Cognitive plants through proactive self-learning hybrid digital twins

COGNITWIN

DT-SPIRE-06-2019 (870130)

Deliverable Report

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Executive Summary

This report presents a summary of dissemination and communication activities carried out until M24 in the COGNITWIN project. The project has been disseminating its results in various modes such as publications (in journals, books, and conference proceedings) and presentations in various events such as conferences, webinars, and workshops with other similar projects. The project has also been providing updates on website and posting project results on its social media channels. Several public dissemination materials such as project video, flyers, and newsletters have been created. Participation in cluster events and liaison with national initiatives have also been a part of the dissemination activities of the project. Finally, the status of KPIs (Key Performance Indicators) is monitored.

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1 Introduction

The COGNITWIN project aims to disseminate the results of the project for value creation within various stakeholders such as industrial, technical, and scientific communities along with the general public. In addition, it is also carrying out standardization activities for long lasting impact.

The project has delivered D7.1 (Website portal) in M2. Further, Dissemination and communication plan and tools were reported in D7.2 in M6 which report presents a strategic plan for efficient and effective dissemination and communication to achieve the planned impact on different stakeholders. Initial results from the dissemination and communication activities such as visual identity, information on publications/presentations, website, social media, flyers, project video, newsletter etc. are also presented in D7.2.

The dissemination and communication activities are being carried out based on the plan defined in D7.2. An overview of the results from these activities obtained so far in the project are presented in this report D7.3. The status of KPIs is also presented in this report.

2 Results from Communication and Dissemination Activities

2.1 Visual Identity

The project has created visual identity in the beginning of the project in the form of project logo, templates for deliverable reports and project presentations etc. These results are presented in detail in D7.2 (Dissemination and communication plan and tools). These identities are used in dissemination and communication activities of the project.

These identities are used in dissemination and communication activities of the project, including public webinars and presentations where project participants use templates and logos to highlight the impact of the COGNITWIN consortium.

2.2 Website

The COGNITWIN website (http://www.cognitwin.eu) provides important project information and updates.

The status of the content on various tabs of the webpage can be summarized as follows:

- **Home page:** This page provides key project information, facts and figures and links to social media channels, downloadable flyers, and the project video (Figure 1). Subscription link for newsletter is also provided on this page.
- **Objectives:** This page shows specific objectives of the project.

- **Public reports:** All the public reports from the project will be available on this page when accepted by the commission.
- **Publications:** Key citation details of all the project publications are provided on this page. This page is regularly updated with new publications. A current list of publications is also provided in Table 1 of this report.
- **Dissemination material:** This page provides the links of project video, downloadable flyers, and newsletters.
- **Consortium:** Weblinks of all the consortium members and their logos are available on this page.
- **News and Events:** This page provides information on project meetings, participation in conferences/webinars, invitation to the events where the project is participating etc. Total 15 items are currently listed on this page. This page is regularly updated.

Figure 1: Screenshot of the homepage of COGNITWIN website.

2.3 Comics

In the beginning of the project, comics have been created to explain the project to public. More details are already available in D7.2.

2.4 Publications/presentations

The project has published several articles in journal, books, and conference proceeding. More details on these publications are provided in Table 1.

Table 1: List of COGNITWIN articles in journals, books and conference proceedings.

Type	Title	Authors	Title of the Journal/Proc./Book	DOI	Year of publication
Article in Journal	Fusing Physical Process Models with Measurement Data Using FIR Calibration	Enso Ikonen, Istvan Selek	Journal of Control Engineering and Applied Informatics	NA	2021
Article in Journal	An Approach for Realizing Hybrid Digital Twins Using Asset Administration Shells and Apache StreamPipes	Michael Jacoby, Branislav Jovicic, Ljiljana Stojanovic, Nenad Stojanović	Information	10.3390/info12060217	2021
Chapter in a Book	Smart Steel Pipe Production Plant via Cognitive Digital Twins: A Case Study on Digitalization of Spiral Welded Pipe Machinery	Özlem Albayrak, Perin Ünal	Impact and Opportunities of Artificial Intelligence Techniques in the Steel Industry - Ongoing Applications, Perspectives and Future Trends	10.1007/978-3-030-69367-1_11	2021
Chapter in a Book	Smart Services in the Physical World: Digital Twins	Ljiljana Stojanovic, Sebastian R. Bader	Smart Service Management - Design Guidelines and Best Practices	10.1007/978-3-030-58182-4_12	2020
Article in Journal	Digital Twin and Internet of Things—Current Standards Landscape	Michael Jacoby, Thomas Usländer	Applied Sciences	10.3390/app10186519	2020
Publication in Conference proceedings/Workshop	COGNITWIN – Hybrid and Cognitive Digital Twins for the Process Industry	Sailesh Abburu, Arne J. Berre, Michael Jacoby, Dumitru Roman, Ljiljana Stojanovic, Nenad Stojanovic	2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)	10.1109/ice/itmc49519.2020.9198403	2020
Publication in Conference proceedings/Workshop	Cognitive Digital Twins for the Process Industry	Sailesh Abburu, Arne J. Berre, Michael Jacoby, Dumitru Roman, Ljiljana Stojanovic, Nenad Stojanovic	International Conference on Advanced Cognitive Technologies and Applications	NA	2020
Publication in Conference proceedings/Workshop	Calibration of Physical Models with Process Data using FIR Filtering	Enso Ikonen, Istvan Selek	2020 Australian and New Zealand Control Conference (ANZCC)	10.1109/anzcc50923.2020.9318340	2020

