of the questionnaire each year, taking also feedback from the SNS JU collaborative bodies (what worked well, what can be improved, etc.).

3.2 Project input processing

As the multiple-choice questions and the free-text questions require completely different processing for the envisioned analysis, two different approaches are devised. The multiple-choice questions have been configured to automatically collect the responder's input (enabled macro-commands in Excel) and to store it in a separate sheet. This facilitates the aggregation of all projects' responses and consequently, their analysis.

With all project responses aggregated in the same sheet, a high-level analysis can be easily performed by generating bar graphs, visually indicating the overall project responses, and immediately providing some early insights with regards to i) the work focus of the majority of projects, ii) over or under addressed areas/subjects, iii) the coverage achieved over the targeted SNS Work Programme (WP) areas, iv) the vision and the targeted maturity of solutions of each project, v) the go-to-market approach

and impact targets of each project, and more.

Such analysis is very useful for the gap analysis that takes place before the definition of the next SNS Work Programme (on a yearly basis), as it provides insights into the actual work that is ongoing, tangible results delivered by the projects, and whether the initial targets of the previous WP have been well covered.

Additional information can be obtained from the projects' responses in the "elaboration text" field of each multiple-choice question, as the received responses may indicate additional aspects the projects are working on. These aspects may be taken into account for the follow-up versions of the questionnaire, including more accurate and well-rounded questions that cover all the aspects/technologies that the SNS projects are working on. Moreover, the elaboration text assist in the understanding of the different approaches of the various projects, even though they may be addressing similar challenges and/or technologies, e.g., they may be measuring the same KPIs but under significantly different conditions and configurations.

The elaboration text is also used to get targeted additional information when listing all possible options in a multiple-choice style is simply not practical (i.e., it would be too extensive). Such cases are, e.g., the identification of the exact standardization sub-groups that the projects follow/attend, and the KVIs that the project intends to address/define. As there are simply too many sub-groups that projects may attend, the multiple-choice question is used to identify the main standardization bodies and the elaboration text is used to identify the specific sub-group(s) within that body.

The analysis of the input provided via the free-text questions does not enable quick insights but rather requires detailed manual processing in order to understand each project's background, targets and scope and to find commonalities and interesting differentiations among the projects. The free-text questions are used to gain insights on the work of the projects in aspects that don't have a defined answer space.

As the questionnaire evolves over time (new yearly editions will be issued) based on the feedback of the projects, the SNS JU collaborative bodies and other stakeholders, the outputs of this analysis will evolve with it, to potentially include additional free-text questions and address a wider field of inputs. In this way, an agile approach is followed to ensure that the framework always accurately captures the pulse and heart of the work performed within the SNS JU.

3.2.1 Technical section targeted analysis

As mentioned in Table 1, the technical section of the questionnaire is comprised of 15 questions in total, 11 of which are multiple choice questions and four that are free text questions.

Multiple-choice questions processing

Figure 3 below provides one example of a graph created from the SNS Phase 1 project responses, regarding the use of technological enablers in each project. This graph immediately helps to understand that most Phase 1 projects make use of AI/ML technology, and that the orchestration of VNFs/CNFs is also very popular. On the other hand, it is clearly seen that optical wireless communications and quantum computing are barely used, which may indicate future directions for the SNS WP, i.e., to cover these gaps in the follow-up phases.

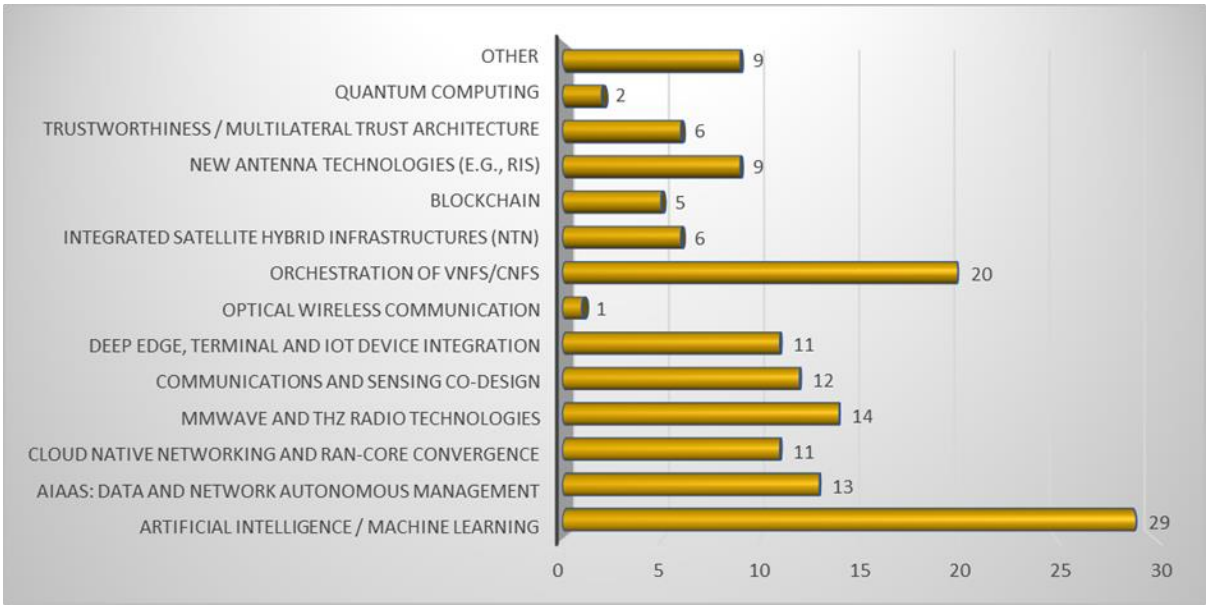


Figure 3: Number of SNS Phase 1 projects using key technological enablers

Based on the current format of the questionnaire (see *Appendix A* for details), the analysis of the technical section will offer insights on:

i. KPIs used/targeted by the projects.
ii. Addressed verticals & use cases.
iii. Technological enablers used by the projects.
iv. Network aspects and technical focus of the projects.
v. End user devices used.
vi. Use of AI/ML mechanisms.
vii. Standardization bodies and (sub-)groups targeted per project.
viii. Participation of verticals & SMEs per projects.
ix. Validation methods used per project.
x. Energy efficiency approaches per project.

The above analysis will take place on multiple different levels, depending on the needs of the SNS WP, the dissemination opportunities (e.g., events of a specific focus) and needs of the collaborative bodies (SB, TB and WGs). The potential levels of analysis are:

i. The entire SNS JU project portfolio.
ii. Per SNS JU Phase / Call.
iii. Per Stream.
iv. Per Strand.
v. Custom (e.g., among all projects addressing a certain vertical).

Besides the aggregated analysis mentioned above, additional insights may be gained by investigating specific aspects and by cross-referencing the answers of projects. For instance, all projects addressing a certain vertical can be identified, thus assisting in the invitations to certain WGs (e.g., identify all projects addressing automotive aspects to be invited in the 6G-IA 5G4CAM WG) or all projects measuring a certain KPI can be identified, thus being invited to contribute to knowledge exchange, white papers, etc. Such analysis will be a very valuable tool for the SNS JU collaborative bodies (SB, TB and WGs) and will greatly assist in bringing experts that work on the same issues together.

Free-text questions processing

Based on the current version of the questionnaire, the analysis of the projects' responses to the free-text questions will offer the following insights:

i. Elaboration on the main planned technology outcome or key technological improvements targeted by each project.

ii. Enumeration of the additional KPIs targeted/addressed by each project (not in the main KPIs list of question T1).

iii. Elaboration on the replicability and accessibility of the developed solutions.

iv. Details on the planned Trials/Pilots of each project.

3.2.2 Vision section targeted analysis

The vision section of the questionnaire comprised six questions, of which four were multiple choice, and two were free text questions. As for the technical section, the multiple choice will be presented as bar charts, and early interpretations are presented further down in section 4. The free text questions will need further time to be analysed manually. One of these two questions were specifically on how the projects address KVIs, which are introduced as a new metric in the SNS JU WP. The other question addresses the expectations and interest from the project in the SNS WGs. Responses to both these questions are of high value for the further development of the SNS programme.

Multiple choice questions processing

Figure 4 shows an example of a graph created from the SNS JU Phase 1 responses in the Vision section of the questionnaire. The immediate observation is that almost all projects claim to focus on **Contributing to global standards** and **Promoting European Leadership** to realize the 6G Vision. The questionnaire and responses do however not give insight in how the projects are addressing standardisation, thus this needs further investigation.

