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A flagship for B5G/6G vision and intelligent fabric of technology enablers connecting human, physical, and digital worlds

Hexa-X

Deliverable D8.2
Intermediate dissemination and communication report

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Abstract

This document presents the progress and activities on impact creation of the Hexa-X project during first year of existence. It provides the first assessment of the project progress towards the fulfilment of its fifth objective. The results are classified in three main groups, following the definition of the Hexa-X impact KPIs: (1) communication activities, which include the project website and social media; (2) dissemination activities, both industrial and scientific, which include, among others, scientific publications, or participation in events, and (3) and standardization/industry fora and intellectual property (the exploitation and business plans were provided in D8.1). The document provides summary statistics on the achievement rate for each of the identified categories, which in general confirm the good progress of the impact creation activities. It also discusses additional actions that should maximize this impact creation.

Keywords

Communication, Dissemination, Publications, Outreach, Standardization

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[1]

PU = Public

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Executive Summary

This document provides a summary of the dissemination and communication activities that have been carried out by Hexa-X partners during the first year of the project (note that the exploitation plans are provided in D8.1 [D8.1]). The results are classified in three main groups, following the definition of the Hexa-X impact KPIs: (1) communication activities, which include the project website and social media; (2) dissemination activities, both industrial and scientific, which include, among others, scientific publications and participation in events, and (3) and standardization/industry fora and intellectual property.

Along with the report of the dissemination and communication activities performed, this document also includes an assessment of the impact achieved with respect to the dissemination KPIs. In general, this assessment is done using absolute figures, i.e., comparing the total number of publications achieved, press releases announced, etc., against the target ones, but it also considers relative figures, namely, publication or dissemination rates, which enables some basic forecasting to anticipate the extent to which the KPIs will be achieved. Depending on the results of this forecasting, some additional actions are suggested to maximize the impact of the corresponding KPI. These predictions will be revisited in the final dissemination and communication report (D8.3), which will be released 18 months after this deliverable.

We list below some key achievements of the project related to the work reported in this deliverable:

- The project has already surpassed the target number of website visits, both absolute numbers and in terms of visits outside the consortium. The number of press releases is already at 80% of the target number. Social media channels have been set up and are being regularly used.
- For the case of YouTube, Hexa-X partners have generated 10 videos, which accumulate a total number of 1865 views as of late December 2021.
- The "Women in Hexa-X" initiative, launched in February 2021, has been expanded for the participations of the whole 5G PPP community in June 2021, and renamed as "Women in Telecommunications and Research (WiTaR)" in October 2021.
- The industrial and scientific dissemination is in good track, with already 3 workshops organized and the participation in 8 scientific or business conferences; the rate of scientific publication is adequate, considering the inherent delays of the scientific publication process.
- Similarly, demonstration activities were not planned during the first year of the project (hence the total number of zero), but will experience a notable increase during the second and third years of Hexa-X.
- Finally, the Hexa-X project has also produced several contributions to standardization bodies, driven some key activities within 5G PPP, generated intellectual property that has resulted in 6 patent applications triggered by different workpackages, and is participating in the Smart Networks and Services Joint Undertaking.

To sum up, this document provides a detailed assessment on the dissemination and communication activities of the project, along with the comparison with the target KPIs. It serves to confirm the general good progress of the project activities, identifying which areas may require an extra effort to guarantee the achievement of the KPIs, and which areas are in good track, and will serve as the basis for the final dissemination and communication report (D8.3).

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List of Acronyms and Abbreviations

|	
3GPP	Third Generation Partnership Project
5G	Fifth Generation
5G PPP	5G infrastructure Public Private Partnership
6G	6th generation of mobile communications systems
AI/ML	Artificial Intelligence/Machine Learning
ETSI	European Telecommunications Standards Institute
EuCNC	European Conference on Networks and Communications
EC	European Commission
H2020	Horizon 2020
ICT	Information and Communication Technologies
IETF	Internet Engineering Task Force
IPR	Intellectual Property Rights
MANO	Management and orchestration
MEC	Multi-Access Edge Computing
SDO	Standards Development Organisations
SNS JU	Smart Networks and Services Joint Undertaking
WiTaR	Women in Telecommunications and Research
WG	Working Group
WP	Work Package

1 Introduction

We present in this document the progress and activities of the Hexa-X project within year 1 (Y1). During this first year of the project, and despite the effects of the global pandemic, communication and dissemination activities were carried out as planned, in some cases exceeding the expected number of contributions. In fact, even though COVID-19 impacts several activities that have been traditionally carried out in face-to-face activities (starting with the project meetings themselves, but also dissemination activities such as conference presentations, panels, workshops, etc.), the Hexa-X consortium managed to plan and invest the required efforts and resources to achieve remarkable communication and dissemination performance indicators. In a nutshell, communication, and dissemination activities were performed successfully in practically all the categories considered within the first year of the project, including the following:

- Press releases.
- Event organizations.
- Appearances in news/media.
- Academic paper publications, both journals and conferences.
- Invited talks within various events.
- Standardization contributions.

The absence of demonstrations and prototype exhibitions was expected at this point. They require mature enough technical advancements and therefore were planned for the later stage in the project. In this way, although the current number of demonstrators is zero, we expect this number to significantly grow for the next deliverable D8.3 that will present the final version of the dissemination and communication report.

A general overview of the cumulative number of communication activities is provided in Figure 1, for a subset of categories.
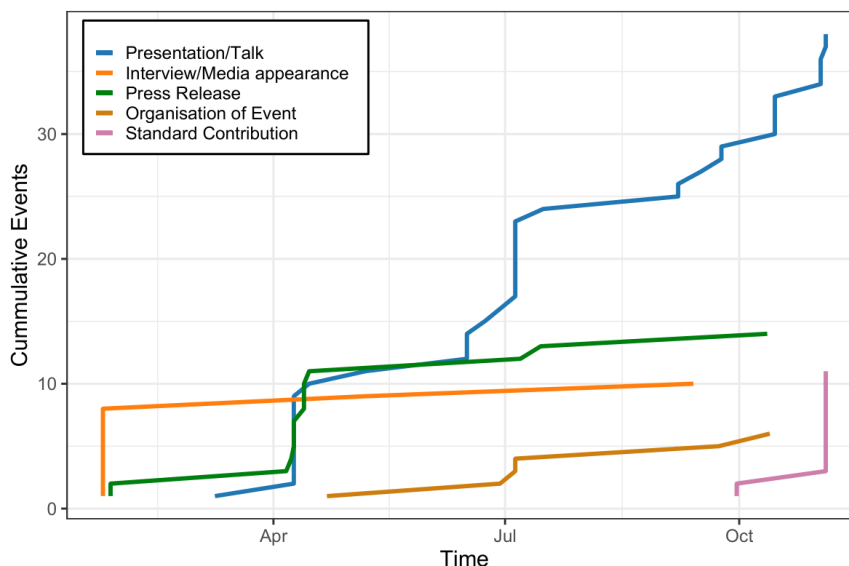
Figure 1. Cumulative events of Hexa-X during Y1.