2.5 Presentations

The project has made presentation in various conferences. The details are presented in Table 2.

Table 2: List of COGNITWIN presentations in conferences along with other relevant details.

Title	Details of the Event	Date (dd.mm.yyyy)	Presenter(s) from COGNITWIN consortium
A Comparison of Deep Transfer Learning Methods on Bearing Fault Detection	The 8th International Conference of Future Internet of Things and Cloud (FiCloud 2021) on http://www.ficloud.org/2021/	25.08.2021	Bilgin Deveci (TEKNOPAR)
A Comparison of State-of-the-Art Machine Learning Algorithms on Fault Indication and Remaining Useful Life Determination by Telemetry Data	The 8th International Conference of Future Internet of Things and Cloud (FiCloud 2021) on http://www.ficloud.org/2021/	24.08.2021	Fırat Unal (TEKNOPAR)
Digitalization of a Steel Pipe Production Factory: STEEL4.0- A Family of Products Developed on Routes from Industry 3.0 to Industry 4.0	The 5th International Iron & Steel Symposium	01.04.2021-03.04.2021	ÖzLem Albayrak (TEKNOPAR)
COGNITWIN project - Cognitive Hybrid Digital Twins for the Process Industry - aspects of Interoperability	IIC Digital Twin Interoperability Task Group Q1 Meeting	09.03.2021	Arne Berre (SINTEF)
Calibration of Physical Models with Process Data using FIR Filtering	Australian and New Zealand Control Conference (ANZCC), Gold Coast, Australia, 2020.	26.11.2020 to 27.11.2020	Enso Ikonen (UOULU)
Cognitive Digital Twins for the Process Industry	The Twelfth International Conference on Advanced Cognitive Technologies and Applications (COGNITIVE 2020)	25.10.2020 to 29.10.2020	Arne Berre (SINTEF)
Smart Steel Pipe Production Plant via Cognitive Digital Twins: A Case Study on Digitalization of SWP	The 3° ESTEP WORKSHOP Impact and opportunities of Artificial Intelligence in the Steel Industry	22.10.2020	ÖzLem Albayrak (TEKNOPAR)
COGNITWIN – Hybrid and Cognitive Digital Twins for the Process Industry	2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Cardiff, United Kingdom, 2020.	15.06.2020 to 17.06.2020	Arne Berre (SINTEF)
Cognitive Digital Twins: Challenges and opportunities for semantic technologies	Keynote at the International Workshop on Semantic Digital Twins (SeDiT 2020) co-located with the 16th European Semantic Web Conference (ESWC 2020) Semantic Web Conference (ESWC 2020).	03.06.2020	Ljiljana Stojanovic (Fraunhofer IOSB)

2.6 Networking Activities

The project has been participating in networking activities through webinars and the events organized with sister projects. More details on these events are presented as follows:

2.6.1 Webinars

The project has delivered lectures in two technical webinars as presented in Table 3.

Table 3: List of webinars where COGNITWIN members delivered lectures.