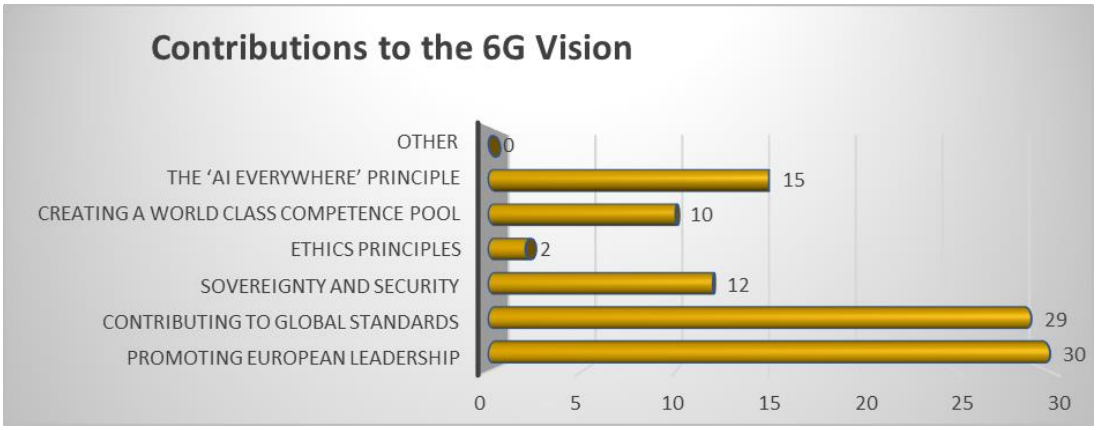


Figure 4: Contributions to the 6G Vision by SNS JU Phase 1 projects.

Based on the current format of the questionnaire (see Appendix A – Full Questionnaire for details), the analysis of the vision section will offer insights on:

1. Contributions to societal challenges.
2. Societal values.
3. Contributions to the 6G Vision.
4. Addressing UN Sustainability Development Goals (SDGs).

As the questionnaire evolves over time based on the feedback of the projects, the SNS JU collaborative bodies and other stakeholders, so will the outputs of this analysis.

Free-text questions processing

Based on the current version of the questionnaire, the analysis of the projects' responses to the free-text questions will offer the following insights:

i. Elaboration of the KVIs addressed by each project.

ii. Elaboration of each project's thematic interest in cross project collaboration in the context of the SNS Working Groups.

3.2.3 Market section targeted analysis

The "Market" section of the questionnaire comprises eight questions (see Appendix A – Full Questionnaire). Half of these are open and the other half are multiple choice, with the possibility to further elaborate in writing. This mix of qualitative and quantitative questions provides complementary types of data, enabling an in-depth analysis and thus, obtaining richer results.

Following the approach of the technical and vision sections, the analysis will be done in an aggregated manner, considering all the projects and the responses per stream. Other specific considerations could be included, i.e., an assessment based on certain vertical sector or technology.

Multiple-choice questions processing

The results of the quantitative analysis of the multiple-choice questions will be illustrated in a bar chart. Additional insights will be provided by examining the free text, which not only offers a more detailed context to the responses selected, but it can also bring new elements that were not included in the different choices available.

Free-text questions processing

The answers to the open questions, including the free text in the multiple-choice ones, will be analysed manually to identify trends and main topics. Nevertheless, new tools and methods to appraise the written content will be explored to gain efficiency, as the number of respondents increases. The market section of the questionnaire will offer insights on:

- The booming domains as well as the key technologies and innovations in the market with the advent of 6G.
- The vertical sectors expected to be most impacted by 6G.
- The different approaches used by projects to validate business opportunities in vertical sectors
- The principal obstacles and challenges to the deployment of 6G networks
- The key technologies and innovations in the telecommunications market in the next year
- The estimated novel market sections that 6G may enable
- The Key Exploitable Result (KER) that projects expect to deliver and at which Technology Readiness Level (TRL) are these expected to be delivered.

The last question of the market section intends to gather any other relevant information, independently of the section, that was not covered by the previous questions.

Overall, the aim is to extract some general conclusions and highlight any novel information that can inform the different stakeholders about the expected impact of the projects in the market, their business validation efforts and their expectations in relation to the 6G market.

According to the feedback provided by the projects and other SNS stakeholders, the questions might be fine-tuned to ensure that all the data obtained continues to be meaningful and adequately reflects the progress of the SNS JU over time.

3.3 Data Storing and handling

Data will be collected and stored for analysis purposes. The SNS OPS team will handle the results and use them for the publications of white papers, presentation at dedicated webinars and other gap analysis documents. The data will also give an input to the first steps of the online tools Standards Tracker and Vertical Engagement Tracker which will be launched online as part of SNS OPS WP4 and SNS ICE WP3 by fall 2023.

All data collected will be handled in compliance with the General Data Protection Regulation (GDPR) guidelines. The data will be securely stored in the project's document repository, which is firewalled by a personal login process. This login process ensures that only authorized personnel have access to the data. Thus, access will be limited to only those individuals involved in the SNS OPS team.

The collected data will be used for analytical purposes, and any published materials will not include any personally identifiable information. The data will be anonymised before being used in any publications or reports.

Any individual or project that contributes data to Task 1.1: SNS progress assessment will have the right to access their data, correct inaccuracies, and request that personal data is deleted. Additionally, the data will not be shared with any third parties and will only be used for the purposes of the SNS project.

4 SNS JU Call 1 Projects – Initial Analysis

The first version of this questionnaire was circulated among SNS JU Phase 1 projects in mid-April 2023. A period of 6 weeks was given to the projects to provide their input, and after a couple of reminders, input from all R&I projects was received by the end of May 2023. As the responses were received too close to the submission deadline of this deliverable, it was not feasible to perform a full-fledged analysis of the received responses (which will be delivered in follow-up deliverables such as D.1.2). However, some first insights are reported here based on an initial analysis of the multiple-choice questions (not including the free text part).

A total of 33 projects answered the questionnaire. This means that all SNS JU Phase 1 projects participated in the exercise, with the exceptions of SNS ICE and SNS OPS CSAs, which were not included as explained earlier.

Lessons learned from this first iteration will also help us improve the follow-up versions of the questionnaire. The full analysis will be disseminated in dedicated webinars to the community and a white paper will be produced based on the outcomes.

4.1 Technical insights – KPI analysis

Figure 5 below depicts the main KPIs addressed within Phase 1 of the SNS JU programme, based on the answers of the R&I projects. The vast majority of projects will address ***Latency, Reliability*** and ***Energy efficiency*** to some extent. This can be largely explained by these KPIs falling within the scope of work described in the SNS JU work programme for Phase 1 (2022 WP[3]). Another interesting insight is that most main KPIs (as depicted in Figure 5 below) seem to be well covered by the projects, offering the possibility for cross-validation of results, with the exception perhaps of Mobility (lower coverage). This is a direct result of the low coverage of the automotive sector in Phase 1 of the SNS JU, as shown in Figure 5.

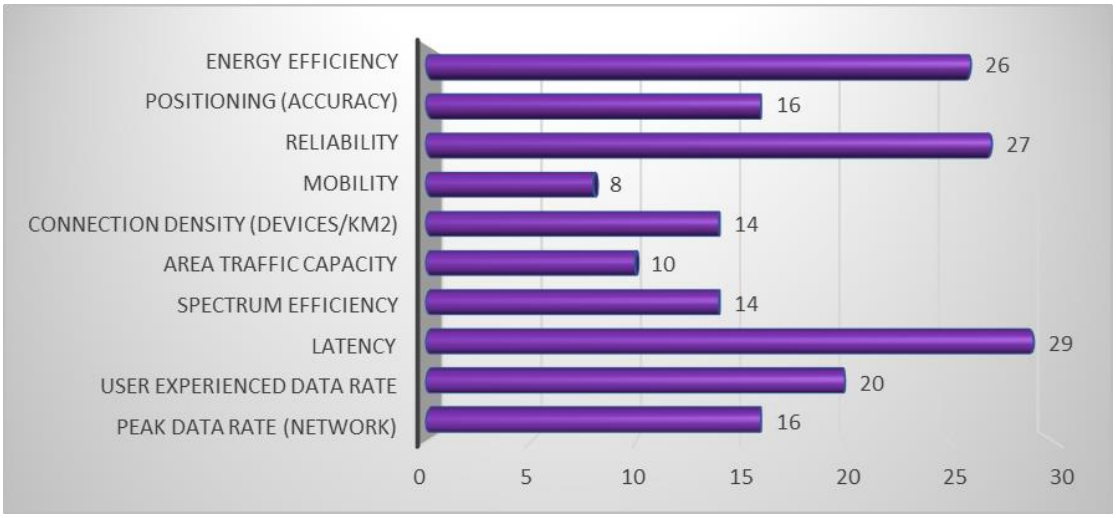


Figure 5: Main KPIs addressed by SNS JU Phase 1 projects.