The figure serves to illustrate how the rate at which different categories grow varies, depending on the activity type: interview and media appearances were relatively very frequent at the beginning of the project, but did not experience significant increases during the whole year; press releases took a bit longer to start, but then experienced a similar pattern; the growth rate of scientific presentations and talks have been more constant throughout the year, with the notable increase caused by the EuCNC conference; the organization of events have lagged after critical momentum of the project was achieved;

and finally, the standards contributions appear towards the end of the first year, once Hexa-X partners have produced a contribution that is mature enough to be presented at the corresponding bodies.

1.1   Objective of the deliverable

The objective of this deliverable is two-fold: first, to provide an overview of the dissemination and communication activities of Hexa-X project during Y1, and second, to present along with this overview an assessment of the impact achieved with respect to the dissemination KPIs. These dissemination and communication activities include published papers, events organized, presentation talks, social media impact, and so on. For each of these categories, the document provides (1) a summary of the number of contributions at the end of December 2021, and (2) a discussion on the resulting level of achievement, considering the different nature of the various activities considered. For instance, it would be expected a strong emphasis on press releases and news appearances at the beginning of the project, while the number of other types of contributions that require more technical and development effort should grow more gradually. This should be the case, for instance, for the demonstrators commented above, or standardization or other industrial activities that typically require several iterations before they are finally achieved.

1.2   Structure of the deliverable

The deliverable is structured into four parts. In Section 1, we introduce the dissemination and communication activities of Hexa-X. Section 2 comprises the communication activities to the general public. Here we present the overall achievements, the web and social media impact, and a novel initiative on gender equality that started in Hexa-X but has grown to other projects. In Section 3, we focus on the industrial and scientific dissemination. We present in this section the overall achievements, online talks, scientific workshops, publications, and communication talks. Finally, in Section 4 we present the standardization, industry fora and intellectual property achievements.

2 Communication

All partners have committed since the first day to promote the project to the general public through different kinds of activities. The Hexa-X project has carried out social media appearances, press releases, project communications, presentations, workshops, and so on. This strong initiative has resulted in the creation and use of social media networks like Twitter, LinkedIn, Youtube, and Instragram. The number of views and followers in these platforms have grown rapidly during this first year, reaching many users, and therefore increasing the awareness about the Hexa-X initiative and its developments.

In the following subsections, we report on all the activities that were categorized under the "communication to the general public" in the project plan.

2.1 Overall achievements

In this section, we report the Y1 achievements of the project related to communication activities with respect to the targets planned in the initial project plan. These are listed in Table 1.

Table 1: Communication achievements during Y1.

Type	Target by the end of the project	Achieved
Press releases	>10	8
Website visits	>1000, with >75% outside the consortium	58.346 views 19.352 users
Social media channels used	Twitter, LinkedIn, Instagram, Youtube	Yes

Regarding the press releases, it is evident that the project is in a good track, having achieved already 80% of the target number. It should be noted that the pace at which press releases are announced will decrease in the following years, since a lot of momentum was gained during the initial phases of Hexa-X. It is foreseeable that the number of press releases during the next two years of the project will be enough to achieve the target number.

The number of website users (detailed next) has already exceeded the target number of website visits, which were set to more than one thousand, with > 75% of visits from outside the consortium. As we will detail in a subsection below, by the end of November 2021 the website had more than 2300 visits from the USA alone, which would serve to achieve the corresponding KPI.

Finally, the project has launched the various social media sites as planned. These social media sites help to further disseminate the project results, as corroborated by some of the statistics collected in the web page, discussed in the section below.

2.2 Press releases

We list below in Table 2 the press releases published by Hexa-X partners, listed by publication date, partner involved, and link to the press release.

Table 2. Press releases

Date	Category	Partners involved	URL
1/28/2021	Press Release	Ericsson AB	https://www.ericsson.com/en/blog/2021/1/hexa-x-initiative-to-shape-6g
3/2/2021	Press Release	Institute IMDEA Networks	https://networks.imdea.org/5tonic-joins-hexa-x-project-to-set-the-path-for-the-next-generation-of-mobile-

			communication-networks-beyond-5g/
8/4/2021	Press Release	Universidad Carlos III de Madrid	https://www.uc3m.es/ss/Satellite/UC3MInstitucional/es/Detalle/Comunicacion_C/1371307779203/1371215537949/Arranca_el_proyecto_europeo_Hexa-X_para_el_desarrollo_de_la_tecnologia_6G
12/7/2020	Press Release	Nokia Solutions and Networks OY	https://www.nokia.com/about-us/news/releases/2020/12/07/nokia-to-lead-the-eus-6g-project-hexa-x/
1/26/2021	Press Release	B-COM	https://b-com.com/en/institute/bcom-galaxy/hexa-x
12/11/2020	Press Release	Chalmers Tekniska Högskola AB	https://www.chalmers.se/en/departments/e2/news/Pages/Designing-the-6G-networks-of-the-future.aspx
7/15/2021	Press Release	Ericsson AB	https://www.ericsson.com/en/blog/2021/7/hexa-x-6g-technology-6g-use-cases
10/10/2020	Press Release	Sztaki	https://www.sztaki.hu/tudomany/hirek/6g-technologiat-kutatja-sztaki

2.3   Project Website

The project website, reachable at https://hexa-x.eu/ has sustained a notable number of visits during the first year of the project. From January 1st until November 28th, the total number of users that visited our web page has been 19,352. In Figure 2, the distribution of this number of users over time is depicted.
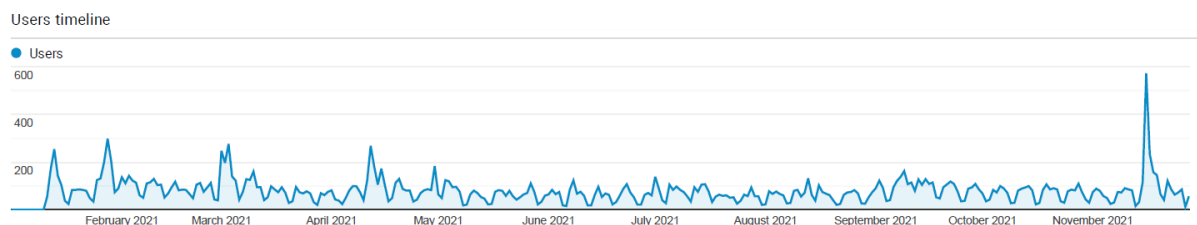
Figure 2. Number of website users over time.

The figure illustrates a typical daily pattern, with most of the visits happening during office hours. Furthermore, a weekly pattern can also be identified, with higher number of visits during weekdays. It is also worth noticing some notable spikes at the beginning of the project, which were triggered by the initial momentum caused by the press releases and media appearances.

The number of users by country is presented in Figure 3. Here, apart from the number of visits from those countries from Hexa-X partners, it is worth remarking the interest caused in the USA (top country) and in India (ranks 5th).

Users by Country

Country	Users
United States	2,347
Germany	2,209
France	1,237
Finland	1,211
India	1,102
Sweden	918
Italy	742
Spain	713
United Kingdom	700
Slovakia	628

Figure 3. Website users by country.

Figure 4 depicts the most visited pages. In total, the web page has accumulated 58,346 visits during the considered period (from January 1st until November 28th). According to the statistics, 40% of the visits are to the main page, while 14% webpage visits are to the About page, and another 14% to the Deliverable page.