Title	Event	Date (dd.mm.yyyy)	Presenter(s) from COGNITWIN consortium
AAS & IDS: FA³ST – An approach and tools for I4.0-compliant, hybrid and data-sovereign Digital Twins	Webinar "Asset Administration Shell (AAS): Interoperable Digital Twins for Industry4.0"	25.06.2021	Ljiljana Stojanovic (Fraunhofer IOSB)
Digital Twin solutions – example of application in process industry	Webinar organized by COGNITWIN Forsterk (a supplemenatry project funded by The Research Council of Norway, Tekna – Teknisk-naturvitenskapelig forening (Norway) and National Centre for Digital Transformation of Process Industries, DigiPro (Norway)	27.05.2021	Frode Brakstad (SINTEF), Dr. Sudi Jawahery/Dr. Stein O. Wasbø (Cybernetica)
Digital Twins for Process Industry	Part of Webinar series on sensor technologies organized by SINTEF and Tekna – Teknisk-naturvitenskapelig forening (Norway)	03.11.2020	Ljiljana Stojanovic (Fraunhofer IOSB), Unamuno Iriondo (Sidenor) and Nenad Stojanovic (Nissatech)

2.6.2 Cooperation with other projects

The project has participated in events to strengthen its cooperation with sister projects (other projects funded in the same call topic - Digital technologies for improved performance in cognitive production plants). These projects are as follows:

- **COGNIPLANT** Cognitive Platform to Enhance 360º Performance and Sustainability of the European Process Industry
- **CAPRI** Cognitive Automation Platform for European PRocess Industry digital transformation
- **INEVITABLE** Optimization and Performance Improving in Metal Industry by Digital Technologies
- **FACTLOG** Energy-aware Factory Analytics for Process Industries
- **HyperCOG** Hyperconnected Architecture for High Cognitive Production Plants

On 22-March-2021, a workshop with COGNIPLANT EU H2020, HyperCOG European Project, INEVITABLE project, FACTLOG Project and CAPRI EU project was organized. A discussion on a joint paper for the MDPI Journal special issue on cognitive digital twins took place. All these projects have slightly different approaches to the concept of Cognitive Plants. The idea for the paper is to describe the project approaches to digital twins and cognition – and then compare and consolidate for similarities and differences.

On 05-Mar-2021, The COGNITWIN and CAPRI EU project held a workshop to learn for each other and explore possible synergies. These projects are taking slightly different approaches to the concept of Cognitive Plants. The main technical approaches were presented and illustrated with key aspects from the selected use cases.

On 16-December-2020, the COGNITWIN consortium, together with INEVITABLE, HyperCOG and COGNIPLANT projects, organized a workshop on "Digital technologies for improved performance in cognitive process industries: Four innovative approaches to this SPIRE PPP topic".

2.6.3 Participation in Clusters:

The COGNITWIN project has been presented in the BDVA PPP cluster for Big Data and presented Big Data and AI Pipelines in COGNITWIN Digital Twins during the BDVA DataWeek in May 2021. This will further be followed up with the Manufacturing domain cluster in BDVA, identifying digital twin synergies between discrete manufacturing and process manufacturing with digital twins.

COGNITWIN was also active in the initial work of the Digitalisation working group in A.SPIRE, and will continue with the following up of this in the context of forthcoming Process4Planet activities.

2.6.4 Liaisons with National Initiatives

The project has been liaising with the following national initiatives:

- Industrie 4.0 – German initiative: Fraunhofer is involved with the Digital Twin group in the German Industrie 4.0 initiative, also related to AAS implementation.
- International Data Spaces Association – Norwegian Hub – SINTEF is establishing a national Norwegian Hub for a IDSA.
- DigiPro (Norway): DigiPro is a national centre for the digitalisation of the process industry (www.digipro-centre.no). By a national co-funding (Forsterk), dissemination of COGNITWIN results will be presented for the Norwegian Process Industry in cooperation with NGOs (Tekna, NITO, FLT) and DigiPro.
- Process-Turke: Perin Ünal (TEKNOPAR) delivered a presentation at HE Strategic Plan 2021-24 & Work Programme 2021-22 organized by TÜBİTAK for ICT, Digital Transformation & Resilient Industry on 08-Apr-2021.

2.7 Public dissemination material

The following public dissemination materials have been prepared and made available to the public through the project website.