Figure 6 offers insights with regards to the use cases and applications being addressed by the SNS JU Phase 1 projects, highlighting the applications considered to be benefited the most by B5G/6G connectivity. The most popular use cases address ***Digital Twin, Industry 4.0*** and ***XR gaming & entertainment*** applications, which are indeed the ones envisioned to have stringent operational requirements translated into high demands from the network[4]. ***Cooperative robots, cyber-physical systems*** and ***intelligent network operations*** are also well covered by the Phase 1 projects. On the other hand, smart building, smart agriculture and tactile/haptic applications seem to be relatively poorly

[3] https://6g-ia.eu/wp-content/uploads/2021/12/sns-ju-ri-work-programme-2021-2022.pdf?x93895

[4] https://5g-ppp.eu/wp-content/uploads/2023/06/5GPPP-TMV_White-paper_Final-Trial-KPIs_v1.0.pdf

covered by Phase 1 projects, which was taken into account (gap analysis) during the creation of the follow up 2023 SNS WP[5]. Automotive/transportation applications seem to be relatively well covered, however a deeper examination based on the elaboration text revealed that the involvement of most projects is limited to enabling technologies that could also assist the automotive sector.

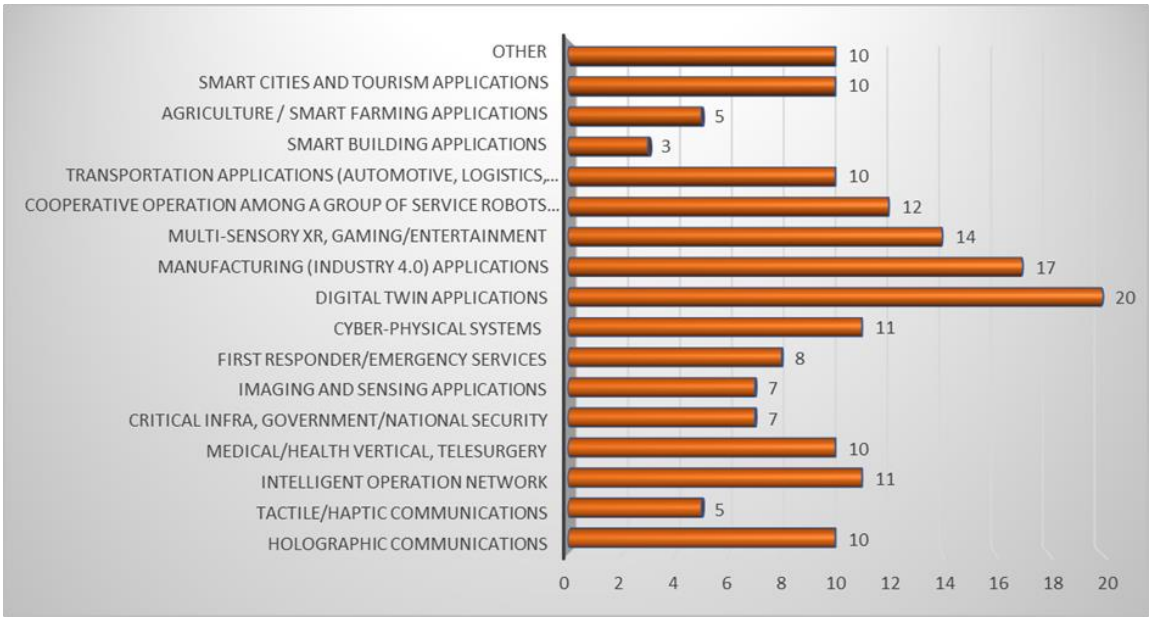


Figure 6: Addressed Use Cases / Applications by SNS JU Phase 1 projects.

Another key piece of information to assess the overall impact of the SNS JU programme is the number and type of Standards Developing Organizations (SDOs) targeted by the projects. Figure 7 depicts the coverage of the key worldwide SDOs by the Phase 1 projects. It comes as no surprise that the vast majority of projects are planning to participate and contribute to ***3GPP*** and ***ETSI***, as these two bodies are closely related with B5G/6G developments. A good coverage of ***IETF, ITU*** and ***Open-source*** bodies seems to be achieved by the Phase 1 projects, while additional SDOs are targeted, depending on the exact scope of work of each project. Further insights will be gained regarding the other SDOs and the specific (sub-)groups targeted that the projects plan to contribute to, once the elaboration text of this question is also analysed.

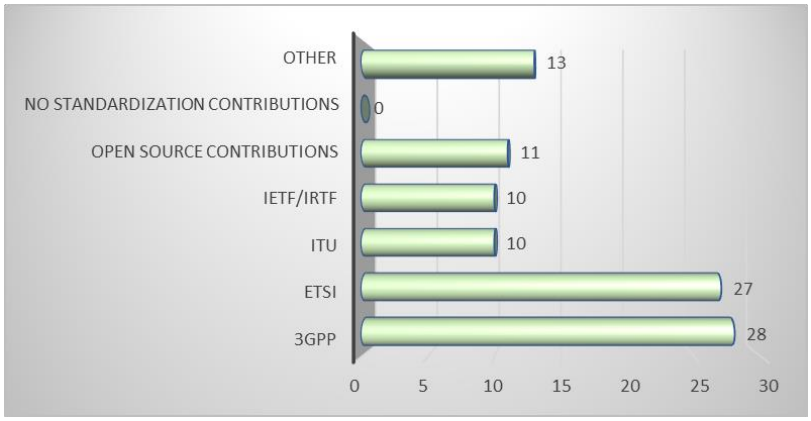


Figure 7: Targeted Standards organizations by SNS JU Phase 1 projects

4.2 Vision insights – KVI analysis

The preliminary analysis of the responses for the vision section is restricted to getting an overview from the responses of the multiple-choice questions. Figure 8 below shows how the projects aim to contribute to societal challenges. The focus of the projects is strong on **advanced 6G ICT solutions for vertical**

[5] https://smart-networks.europa.eu/wp-content/uploads/2022/12/sns-work-programme-2023.pdf

industries, and to **accelerate the development and deployment of advanced infrastructures**. It is also interesting to see that many projects highly value the importance of **promoting SME involvement** and the **support of research and energy efficiency**.

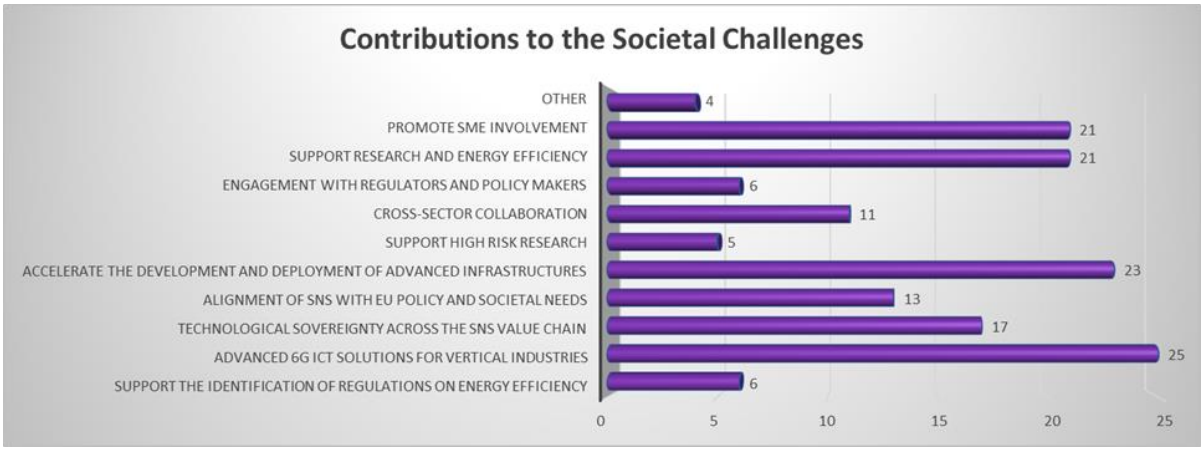


Figure 8: Contributions to societal challenges by SNS JU Phase 1 projects

In Figure 9, we see that **Sustainability and energy consciousness** is on top of the **societal values** being addressed. **Native AI** and **Trusted technology** also have high scores. Societal acceptance of AI is a key issue and is including with both ethical and trust questions. For now, we can only say that the projects are sensitive to these aspects. Related to this is the free text question on KVIs which is expected to give more details to the understanding of societal values.