Page Views by Page Title

Page Title	Page Views
Hexa-X	23,991
Hexa-X – Deliverables	8,102
Hexa-X – About	8,077
Hexa-X – News	3,265
Hexa-X – Consortium	2,561
Hexa-X – Hexa-X – The joint European initiative to shape 6G	1,877
Hexa-X – Contact	1,238
Hexa-X – Submission of first Hexa-X deliverable	1,169
Hexa-X – First technical deliverables from Hexa-X published	900
Hexa-X – Objectives	715

Figure 4. Most visited website pages.

2.4 Social media and other sites

The project has set up and actively provided content to different social sites, namely:

- Twitter account: https://twitter.com/hexa_x_2020
- YouTube account: https://www.youtube.com/channel/UC_pKq13zKmepaEtl2Wv1dyg
- LinkedIn group: https://www.linkedin.com/groups/9019059/
- Instagram account: https://instagram.com/hexa_x_2020/

In the following, some additional details about the activity and statistics for each of these channels are presented.

2.4.1 Twitter

As of late November, the twitter account has 258 followers and follows 10 accounts. Figure 5 below depicts the number of tweet impression during Y1.
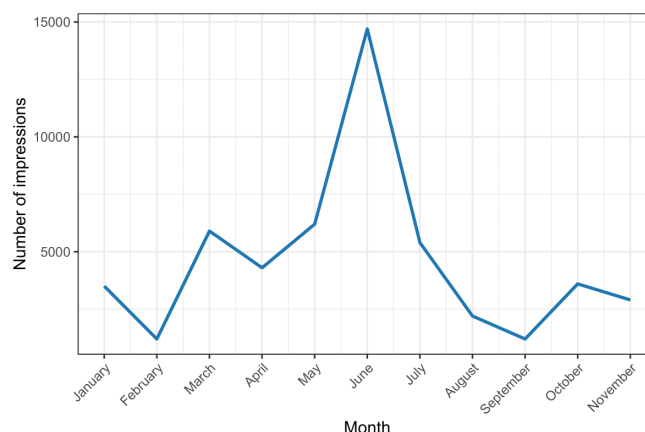
**Figure 5. Tweet impressions by month during Y1.**

2.4.2 **YouTube**

Project partners have invested a remarkable effort to disseminate the results through as many channels as possible. The YouTube channel exemplifies this. In addition to the online presentation of talks, partners have recorded their intervention for a later upload to the channel, in this way reaching a larger audience than by just the real-time streaming of the event. As of late November, the YouTube account has 60 subscribers and accumulated 1655 views. Table 3 presents uploaded videos during Y1 of the project.

Table 3: Hexa-X communication videos in Y1.

Date	Item	URL
8/6/2021	EuCNC Workshop	https://www.youtube.com/watch?v=2dkC3spqOqU&t=587s
8/6/2021	Hexa-X Use cases and key value indicators	https://www.youtube.com/watch?v=N_bUAGkzz-8
5/19/2021	Hexa-X overview panel	https://www.youtube.com/watch?v=js-v00y3jt4
16/6/2021	Hexa-X: Defining the Blueprint for 6G	https://www.youtube.com/watch?v=Xvc_w_VmlwA
14/5/2021	Hexa-X project overview	https://www.youtube.com/watch?v=d-_WERSmjPE
23/6/2021	Advances in network evolution and expansion	https://www.youtube.com/watch?v=-H2e-HeBHlU
8/6/2021	DEDICAT 6G	https://www.youtube.com/watch?v=829Tungv6-0
24/8/2021	Integrated communication, localization and sensing in 6G era.	https://www.youtube.com/watch?v=zGOGzbHz0SA
27/8/2021	AI Based Landscape Sensing	https://www.youtube.com/watch?v=XMrDfTemRUo&t=16s
1/7/2021	Hexa-X workshop on 6G vision	https://www.youtube.com/watch?v=v8RFpXIEfzs

Figure 6 below depicts the number of unique viewers by video during Y1.
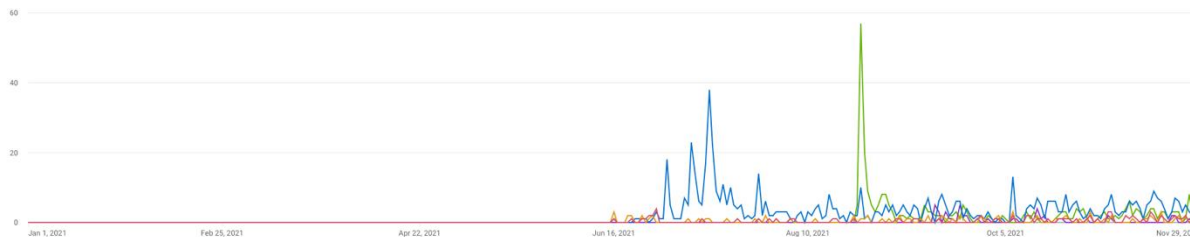
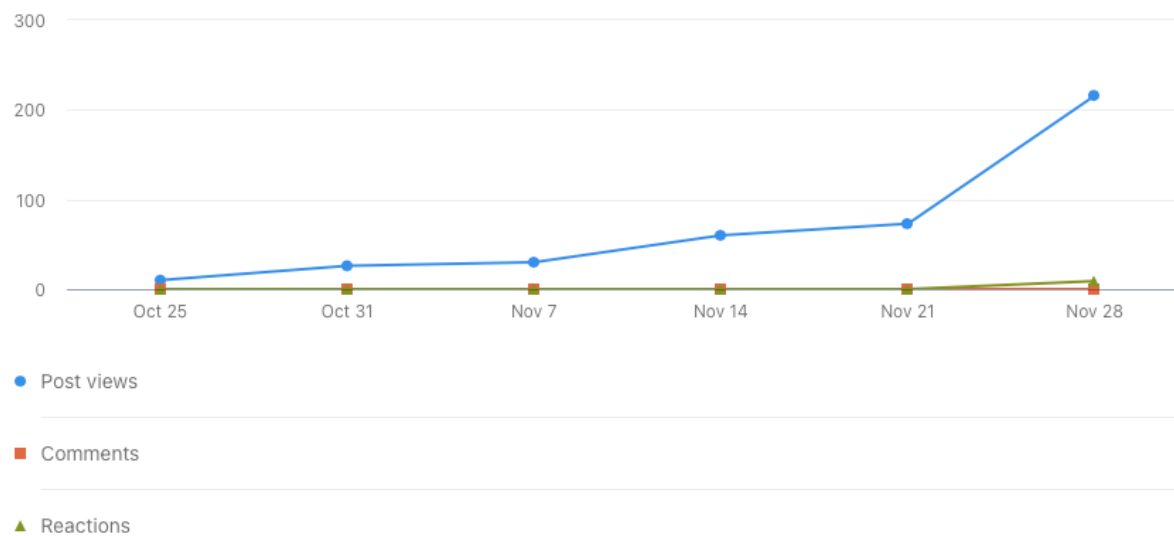**Figure 6. Number of unique YouTube videos during Y1.**

There are two outstanding videos, according to the blue and green spikes, which corresponds to the following videos, respectively:

- The talk by Peter Vetter and Magnus Frodigh during the Hexa-X workshop at the Joint EuCNC & 6G summit (https://www.youtube.com/watch?v=Xvc_w_VmlwA)
- The IEEE PIMRC 2021 Workshop 6 on Integrated communication, localization and sensing in 6G era (https://www.youtube.com/watch?v=zGOGzbHz0SA).