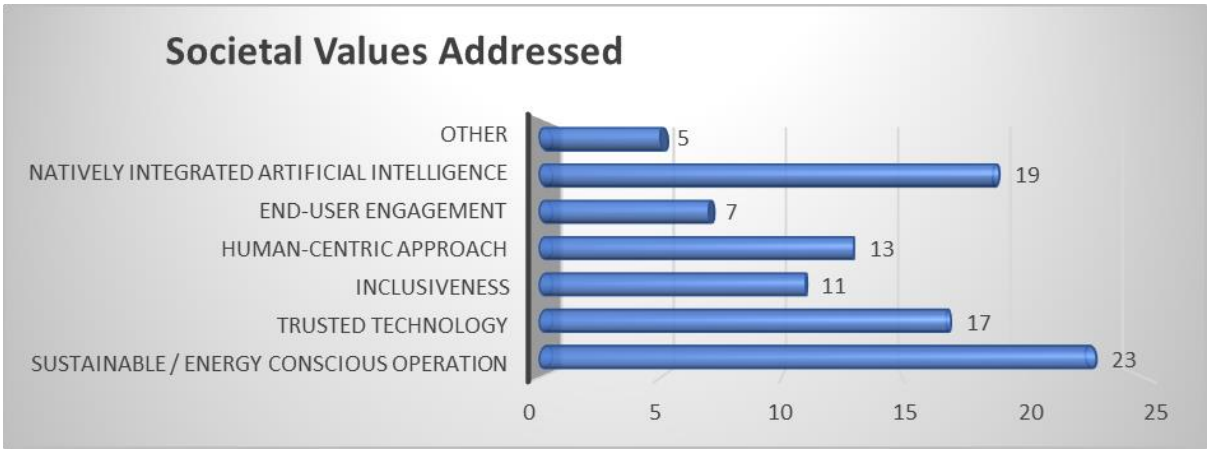


Figure 9: Societal values addressed by SNS JU Phase 1 project.

Figure 10 shows the expected contributions to the UN SDGs. **Industry, Innovation and Infrastructure** are clearly favoured. The SNS work programme states four specific SDGs: Promote sustained, inclusive, and sustainable economic growth (SDG 8[6]), Build resilient infrastructure, promote inclusive and sustainable industrialization (SDG 9[7]), Make cities and human settlements inclusive, safe, resilient, and sustainable (SDG 11[8]), and Climate Action (SDG 13[9]). We see that **Sustainable cities and infrastructures** score quite high (22/33), addressing SDG 11. Further analysis is needed to understand the full depth.

[6] https://sdgs.un.org/goals/goal8

[7] https://sdgs.un.org/goals/goal9

[8] https://sdgs.un.org/goals/goal11

[9] https://sdgs.un.org/goals/goal13

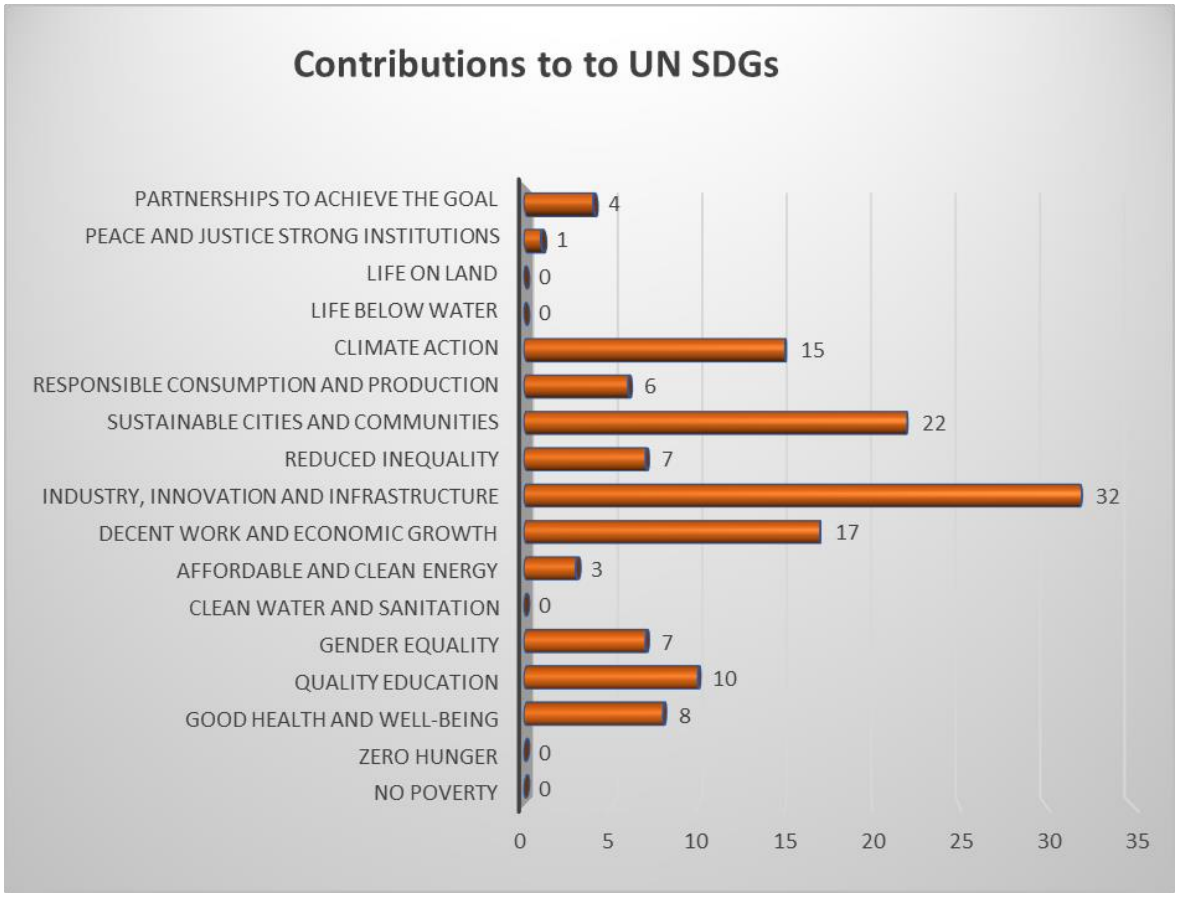


Figure 10: Contributions to UN SDGs by SNS JU Phase 1 projects

4.3 Market Insights

The preliminary analysis is limited to multiple choice questions due to time constraints. This only includes the quantitative data (responses selected) as the analysis of the written answers is yet to be completed. Therefore, the insights provided below must be considered in this context.

When asked about which technologies and innovations are expected to be key in the telecommunications market, 31 out of the 33 (94%) projects that replied indicated **AI-based solutions** to be the biggest game changer, as depicted in Figure 11. **Energy efficiency** and **dynamic/zero touch network management** also gather significant consensus, with 25 (80%) and 24 (72%) projects selecting them respectively, as key for the future of telecommunications. Contrariwise, less than 40% of the projects expect TN-NTN-PN integration/interoperability and cloudification to have a significant role.

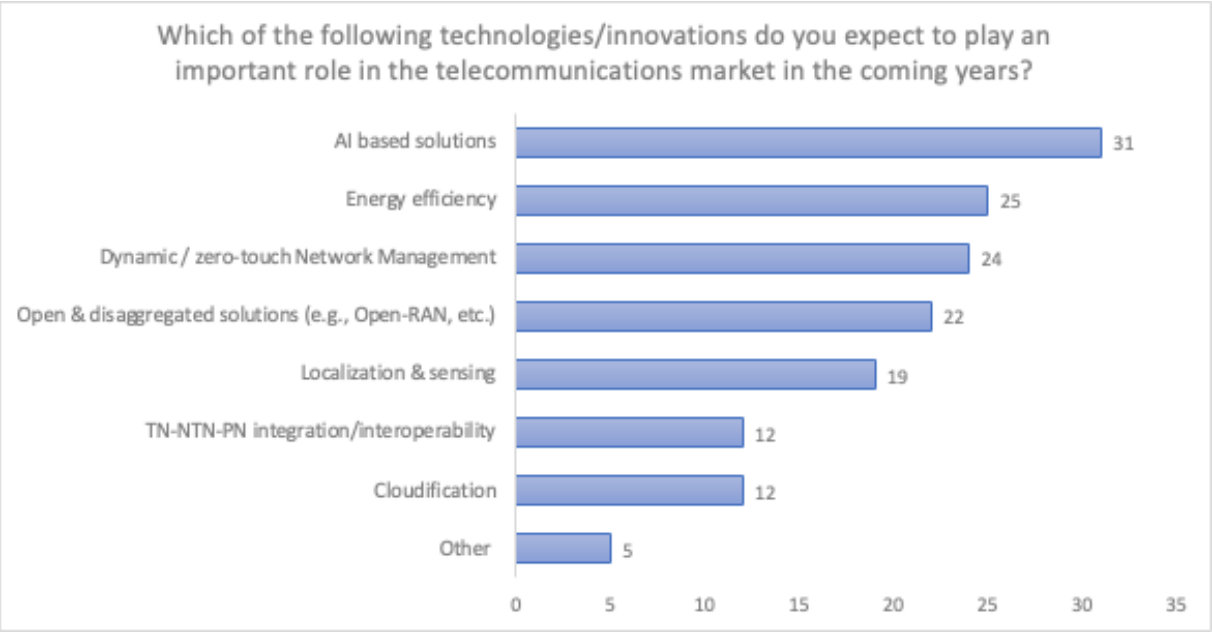


Figure 11: Technologies/Innovations expected to play an important role in the telecoms market according to SNS Phase 1 projects.

Figure 12 shows the variety of opinions concerning the vertical sectors that are expected to be more impacted by 6G. **Industry 4.0/manufacturing**, closely followed by **media/XR**, are indicated by over 60% of the projects to be the sectors more disrupted by the advent of 6G. Slightly less than half of the projects also underline the **Automotive/transport/logistics** sector.

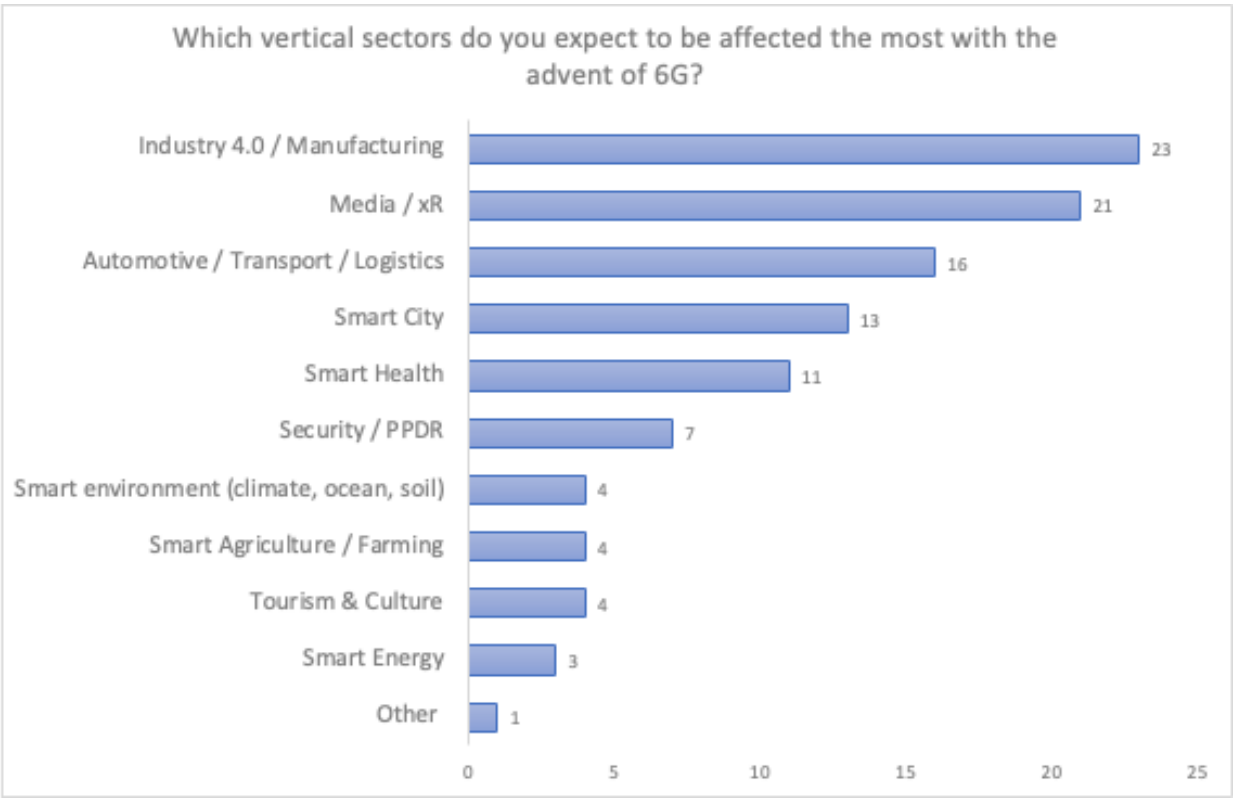


Figure 12: Which vertical sectors do you expect to be affected the most with the advent of 6G?

In contrast, smart environment, smart agriculture/farming, tourism and culture and smart energy are forecasted to be the less impacted by 6G. One project points out in "Other" to the availability of technologies that ensure security and privacy, enhancing the trustworthiness of services of which vertical industries are users.

With regards to validation of business opportunities in vertical sectors, most projects seem to favour **working closely with use case owners,** with 23 out of 33 (70%) projects selecting this option. To a lesser extent, **developing hypothesis about the needs of vertical industries** as regards as a specific technology and the **value proposition canvas method** are also used by projects to understand business opportunities, as depicted in Figure 13.

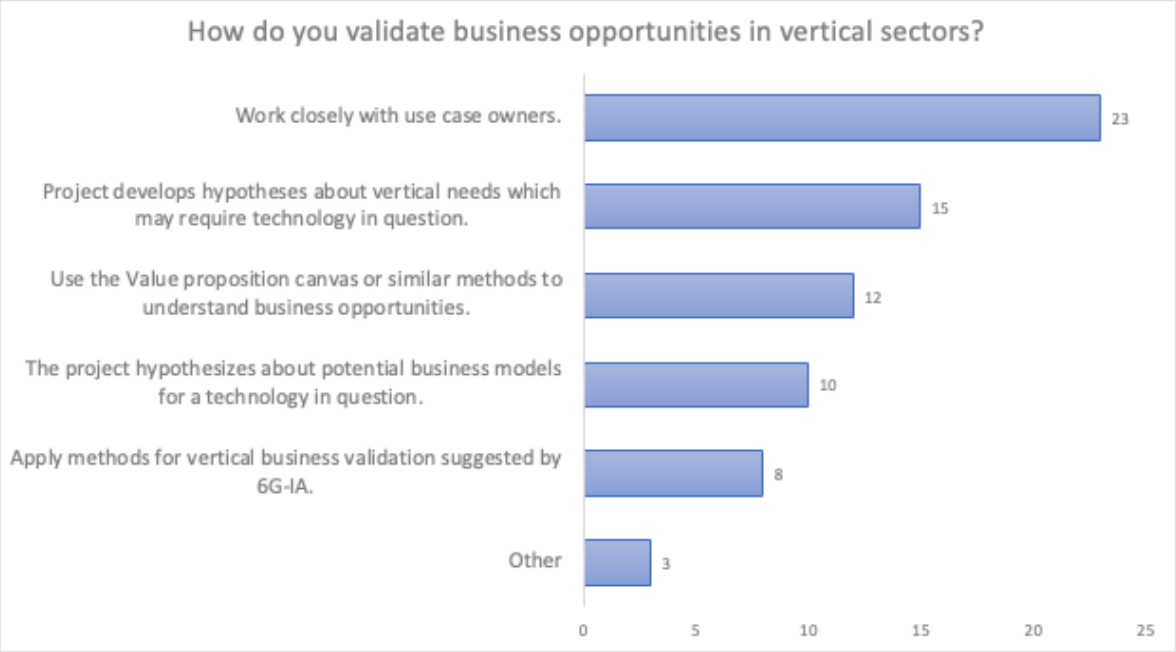


Figure 13: Validation of business opportunities in vertical sectors

Many projects prefer a combination of different methods. For instance, some 11 projects opt for a combination of use cases and hypothesis. It is important to note that one project does not employ any of the methods nor provides any information on the matter.

With regards to the greatest obstacles for the deployment of 6G networks (see Figure 14), the **costs** seem to be the main deterrent for the deployment of 6G networks, according to 22 out of 33 (67%) projects. Almost half of the projects (16 out of 33, 48%) also underline the **lack of demand for unique 6G services** as a challenge.