2.4.3 LinkedIn

The total number of members of the LinkedIn group as of November 2021 is 175. According to the "Group Analytics" recently provided by Linkedin, the number of active members in the past 30 days is 66 (33%). The user engagement over the last month is depicted in Figure 7.

Figure 7. Engagement at LinkedIn during November 2021.

Although the analytics cover only one month, according to the webpage statistics, LinkedIn is among the top sources of traffic for the webpage (apart from Google or direct sources), which proves its utility as means to help disseminate the project results. Because of this, the plan is to further invest in this group to maximize the outreach of the project.

2.4.4 **Instagram**

The Instagram account was set up as planned, with a total of 13 followers as of November 2021. In contrast to the other social media sites and groups, the activity of this account is relatively smaller, since the service aims to provide a photo and video sharing service, with an increasing emphasis on short videos and real-time content. Given the situation caused by COVID19, with the travel and meeting restrictions, all the content uploaded consists in snapshots of virtual meetings. It is envisioned that as restrictions are alleviated, more adequate content (e.g., pictures) can be produced for the platform.

2.5 **Women in Telecommunications and Research (WiTaR)**

The road to close gender equality is still a very long one. Hexa-X aims at closing gender gaps and improve diversity. The participation of women in Hexa-X is 20%. Women in Hexa-X decided to act and start an initiative to increase women participation in as many social fields as possible in the 6G R&I community. This initiative was originally established by Hexa-X as "Women in Hexa-X" initiative in February 2021 and then was expanded for the participations of the whole 5G PPP community in June 2021. To reflect the wide participation, the initiative was renamed as "Women in Telecommunications and Research (WiTaR)" in October 2021, with its webpage available at https://hexa-x.eu/witar/.

Figure 8. Participants during the international women in engineer day 2021

The initiative is open to all and gender neutral. WiTaR organizes monthly meetings as depicted in Figure 8 where all members exchange ideas and work together. The priorities are to:

- Promote equality, diversity and is gender balanced approach in 6G R&I community and working environment;
- Empower women and promote the visibility of women and women leadership in European 6G R&I community;
- Establish a global network from industry, universities, and schools to provide personal support to women in 6G R&I community;
- Promote and encourage to take gender perspective into account in the 6G design;
- Promote and encourage more women joining into technical and engineering studies and actively participate in European 6G R&I community.

3 Industrial and scientific dissemination

This section reports the status on industrial and scientific dissemination as of late November 2021. This dissemination corresponds to activities such as participation in industrial and scientific exhibitions, events, small-scale demonstrators, industrial and scientific workshops organized by Hexa-X, 5GPPP activities, etc.

Table 4 provides a summary of the target KPIs and the achievement during Y1. Apart from the lack of demonstration activities, which follows the plan for the first year of the project, the results illustrate that Hexa-X members have been very active across the different categories, impacting the various fora considered. It is reasonable to expect, for the following months, an even higher impact on these activities, once the technology advances designed by project partners have gained in maturity.

Table 4: Industrial and scientific dissemination achievements during Y1.

Type	Target by the end of the project	Achieved
Participation in industrial and scientific exhibitions and events; business conferences	MWC, IWPC, NGMN, EuCNC, IEEE Future Networks	8
Number of small-scale demonstrators	At least 5 (at the end of the project)	0
Organisation and attendance of Hexa-X industrial and scientific workshops	Three A series (beginning, middle, and end of the project) of workshops, each with 100+ attendees, creating the "6G Workshops" series	3
5G PPP activities	Contribution to "Steering Board (SB), Technology Board (TB)", pre-standardization, trials, architecture, vision, spectrum, SW networks, Vision and societal challenges, and SME WGs	Participation in several WGs, participation in the SB and TB, lead of a white paper on 6G vision.
Smart Networks and Services Programme	Active contributions to the SN&S activities within Horizon Europe framework	SNS initiative approved in November 2021
Number of publications	>100	21

The total number of publications might appear relatively low, given the target number of 100. It should be noted, though, that the publication of scientific results typically requires a notable investment on time (development, writing, submission, revision, etc.), and therefore a remarkable increase of this number is expected during the next months, in particular considering the scientific excellence of the Hexa-X consortium.

3.1 Participation in industrial and scientific exhibitions and events; business conferences

Here we summarize the participation in industrial and scientific exhibitions and events. Up to the first year, Hexa-X has caused impact regarding industrial and scientific exhibitions. In fact, Hexa-X

members have participated in a total of 8 events (and a related media appearance, reported in Section 3.6). The following Table 5 presents a summary of the events during Y1.

Table 5. Participation in industrial and scientific exhibitions and events, and business conferences.

Date	Venue	Link
3/26/2021	Fierce Wireless panel on 6G	https://www.fiercedigitaltechevents.com/5g-blitz-week-spring
4/27/2021	IEEE VTC 2021 Spring	https://events.vtsociety.org/vtc2021-spring/conference-sessions/keynote-panels/
5/4/2021	6G Symposium - KPIs Services, 6G vision	https://www.6gworld.com/spring-2021-6g-symposium-agenda/
6/11/2021	Intel MWC Panel on 6G	https://www.telecomtv.com/content/intel-network-and-edge/
6/22/2021	Informa 6G Panel at Informa Digital Symposium	https://tmt.knect365.com/5gworldevent/6g-digital-symposium-2021/
7/12/2021	Globecom workshop on Future wireless access for Industrial IoT (FutureIIoT)	https://globecom2020.ieee-globecom.org/workshop/ws-02-future-wireless-access-industrial-iot-futureiiot-enabling-industry-40-revolution-2
9/15/2021	IEEE PIMRC 2021 conference	https://pimrc2021.ieee-pimrc.org/global-view-on-6g/
10/25/2021	NetPA workshop at CNSM 2021	http://www.cnsm-conf.org/2021/workshop_NetPA.html

3.2 Organisation and attendance of Hexa-X industrial and scientific workshops

The industrial and scientific workshops of Hexa-X that took place during Y1 are presented in Table 6, which account for a total number of four. It is expected that this number continues to grow over the months, to continue the "6G Summit" series (the second edition is already under preparation) but also to account for other topics addressed in the project, such as artificial intelligence or localization.

Table 6. Hexa-X workshops organized in Y1.