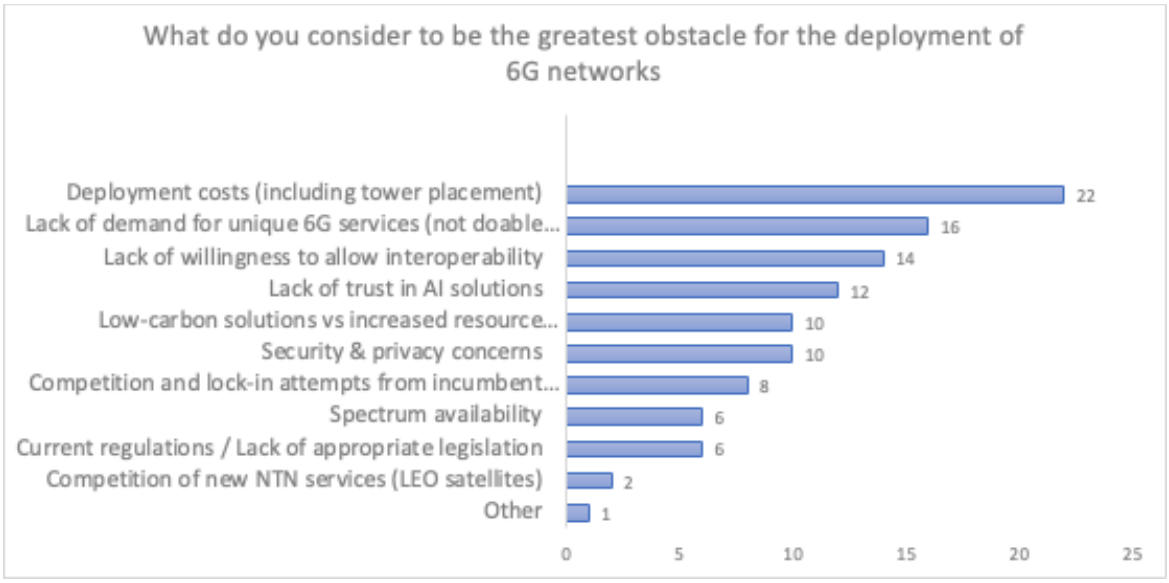


Figure 14: Main obstacles for the deployment of 6G

The potential obstacles related to spectrum availability, regulations and competition of new NTN services seem to be the least concerning. In the category "Other", a project mentions the "spectrum management at unlicensed bands in the mmWave and THz spectrum".

5 Building SNS momentum & framework promotion

This section highlights the importance of the analysis and monitoring framework and how this will enable the development of the SNS internal and external momentum.

5.1 Contributing to SNS Momentum

The defined framework and its ongoing implementation will be key for both SNS internal and external development. The analysis of the questionnaire will enable multiple SNS programmatic cartographies, e.g., over the entire SNS project portfolio, per SNS Phase / Call, per SNS Stream, per SNS Strand, per SNS Vertical, and it will lay the foundation for a gap analysis that will be one of the main inputs in the elaboration of the SNS portfolio.

The evaluation of the SNS coverage and gaps is and will be directly taken into account for the definition of the forthcoming SNS Work Programmes / Calls for proposals. It is also expected that the initial SNS Phase 1 projects analysis will be up-dated on annual basis and to consider the projects evolution and up-dates. This will also be used at the end of each SNS Phase / Call implementation, to evaluate the overall outcomes as compared to the initial targets. The portfolio and gap analysis will be very beneficial for the overall community to better understand the SNS technical, vision and market perspectives and for organizations not yet involved in the programme to rapidly ramp-up in their understanding and potentially define their potential optimal engagement in the forthcoming Calls for proposals.

Externally, the analysis outcome will also be widely used for SNS related communication on the overall SNS programmatic and projects perspectives. The analysis was already used during EuCNC & 6GS 2023 Workshop 9 “Empowering Transatlantic Platforms for 5G Advanced and 6G Networks”[10] to present the first Streams C and D projects perspectives on Platforms and Verticals. Based on the 5G Infrastructure PPP experience, the overall programmatic cartographies were the most used and impacting dissemination vectors, e.g., Platforms cartographies, Verticals cartographies...

5.2 Promotion tools & materials

The purpose of stakeholder engagement is to create synergies and contribute to develop partnerships and knowledge among the community. Objectives include exploiting the results and main achievements of SNS projects and ensure the growth and sustainability of the SNS JU initiative. The presented framework, will provide the necessary results and insights to contribute to these objectives.

5.2.1 Online communication

5.2.1.1 Website

The CSAs 6GStart and SNS OPS collaborate with the SNS JU Office to maintain the new SNS JU portal. If agreed by the SNS Office, release of the questionnaire’s process and main findings from this deliverable could be echoed on the portal which is the central point for accessing the SNS programme and related strategies.

5.2.1.2 Social media channels

The SNS JU social media channels will be used to animate discussion and echo the framework and the questionnaires’ main findings. Social media postings will also serve to actively promote involvement, responses, reactions, outputs, release of promotional materials and the organization of webinars. The webinar would be promoted through the website and social media channels, before, during and after the event.

SNS OPS monitors an active presence on most popular social media channels such as Twitter (more than 9,000 followers at the time of writing), LinkedIn (more than 1,400 followers at the time of writing).

[10] https://www.eucnc.eu/programme/workshops/workshop-9/

5.2.1.3 Newsletter/newsflash

If agreed by the SNS Office, newsflashes and newsletters issued on a regular basis by SNS OPS could be used to echo the Framework and its questionnaire's main findings.

5.2.2 Promotional material

Promotional materials are key to promote the SNS work and values and enhance the SNS brand recognition. A poster can be produced to generate a short description of the Framework and its results to inform the community. The poster could be distributed or be downloaded via a QR code at major events.

Main outcomes of the questionnaire could also be further promoted in the SNS Journal 2024 scheduled to be released in June 2024 (the 2023 edition has already been released in June).

5.3 Promotion events

SNS OPS aims to pool forces in maximizing the outreach, ensuring the best promotion of the questionnaire results with relevant stakeholders and through inter-projects collaboration.

SNS OPS will then organize, promote and cover with social media live noise a set of webinars, a webinar per year (the first could take place before the end of 2023), to introduce main results from the questionnaire and highlight changes and evolutions.

SNS OPS will also consider to further promote the questionnaire results at additional events: the EuCNC&6G Summit could be a suitable venue for a workshop to present and discuss the conclusions and their implications, and salient points highlighted by the questionnaire.

5.4 Replicability and transferability of SNS projects results

One of the questions included in the questionnaire addresses replicability, which is key for the increased momentum of the results of the SNS. The objective was to better understand the strategy of each project regarding the reusage of projects results. While Stream C and stream D projects have to target the development and the experimentation of a number of use cases, it would be interesting to understand if other projects have also the objective to do so.

Replicability is one of the objectives of the Horizon Result Platform[11]. AIOTI, with the support of 6GStart (predecessor of SNS OPS to hand over its outcomes), took the lead of this activity in order to define and develop an assessment tool able to identify the level of replicability of a solution.

For those projects who gave a positive answer to this question, we shall use the replicability assessment tool to define their respective level of replicability. This level is calculated through the answers provided on 33 questions addressing five dimensions:

1. Technical dimension: 11 questions
2. Data dimension: 6 questions
3. Market dimension: 7 questions
4. Acceptance dimension: 6 questions
5. Regulatory/Policy dimension: 3 questions

Following the answers provided to each question of the questionnaire, a number of points is allocated to a solution, and the following replicability levels can be considered, as depicted in Figure 15.

[11] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform

High level of replicability : 50 < LR < 74
Good level of replicability: 25 < LR < 49
Low level of replicability: 02 < LR < 24

Figure 15: Initial Replicability levels

Looking to the preliminary answers collected on Technical question 10 (T10: Will the use cases / Solutions developed and experimented within your project be replicable? Will they be accessible to other / future experimenters?), it appears that 31 out of 33 projects gave a positive response. In a few months, a Replicability assessment tool will be available to qualify each solution and rate the level of replicability.

With such indications, integrators will get a good understanding on the possibility to use a solution in the context of the Digitalization of the European Industry. One of the key integrators are the Smart Connectivity Digital Innovation Hubs which are a member of the SCoDIHNet. They are eagerly expecting this qualification in order to choose the best solution with regards to the end customer needs.

6 Conclusions and way forward

One of the key goals of SNS OPS WP1 is to set-up a framework to monitor and analyse the technological KPIs, societal KVIs and other related work aspects of the SNS-JU projects in a sustainable way. This has been completed, and the proposed framework presented in this document will assist and support the SNS JU ecosystem (Phase 1 and follow up projects, the SNS Office, the SNS SB, TB and WGs) to achieve their goals.

The framework created for the monitoring and analysis of SNS projects' work and outcomes, comprises a structured approach to collect key information from projects on an annual basis, taking into account the intricacies of each SNS Phase and the adjusted focus of newly accepted projects. The revision guidelines presented ensure that all relevant stakeholders, namely, the SNS projects themselves, the SNS JU office, the SNS SB, TB and WGs and the 6G-IA will be able to give feedback and improve the framework in a way that will make it more useful to them. The presented framework also includes dissemination and promotion guidelines of the results of the analysis, to ensure the maximization of the impact achieved by this activity and the promotion of the results of the SNS JU projects.

A first version of the questionnaire that constitutes a key element of the framework to extract information from the projects was presented and used to collect information from Phase 1 projects. The questionnaire is expected to evolve and adapt on an annual basis, based on the received feedback and to better reflect the focus of new projects, while a new online format is considered for the 2024 edition.

The preliminary analysis of the multiple-choice questions which was presented already provide a good indication of the significant added-value that this framework offers to the SNS JU programme by allowing the extraction of cumulative insights, the estimation of expected KPIs/KVIs and the performance of a gap analysis to drive developments in follow up work programmes.

Regarding the next steps, the most important activity is the in-depth analysis of the provided projects responses, on multiple levels, to assist with the understanding of their work focus, expected outcomes and impact and of course the monitoring of their respective KPIs and KVIs. Once the analysis is ready, the project will undertake a number of dissemination and promotional activities, including:

- The results of the analysis will be used to assist with the dissemination and promotional activities of the Phase 1 project results via online communications tools.
- Host/organize relevant webinars and events to share the findings after every questionnaire study.
- Provide the outcome of the results to the SNS Steering Board, Technology Board and Working Groups, to assist with project results tracking and grouping of relevant projects (according to interest).
- The results of the questionnaire responses analysis will be shared with all SNS projects, and the key findings and insights will be presented in a dedicated webinar.

The timeline of the follow up phases of this activity of SNS OPS has been presented in detail in Section 2.2. It is envisioned that the refined and improved framework that SNS OPS will have created by the beginning of 2025 will be handed over to the next operational CSA project, to carry on the monitoring and analysis of the SNS Projects, from 2025 onwards.

Appendix A – Full Questionnaire

Technical Section - 15 Questions (T1-T15)

T1: What is the main planned technology outcome or the key technological improvements targeted by your project? (Please explain in a concise manner what you will deliver) (max 200 words)

[*Elaboration Text*]

T2: Which of the following main KPIs will your project Address?

- ☐ Peak data rate (network)
- ☐ Area traffic capacity
- ☐ Positioning (accuracy)
- ☐ User experienced data rate
- ☐ Connection density (devices/km2)
- ☐ Energy efficiency
- ☐ Latency
- ☐ Mobility
- ☐ Spectrum efficiency
- ☐ Reliability

[*Elaboration Text*]

T3: Will your project address additional KPIs? If yes, which ones?

[*Elaboration Text*]

T4: Which B5G/6G network part / aspect and/or technology will your project address?

- ☐ System network architecture and control)
- ☐ Network and service security
- ☐ Micro-electronics
- ☐ Edge and ubiquitous computing
- ☐ Non-terrestrial networks
- ☐ Other (Please elaborate)
- ☐ Radio technology and signal processing
- ☐ Special purpose networks / sub-networks
- ☐ Optical networks
- ☐ Opportunities for devices and components

[*Elaboration Text*]

T5: Which technological enablers will your project work on / make use of?

- ☐ Artificial Intelligence / Machine Learning
- ☐ AI as a Service: Data and network autonomous
- ☐ Cloud Native Network & RAN-Core Convergence
- ☐ mmWave and THz Radio Technologies
- ☐ Communications and Sensing co-design
- ☐ Deep Edge, Terminal and IoT device integration
- ☐ Optical Wireless communication
- ☐ Orchestration of VNFs/CNFs
- ☐ Integrated Satellite hybrid infrastructures (NTN)
- ☐ Blockchain
- ☐ New Antenna Technologies (e.g., RIS)
- ☐ Trustworthiness / Multilateral trust architecture
- ☐ Quantum Computing
- ☐ Other (Please elaborate)

[*Elaboration Text*]

T6: Which of the following use cases / applications will your project support?

- ☐ Holographic Communications
- ☐ Tactile/Haptic Communications
- ☐ Intelligent Operation Network
- ☐ Medical/Health Vertical, Telesurgery
- ☐ Critical Infra, Government/National Security
- ☐ Imaging and Sensing Applications
- ☐ First Responder/Emergency Services
- ☐ Cyber-Physical Systems
- ☐ Digital Twin Applications
- ☐ Manufacturing (Industry 4.0) Applications
- ☐ Multi-Sensory xR, Gaming/Entertainment
- ☐ Cooperative Robots / drones
- ☐ Transportation Apps (automotive, logistics, etc.)
- ☐ Smart Building Applications
- ☐ Agriculture / Smart Farming Applications
- ☐ Smart cities and tourism applications
- ☐ Other (Please elaborate)

[*Elaboration Text*]

T7: Will your project make use of AI/ML? if yes, on which part of the system will your project use AI or which AI services will you develop?

- ☐ RAN
- ☐ Core
- ☐ Device side
- ☐ Management & Orchestration
- ☐ User or service side
- ☐ Security
- ☐ Other (Please Elaborate)

[*Elaboration Text*]

T8: Which standardization bodies will your projects target for contributions?

- ☐ 3GPP (please mention the sub-groups)
- ☐ ETSI (please mention the sub-groups)
- ☐ ITU (please mention the sub-groups)
- ☐ IETF/IRTF (please mention the sub-groups)
- ☐ Open Source contributions (which ones)
- ☐ No standardization contributions envisioned
- ☐ Other (Please Elaborate)

[*Elaboration Text*]

T9: Which methods will your project use to validate the technologies to be developed?

☐ Simulations	☐ Advanced Testbed(s)	☐ Reuse of existing platforms (e.g., H2020-ICT17)
☐ Lab tests	☐ Trials/Pilots validation (Large Scale Trials)	☐ Other (Please Elaborate)

[*Elaboration Text*]

T10: Will the use cases / Solutions developed and experimented within your project be replicable? WIl they be accessible to other / future experimenters?

[*Elaboration Text*]

T11: What type of (End User) Equipment will be used for testing/trialling in your project?

☐ Mobile phone	☐ On Board Unit [V2X]	☐ Satellite receiver
☐ CPE (Customer Premise Equipment)	☐ Drone	☐ Other (Please elaborate)
☐ Modem/Router	☐ IoT Sensors	

[*Elaboration Text*]

T12: If your project includes validation via Trials and Pilots, what is the focus of each such trial and the planned start and end dates? Please provide the information separately for each Trial/Pilot

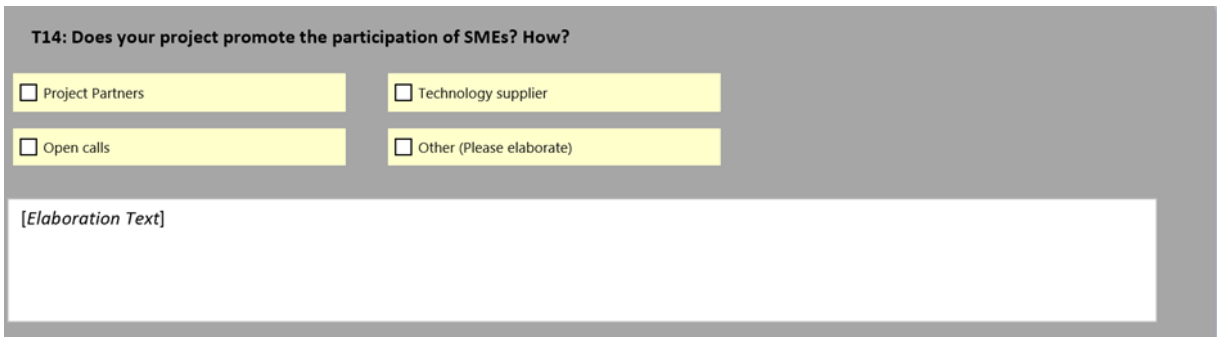
[*Elaboration Text*]

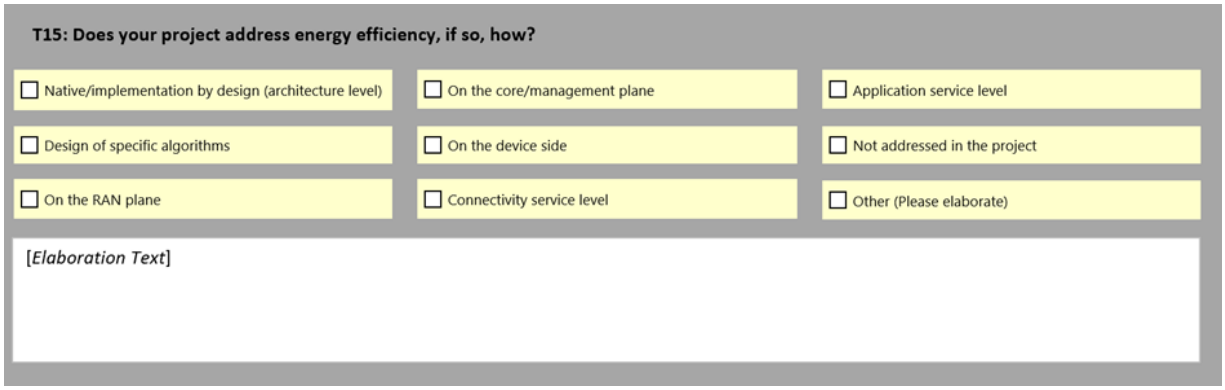
Trial 1 focus:	Trial 1 Start date:	Trial 1 End date:
Trial 2 focus:	Trial 2 Start date:	Trial 2 End date:
Trial 3 focus:	Trial 3 Start date:	Trial 3 End date:
...		
Trial X focus:	Trial X Start date:	Trial X End date:

T13: How do you engage verticals in your project? (If relevant, consider whether vertical users are internal vs. external to your project).