Date	Venue	Description
9/13/2021	IEEE PIMRC	1st Workshop on Integrated Communication, Localization and Sensing in 6G Era https://pimrc2021.ieee-pimrc.org/integrated-communication-localization-and-sensing-in-6g-era/
9/13/2021	IEEE PIMRC	1st Workshop on Dependable Connectivity in 6G https://pimrc2021.ieee-pimrc.org/workshop-on-dependable-connectivity-in-6g/
6/8/2021	EuCNC & 6G Summit	Hexa-X - The European 6G Initiative https://www.eucnc.eu/programme/workshops/workshop-5/

6/28/2021	ONDM2021	Hexa-X workshop on 6G vision https://ondm2021.chalmers.se/hexa-x-workshop-on-6g-vision/

Regarding the audiences of the workshops, it was difficult to accurately estimate it given the current conditions caused by COVID19. Still, according to Hexa-X participants the number of people online were estimated as:

- IEEE PIMRC: approx. between 50-100 people for each workshop.
- EuCNC & 6G: approx. between 50-100 people.
- ONDM: approx. between 20-50 people.

3.3 5G PPP activities

Hexa-X members have been actively participating and contributing to several 5G PPP initiatives. The Vision and Societal Challenges working group published the white paper "European Vision for the 6G Network Ecosystem" [5G-Vision], which was led and edited by the Hexa-X project coordinator.

The Project Coordinator Mikko Uusitalo participates in the Steering Board of the 5G PPP, while the Technical Manager Patrik Rugeland participates in the Technology Board. In addition, representatives from the different work areas participate in the following 5G IA Working Groups:

- Pre-Standardization
- Software
- SME
- Test, Measurement, and KPIs Validation.

Finally, as mentioned above, the project also presented the "Women in Hexa-X/6G Initiative" to the Steering Board, which was eventually rebranded and extended to the whole 5G PPP association.

3.4 Smart Networks and Services Joint Undertaking

The Council of the European Union approved the creation of the European Smart Networks and Services Joint Undertaking (SNS JU) in November 2021. Members from the Hexa-X consortium have contributed towards the success of this initiative, via the preparation, organization, and participation in several meetings. As the SNS JU plans to foster Europe's technology sovereignty in 6G, and boost the deployment of 5G in Europe, it is expected that Hexa-X members will continue their active participation in this initiative.

3.5 Scientific Publications

The numbers of scientific publications (conference papers, journals, etc.) has started growing since the beginning. After the initial time invested during the first months of the project, to perform the initial gap analyses, identify the research problems, etc., the growth of scientific achievements is gaining importance. Up to the date, Hexa-X has 21 accepted scientific contributions (the number of submitted papers is obviously larger), including journal articles, conference papers, and book sections. This publication rate is expected to grow significantly during the next moths of the project, surpassing the KPI of having > 100 publications with a large margin.

Figure 9 depicts the research activities of Hexa-X project during Y1 by type. As can be observed, conference papers are majority with a total of 13, followed by journal articles and book sections. In Table 7, the aforementioned activities are detailed with the corresponding title and publisher.
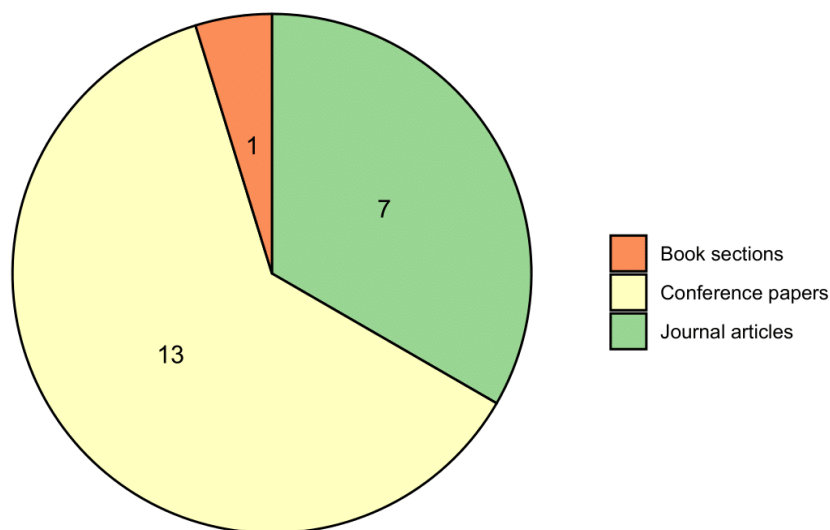
Figure 9. Research activities by type of Hexa-X during Y1.

Table 7. Scientific publications in Y1.

Type	Title	Publication/Conference
Journal	Federated Learning at the Network Edge: When Not All Nodes are Created Equal,	IEEE Communication Magazine
Journal	6G networks: Beyond Shannon towards semantic and goal-oriented communications	Elsevier Computer Networks
Journal	Why Do We Need 6G?	ITU Journal on Future and Evolving Technologies: 2 (6).
Journal	Scalable Real-time Emulation of 5G Networks with Simu5G	IEEE Access
Journal	Discontinuous Computation Offloading for Energy-Efficient Mobile Edge Computing	IEEE Transactions on Green Communications and Networking.
Journal	6G Vision, Value, Use Cases and Technologies From European 6G Flagship Project Hexa-X	IEEE Access
Journal	How many beams does sub-THz channel support?	IEEE Antennas and Wireless Propagation Letters
Conference	Hexa-X The European 6G flagship project	EuCNC 2021
Conference	Predictive Network Management and Orchestration Towards 6G	EuCNC 2021
Conference	Study of Reflection-Loss-Based Material Identification	EuCNC 2021

	from Common Building Surfaces	
Conference	Blind Neural Belief Propagation Decoder for Linear Block Codes	EuCNC 2021
Conference	Above-100 GHz Wave Propagation Studies in the European Project Hexa-X for 6G Channel Modelling	2021 Joint European Conference on Networks and Communications & 6G Summit (EuCNC/6G Summit)
Conference	Measured Blockage Effect of a Finger and Similar Small Objects at 300 GHz	2021 15th European Conference on Antennas and Propagation (EuCAP), 22-26 March 2021
Conference	XAI Models for Quality of Experience Prediction in Wireless Networks	2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), Luxembourg, Luxembourg, 11-14 July 2021
Conference	Hexa-X: Trustworthy Networking Beyond 5G	EuCNC 2021
Conference	Nuberu: Reliable RAN Virtualization in Shared Platforms	ACM MobiCom 2021: The 27th Annual International Conference On Mobile Computing And Networking (ACM MobiCom 2021),
Conference	Uncertainty of Millimeter-Wave Channel Sounder due to Integration of Frequency Converters	International Symposium on Wireless Communication Systems 2021 (ISWCS 2021)
Conference	AI Based Landscape Sensing Using Radio Signals	2021 IEEE 32nd Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)
Conference	6G Architectural Trends and Enablers	5GWF 2021
Conference	Resilience Analysis of Distributed Wireless Spiking Neural Networks	IEEE Wireless Communications and Networking Conference (WCNC)
Book section	Wireless Edge Machine Learning in 5G/6G Networks	MACHINE LEARNING AND 5G/6G NETWORKS: INTERPLAY AND SYNERGIES

Given that Hexa-X is using the Zenodo platform developed by the OpenAIRE project ([Zenodo]) to keep track of the scientific papers, it is possible to obtain certain statistics about them. As of November 2021, the community has 21 records, with a total impact of 859 views and 535 downloads, as illustrated in Figure 10.
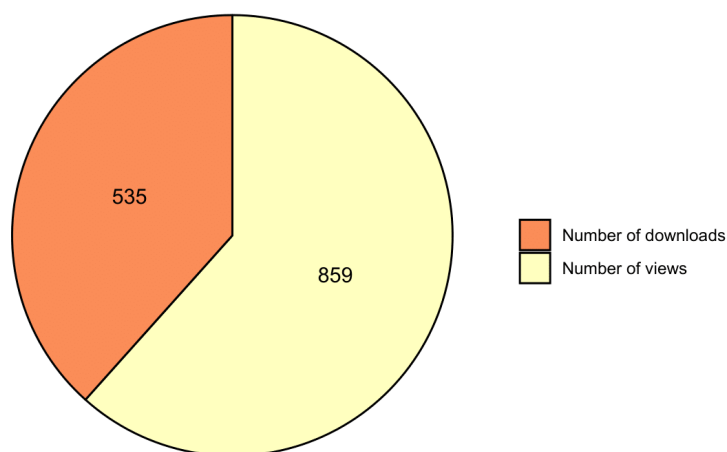
Figure 10. Hexa-X Zenodo statistics during Y1.

3.6   Communication, Talks and Other Actions

Despite the ongoing COVID-19 pandemic, the Hexa-X project has made extra efforts to carry out talks and other communication activities (apart from scientific peer reviewed talks, or participation in industrial conferences). Because of the global situation, they were mainly conducted via online events. Figure 11 depicts the communication statistics for these types of activities during Y1 of the project, which are listed in Table 8.
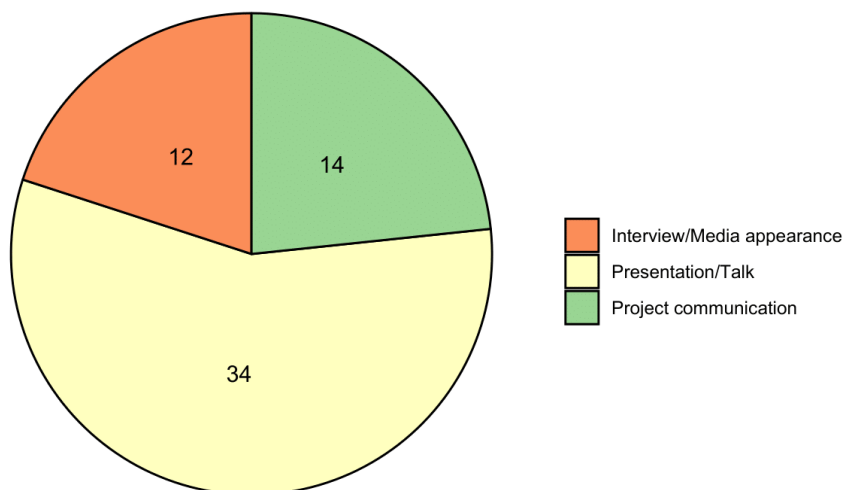
Figure 11. Communication statistics during Y1.

Table 8. Communication activities of Hexa-X during Y1.

Date	Category	Partners involved	URL
3/19/2021	Interview/Media appearance	Nokia Bell Labs	https://www.fiercewireless.com/tech/6g-doesn-t-mean-ditching-5g-but-evolving-to-next-g
1/25/2021	Interview/Media appearance	University of Pisa	https://www.primaonline.it/2020/12/18/317707/universita-di-pisa-al-

			lavoro-sul-6g-la-prossima-generazione-di-rete-mobile-che-usera-lintelligenza-artificiale/
1/25/2021	Interview/Media appearance	University of Pisa	https://www.greenreport.it/news/scienze-e-ricerca/altro-che-5g-luniversita-di-pisa-prepara-il-6g/
1/25/2021	Interview/Media appearance	University of Pisa	https://www.key4biz.it/il-1-gennaio-2021-partira-il-nuovo-progetto-europeo-sul-6g/335949/
1/25/2021	Interview/Media appearance	University of Pisa	https://www.9colonne.it/289405/tecnologia-l-universit%C3%83%C2%A0-di-pisa-prepara-il-6g-2#.X-L0hulKiu4
1/25/2021	Interview/Media appearance	University of Pisa	https://www.villaggiotecnologico.it/luniversita-di-pisa-prepara-la-prossima-generazione-di-rete-mobile-che-usera-lintelligenza-artificiale/
1/25/2021	Interview/Media appearance	University of Pisa	https://www.iltempo.it/adnkronos/2020/12/18/news/tlc-unipi-prepara-il-6g-la-prossima-generazione-di-rete-mobile-che-usera-l-intelligenza-artificiale-25589617/
1/25/2021	Interview/Media appearance	University of Pisa	https://www.corr.it/news/adnkronos/25589615/tlc-unipi-prepara-il-6g-la-prossima-generazione-di-rete-mobile-che-usera-l-intelligenza-artificiale.amp
1/25/2021	Interview/Media appearance	University of Pisa	https://www.dropbox.com/s/55q6p15ffg0qi3g/2021012547516315.pdf?dl=0
06/23/2021	Interview/Media appearance	B-COM	https://www.eetimes.eu/ee-times-europe-magazine-june-2021/
4/27/2021	Interview/Media appearance	Universidad Carlos III de Madrid	https://play.cadenaser.com/audio/ser_madrid_hoyporhoymadrid_20210427_122003_140000/
9/11/2021	Interview/Media appearance	Universidad Carlos III de Madrid	https://www.rtve.es/play/videos/zoom-net/robots-2-0-proyecto-hexa-galaxy-z-flip3proyecto-hexagalaxy-z-flip3/6090713/
1/8/2021	Project communication	B-COM	https://www.linkedin.com/posts/irt-b-com_wireless-networks-activity-6742031548054302720-lVIe
1/27/2021	Project communication	Nokia Solutions and Networks OY, 2. Ericsson AB, 23. University of Oulu	https://hexa-x.eu/research/hexa-x-the-joint-european-initiative-to-shape-6g/
2/10/2021	Project communication	Nokia Solutions and Networks OY, 2. Ericsson AB, 23. University of Oulu	https://www.linkedin.com/feed/update/urn:li:activity:6765180465541341184
1/27/2021	Project communication	Nokia Solutions and Networks OY, 2.	https://www.linkedin.com/feed/update/urn:li:activity:6760185895795662848