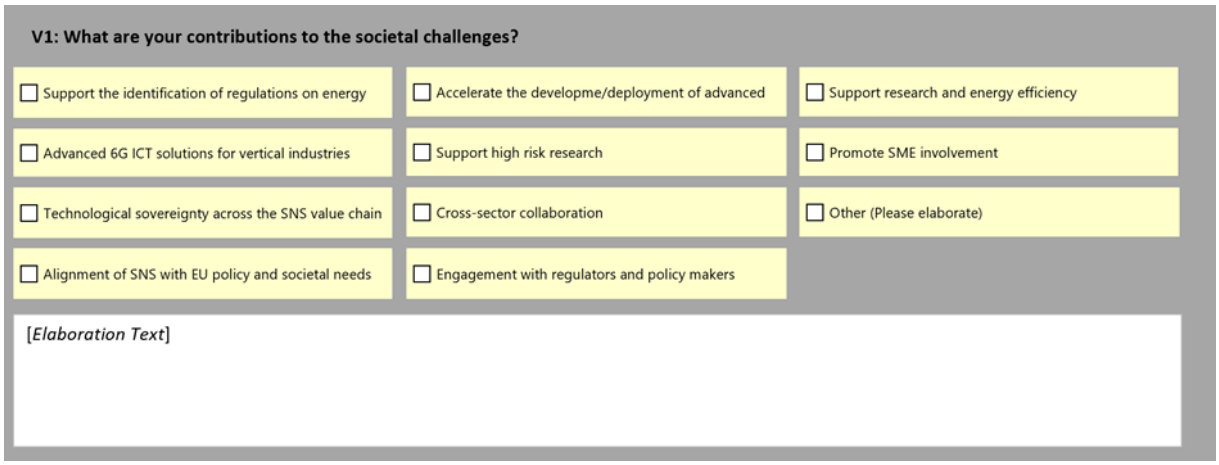
☐ End-user testing	☐ Integration of vertical system with project developed	☐ Use of vertical devices/equipment for testing/trialling
☐ Requirements provisioning	☐ Common technology development with vertical	☐ Other (Please Elaborate)

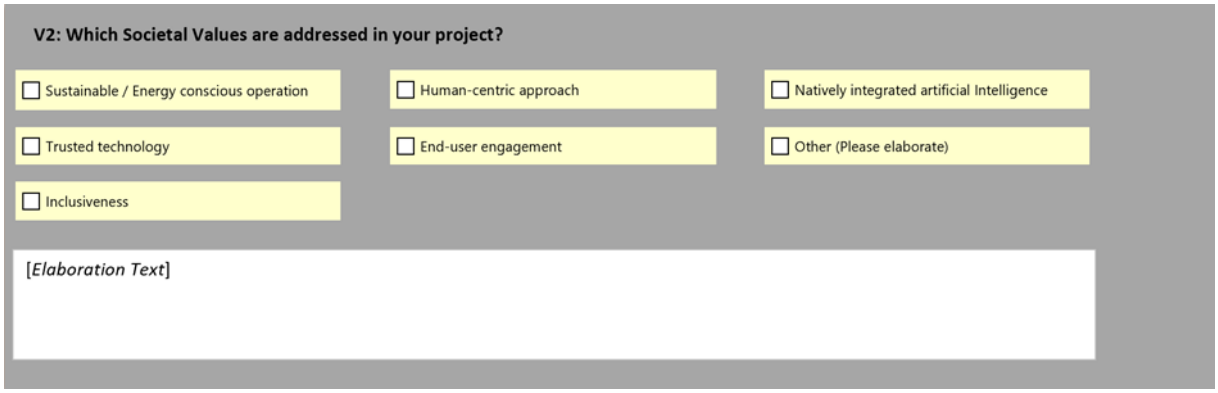
[*Elaboration Text*]





Vision Section - 6 Questions (V1-V6)





V3: Does your project address Key Value Indicators (KVIs)*? If yes, which ones? Which use case/vertical do they address? (max 200 words)

[*Elaboration Text*]

V4: How do you contribute to the 6G Vision in your project?

- ☐ Promoting European leadership
- ☐ Ethics principles
- ☐ The 'AI everywhere' principle
- ☐ Contributing to global standards
- ☐ Creating a world class competence pool
- ☐ Other (Please elaborate)
- ☐ Sovereignty and security

[*Elaboration Text*]

V5: As sustainability is essential for B5G/6G networks, which UN Sustainable Development Goals (SDGs) will your project contribute to?

- ☐ No Poverty
- ☐ Affordable and Clean Energy
- ☐ Climate Action
- ☐ Zero Hunger
- ☐ Decent Work and Economic Growth
- ☐ Life Below Water
- ☐ Good Health and Well-being
- ☐ Industry, Innovation and Infrastructure
- ☐ Life on Land
- ☐ Quality Education
- ☐ Reduced Inequality
- ☐ Peace and Justice Strong Institutions
- ☐ Gender Equality
- ☐ Sustainable Cities and Communities
- ☐ Partnerships to achieve the Goal
- ☐ Clean Water and Sanitation
- ☐ Responsible Consumption and Production

[*Elaboration Text*]

V6: Once the SNS Steering Board is formed, several WGs will also be created to strengthen collaboration among SNS projects as described in the collaboration agreement. What type of thematic areas would be of interest to your project to commit resources and actively participate & contribute? (* Your response is not binding and will only be treated as an indication. You are free to change your view at any point). [max 200 words]

[*Elaboration Text*]

Market Section - 8 Questions (M1-M8)

M1: Which are the biggest market changes you expect in your domain/market area with the advent of 6G? (max 200 words)

[*Elaboration Text*]

M2: Which of the following technologies/innovations do you expect to play an important role in the telecommunications market in the coming years?

- ☐ AI based solutions
- ☐ Dynamic / zero-touch Network Management
- ☐ TN-NTN-PN integration/interoperability
- ☐ Open & disaggregated solutions (e.g., Open-RAN)
- ☐ Localization & sensing
- ☐ Other (Please elaborate)
- ☐ Cloudification
- ☐ Energy efficiency

[*Elaboration Text*]

M3: Which vertical sectors do you expect to be affected the most with the advent of 6G? Please only provide your top 3, i.e., select only up to 3 options.

- ☐ Industry 4.0 / Manufacturing
- ☐ Security / PPDR
- ☐ Smart Agriculture / Farming
- ☐ Smart City
- ☐ Media / xR
- ☐ Smart environment (climate, ocean, soil)
- ☐ Smart Health
- ☐ Smart Energy
- ☐ Other (Please elaborate)
- ☐ Automotive / Transport / Logistics
- ☐ Tourism & Culture

[*Elaboration Text*]

M4: How do you validate business opportunities in vertical sectors?

- ☐ Project develops hypotheses about vertical needs which may require technology in
- ☐ Use the Value proposition canvas or similar methods to understand business
- ☐ Work closely with use case owners.
- ☐ The project hypothesizes about potential business models for a technology
- ☐ Apply methods for vertical business validation suggested by 5GPPP/6G-IA.
- ☐ Other (Please elaborate)

[*Elaboration Text*]

M5: What do you consider to be the greatest obstacle for the deployment of 6G networks?

☐ Current regulations / Lack of appropriate legislation	☐ Security & privacy concerns	☐ Competition and lock-in attempts from incumbent
☐ Spectrum availability	☐ Deployment costs (including tower placement)	☐ Low-carbon solutions vs increased resource
☐ Lack of trust in AI solutions	☐ Lack of demand for unique 6G services (not doable	☐ Other (Please elaborate)
☐ Lack of willingness to allow interoperability	☐ Competition of new NTN services (LEO satellites)	

[*Elaboration Text*]

M6: 4G enabled the "App ecosystem". Do you believe 6G can accomplish something similar? If yes, what would be your estimation as to the novel market section that 6G may enable? (max 200 words)

[*Elaboration Text*]

M7: What are the Key Exploitable Results (KER) expected to be delivered by your project? At which Technology Readiness Level (TRL) is each of them expected to be delivered? (max 200 words)

[*Elaboration Text*]

M8: Is there any other important aspect that your project is addressing (technical, vision or market related) and is not included in the previous questions? (max 200 words)

[*Elaboration Text*]