		Ericsson AB, 23. University of Oulu	
1/27/2021	Project communication	Nokia Solutions and Networks OY, 2. Ericsson AB, 23. University of Oulu	https://www.linkedin.com/posts/university-of-oulu_hexa-x-the-joint-european-initiative-to-activity-6760186007204761602-vnkC
4/19/2021	Project communication	University of Oulu	https://hexa-x.eu/6g/strong-participation-of-hexa-x-at-the-eucnc-6g-summit/
5/3/2021	Project communication	University of Oulu	https://hexa-x.eu/6g-vision/d1-2-expanded-6g-vision-use-cases-and-societal-values-including-aspects-of-sustainability-security-and-spectrum/
5/18/2021	Project communication	University of Oulu	https://hexa-x.eu/dissemination/simu5g-the-first-real-time-open-source-5g-simulator-will-support-federated-xai-within-hexa-x-project/
6/8/2021	Project communication	University of Oulu	https://hexa-x.eu/6g/european-vision-on-6g-revealed/
6/22/2021	Project communication	Chalmers Tekniska Högskola AB, 23. University of Oulu	https://hexa-x.eu/networks/6g-and-optical-networks/
6/23/2021	Project communication	University of Oulu	https://hexa-x.eu/6g/women-in-hexa-x-eu-flagship-project-leads-the-way-to-gender-equality-and-diversity-in-6g-research-innovation/
7/1/2021	Project communication	University of Oulu	https://hexa-x.eu/6g/first-technical-deliverables-from-hexa-x-published/
9/9/2021	Project communication	University of Oulu	https://hexa-x.eu/research/call-for-papers-to-the-1st-international-workshop-on-6g-vision-use-cases-and-technologies-at-the-ieee-ccnc22-conference-in-las-vegas-usa-8-11-jan-2022/
6/4/2021	Project communication	Atos Spain SA	https://booklet.atosresearch.eu/units/smart-networks-services
1/28/2021	Presentation/Talk	Nokia Solutions and Networks OY	http://w-i-c.org/MWM2021/MWM2021_invitation.pdf
1/27/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.kauppalehti.fi/uutiset/nokia-vetoinen-jattiprojekti-piirtaa-6g-verkkojen-suuntaviivoja-tama-on-ainoa-6g-lippulaivahanke-joka-on-eu-tasolla-kaynnissa/a0ef43fa-da21-4617-bc07-302b789f0c0b
3/16/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://5g-ppp.eu/event/5g-ppp-webinar-europe-accelerates-towards-6g/
12/7/2021	Presentation/Talk	Siemens Aktiengesellschaft	https://globecom2020.ieee-globecom.org/workshop/ws-02-future-wireless-access-industrial-iot-

			futureiiot-enabling-industry-40-revolution-2
4/12/2020	Presentation/Talk	Chalmers Tekniska Högskola AB	https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=30246&parsergrp=3
4/27/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://events.vtsociety.org/vtc2021-spring/conference-sessions/keynote-panels/
6/8/2021	Presentation/Talk	Nokia Solutions and Networks OY, 2. Ericsson AB	https://www.eucnc.eu/workshops/workshop-5/
6/24/2021	Presentation/Talk	Telecom Italia S.p.A.	https://tmt.knect365.com/6g-digital-symposium/agenda/2
6/28/2021	Presentation/Talk	Ericsson AB	https://ondm2021.chalmers.se/hexa-x-workshop-on-6g-vision/
5/27/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://asut.ch/asut/de/page/index.xhtml
6/7/2021	Presentation/Talk	Nokia Solutions and Networks OY, 2. Ericsson AB, 4. Atos Spain SA, 6. Chalmers Tekniska Högskola AB, 11. Intel Deutschland GmbH, 13. Nokia Solutions and Networks GmbH & Co. KG, 14. Orange, 18. Technische Universität Dresden, 20. Telecom Italia S.p.A., 21. Telefónica Investigación y Desarrollo S.A.U., 22. Universidad Carlos III de Madrid, 23. University of Oulu, 25. Wings ICT Solutions PC	https://5g-ia.eu/single_post/?slug=the-5g-infrastructure-association-5g-ia-publishes-the-white-paper-european-vision-for-the-6g-network-ecosystem
6/11/2021	Presentation/Talk	Nokia Solutions and Networks OY, 11. Intel Deutschland GmbH	https://www.telecomtv.com/content/intel-network-and-edge/
6/22/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://tmt.knect365.com/5gworldevent/6g-digital-symposium-2021/
7/7/2021	Presentation/Talk	University of Pisa	https://www.dii.unipi.it/5g-enabling-technologies-opportunities-and-research-challenges-ahead
7/1/2021	Presentation/Talk	Orange	https://www.6gwff.org/
5/31/2021	Presentation/Talk	Commissariat à l'énergie atomique et	https://digicosme.cnrs.fr/event/digicosme-webinar-of-the-wg-future-access-networks/

		aux énergies alternatives	
5/31/2021	Presentation/Talk	Commissariat à l'énergie atomique et aux énergies alternatives	https://www.6gworld.com/spring-2021-6g-symposium-agenda/
9/15/2021	Presentation/Talk	1. Nokia Solutions and Networks OY, 2. Ericsson AB	https://pimrc2021.ieee-pimrc.org/global-view-on-6g/
9/24/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://tmt.knect365.com/5g-world-series/
10/13/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://5g-ppp.eu/5g-ppp-workshop-5g-world-forum-call-for-papers/
10/19/2021	Presentation/Talk	Siemens Aktiengesellschaft	https://5g-ppp.eu/5g-ppp-work-groups/
10/28/2021	Presentation/Talk	Siemens Aktiengesellschaft	https://www.bayern-innovativ.de/veranstaltung/summit-event-thinknet-6g
6/1/2021	Presentation/Talk	Telefónica Investigación y Desarrollo S.A.U.	https://www.gsma.com/newsroom/wp-content/uploads//NG.127-v1.0-2.pdf
10/28/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.bdva.eu/
11/9/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.businessfinland.fi/suomalaisille-asiakkaille/palvelut/ohjelmat/sustainable-manufacturing-finland-ohjelma
11/10/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.omc.co.jp/beyond5G/en
11/10/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://forum-americas.org/toronto/home/
11/30/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.aalto.fi/fi/tapahtumat/internet-forum-avoimet-verkkoluennot-5g-what-do-we-all-have-to-know
12/1/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.wwrf.ch/wwrf46.html
12/1/2021	Presentation/Talk	Nokia Solutions and Networks OY	https://www.psc-europe.eu/news-events/events/psce-conference-in-brussels-nov21.html
9/16/2021	Presentation/Talk	Ericsson AB	https://www.netsys2021.org/program/#zdn02
12/6/2021	Presentation/Talk	Ericsson AB, 6. Chalmers Tekniska Högskola AB	https://www.wwrf.ch/wwrf46.html
13/10/2021	Presentation/Talk	Ericsson AB	https://ieee-wf-5g.org/path-to-6g/
06/08/2021	Presentation/Talk	ATOS, INT	https://www.eucnc.eu/2021/www.eucnc.eu/index.html

4 Standardization, Industry fora, and Intellectual Property

This section is based on the standardization plans for the Hexa-X project. Initially, the objectives of Hexa-X for standardization, industry fora and intellectual property are as follows: (i) standards and industry groups (e.g., 3GPP, ETSI MEC, IETF and IEEE); (ii) more than 100 standards contributions by participants based on work in Hexa-X; (iii) at least 50 patent applications.

4.1 Overall achievements

The overall achievements of Hexa-X during Y1 are listed in Table 9.

Table 9. Standardization, Industrial impact and IP achievements in Y1.

Type	Target by the end of the project	Achieved
Standards and industry groups impacted	3GPP RAN, 3GPP SA, ETSI ENI, ETSI ZSM, ETSI PDL, ETSI OSM. ETSI NFV, ETSI MEC, NGMN, GSMA ITU, IETF, IEEE, TMF	3GPP, GSMA, ETSI, IETF, ITU-R
Total number of standards contributions by participants based on work in Hexa-X	More than 100	16
Number of patent applications	At least 50	6

Like in the case of the scientific publications, the total number of standard contributions might seem relatively low when compared against the target number. It should be noted that this type of contribution also suffers from a "slow start" effect, as detailed next –first the identification of the suitable topics is required, which can then trigger the addressing of the corresponding group. Similarly, the generation of intellectual property is far from being an immediate process, given the procedures involved. In both cases, we expect the growth rate of these numbers to multiply by a large factor, thus meeting the targeted KPIs.

4.2 Standards and industry groups

During the first year we have identified suitable topics and Standards Development Organisations (SDO) that will be targeted once the concept and technology explorations and evaluations mature. In addition to having relevant results the respective specification development and planning cycles of the target SDO needs to be considered so that SDO would be acceptable to new proposals. We have started with the unique use cases developed in WP1 of Hexa-X that justify the need to further work of 6G topics. To this aim we started our 6G contribution by submitting use case contributions to ITU-R WP5D "Future Technology Report and Vision of IMT-2030 and beyond".

Another early topic for targeted contributions is sustainability. This topic is already under active considerations in multiple SDOs including ITU-T SG5, 3GPP SA2, ETSI and ATIS. We have started contributing to 3GPP SA2 Energy Efficiency for 5G item and will extend to other SDO soon.

Towards ETSI RISE [ETR21] community we have had meetings to identify which topics would have most interest in the ETSI community. Channel modelling and the related measurements for WP2 is the most attractive area for a deep dive and to create motivation for other 6G topics. The deep dive for

channel modelling is still planned to take place by the end of 2021. After this the use of AI/ML in the network management and orchestration is targeted next once the project results reach sufficient level of maturity.

Table 10 lists the different standardization and industry groups being tracked by Hexa-X partners.

Table 10. Standardization and industry groups being tracked.

Groups	Related WP	Key topics
3GPP SA5	WP6	Capability exposure, network slicing management enhancements, non-public networks management, intent modelling, AI-assisted service assurance.
ETSI ISG SAI	WP4	Explicability and transparency of AI processing (SAI-007), Privacy aspects of AI/ML systems (SAI-008), Traceability of AI Models (SAI-010),
ETSI ISG NFV	WP6	Rule based auto-scaling and auto-healing. Application of "continuus orchestration" via the Nf-Vi interface to exchange hardware resource configuration and state information (e.g., events)
ETSI ISG ZSM	WP6	Intent driven management, security management services, closed loop automation, CI/CD pipeline management, AI model/application management and training.
ETSI RISE	WP2 / WP4 / WP5 / WP8	Channel modelling, sub-THz radio, AIaaS

On the other hand, Table 11 details the various contributions that Hexa-X partners have made in different standardization and industry groups during Y1.

Table 11. Submissions to standardization and industry groups.

Date	Partners	Group	URL
9/27/2021	Nokia Corporation, Ericsson AB, Intel Deutschland GmbH	ITU-R	https://www.itu.int/md/R19-WP5D-C-0843/en
6/22/2021	Nokia Corporation, Intel Corporation , Telefon AB - LM Ericsson	ITU-R	https://www.itu.int/md/R19-WP5D-C-0653/en
2/22/2021	Nokia Corporation, Intel Corporation , Telefon AB - LM Ericsson	ITU-R	https://www.itu.int/md/R19-WP5D-C-0540/en
3/9/2021	Nokia Solutions and Networks OY, Intel Deutschland GmbH, Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_136e/Docs/S5-212408.zip

3/9/2021	Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_136e/Docs/S5-212398.zip
5/19/2021	Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_137e/Docs/S5-213534.zip
5/19/2021	Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_137e/Docs/S5-213462.zip
5/19/2021	Orange,	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_137e/Docs/S5-213535.zip
5/19/2021	Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_137e/Docs/S5-213554.zip
5/19/2021	Orange, Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_137e/Docs/S5-213555.zip
10/22/2021	Telefónica	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_139e/Docs/S5-215649.zip
10/22/2021	Telefónica, Orange	3GPP	https://www.3gpp.org/ftp/TSG_SA/WG5_TM/TSGS5_139e/Docs/S5-215526.zip
02/27/2021	Telefónica	GSMA	https://www.gsma.com/newsroom/wp-content/uploads//NG.127-v1.0-2.pdf
10/13/2021	Telefónica	GSMA	https://infocentre2.gsma.com/_layouts/Infocentre/InfocentreRedirect.aspx?WebId=ab628084-a93e-4a94-9311-7d996a49febf&ListId=a66b5c76-6008-458f-87f1-8480f728f3e0&ItemId=7a7af075-33e4-4714-8f4a-233992405e9a&VersionLabel=0.2
06/27/2021	Nokia	IETF-111 Side Meeting: FIPE	https://mailarchive.ietf.org/arch/msg/icnrg/l5jRznmWL3cIzqV7TqfJQIGDc4A/
09/23/2021	Nokia	ETSI MEC	https://docbox.etsi.org/ISG/MEC/05-Contributions/2021/2021_09_21_PL_MEC%2327/MEC(21)000478_Hexa-R_The_European_6G_flagship_project.zip

4.3   Patents

The Hexa-X project brings several opportunities for patent creation (IPR). During the first year, Hexa-X partners have applied to six patents (more details regarding title and type of patents will be detailed at a future stage). The distribution of the patents across partners and WPs is as follows. Nokia has contributed with three IPRs, one related to its work in WP7, and two related to contributions in WP4. Ericsson has also contributed with three IPRs, one for each of the following WPs: WP2, WP3, and WP5. We expect an increase of patent creations in the following months, after the project has gained momentum and the technical activities have reached an appropriate maturity level.

5 Summary

This document provides a detailed report on the dissemination and communication activities of the Hexa-X project during its first year of existence. It provides an accurate description of the various achievements of the project, structured in different categories, along with a first estimation of the extent to which the communication KPIs will be achieved. The collected statistics so far serve as a milestone to confirm the good progress of the impact creation activities in general, and to identify in which areas the project partners may have to keep a careful monitoring via Task 8.1 to guarantee a successful achievement of the communication objectives.

References

[5G-Vision]   5G Infrastructure Public Private Partnership, "European Vision for the 6G Network Ecosystem", available at: https://5g-ppp.eu/wp-content/uploads/2021/06/WhitePaper-6G-Europe.pdf

[D8.1]   Hexa-X Deliverable 8.1 "Initial market analysis and exploitation and business sustainability plans", confidential deliverable.

[ETR21]   ETSI Research, Standards & Innovation, https://www.etsi.org/research/learn-more

[ISG NFV]   Network Functions Virtualisation, link: https://www.etsi.org/committee/nfv

[ISG SAI]   Securing Artificial Intelligence (SAI), link: https://www.etsi.org/committee/sai

[ISG ZSM]   Zero Touch Network and Service Management, link: https://www.etsi.org/committee/zsm

[SNS-JU]   The Smart Networks and Services Joint Undertaking, available at: https://digital-strategy.ec.europa.eu/en/policies/smart-networks-and-services-joint-undertaking

[Zenodo]   The Hexa-X Community at Zenodo, link: https://zenodo.org/communities/hexa-x/