2.7.1 Flyers

The project has published two flyers to provide general project information such as facts and figures along with a brief technical introduction to the public. A screenshot of the flyer is shown in Figure 2. These flyers are available for public download at the following link:

https://www.sintefo/projectweb/cognitwin/dissemination-materials/

2.7.2 Newsletters

The project has published two newsletters which are available to be download on project website at the following link:

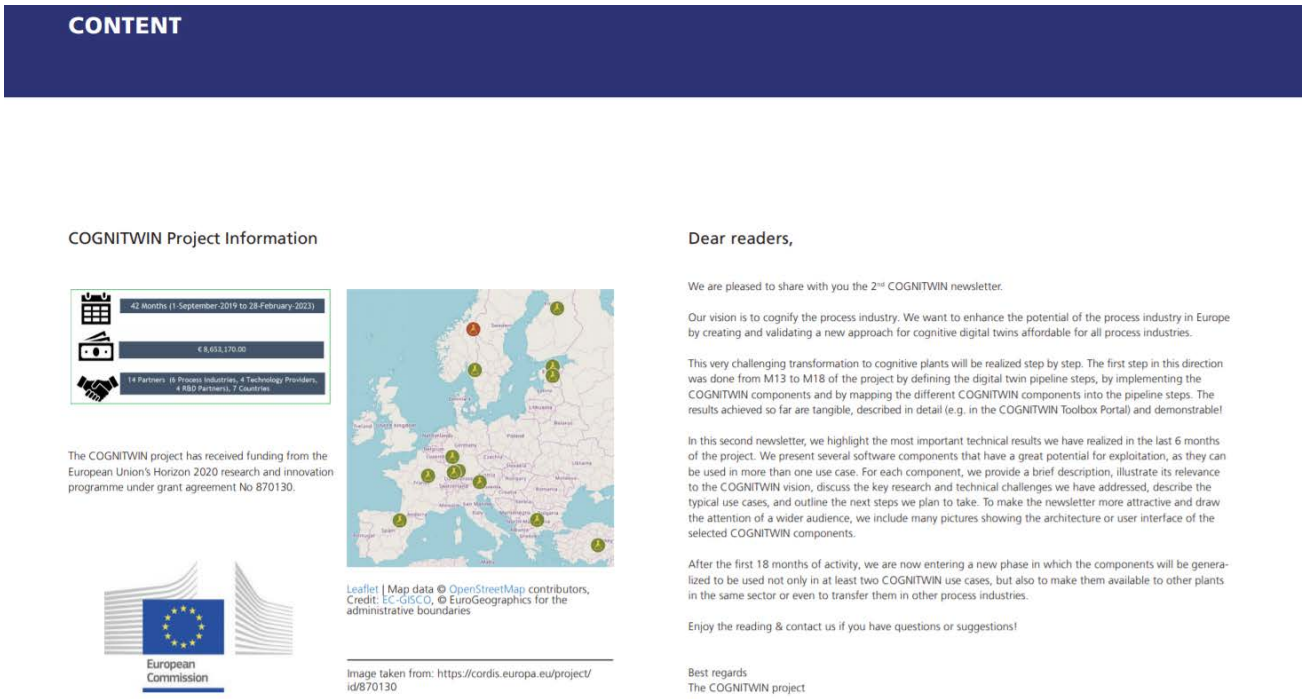
https://www.sintef.no/projectweb/cognitwin/dissemination-materials/

Figure 2: Screenshot of the first page of project flyer.

First newsletter was published in December 2020. The content is divided in the following three parts,

- Technical aspects
- COGNITWIN use cases
- Exploitation, dissemination, and project management activities

Second newsletter was published in June 2021. The most important technical results obtained in the first 6 months are highlighted. A screenshot from the content page of the newsletter is provided in Figure 3.


CONTENT

COGNITWIN Project Information

42 Months (1-September-2019 to 28-February-2023)

€ 8,653,170.00

14 Partners (6 Process Industries, 4 Technology Providers, 4 R&D Partners), 7 Countries

The COGNITWIN project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870130.

European Commission

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Image taken from: https://cordis.europa.eu/project/id/870130

Dear readers,

We are pleased to share with you the 2nd COGNITWIN newsletter.

Our vision is to cognify the process industry. We want to enhance the potential of the process industry in Europe by creating and validating a new approach for cognitive digital twins affordable for all process industries.

This very challenging transformation to cognitive plants will be realized step by step. The first step in this direction was done from M13 to M18 of the project by defining the digital twin pipeline steps, by implementing the COGNITWIN components and by mapping the different COGNITWIN components into the pipeline steps. The results achieved so far are tangible, described in detail (e.g. in the COGNITWIN Toolbox Portal) and demonstrable!

In this second newsletter, we highlight the most important technical results we have realized in the last 6 months of the project. We present several software components that have a great potential for exploitation, as they can be used in more than one use case. For each component, we provide a brief description, illustrate its relevance to the COGNITWIN vision, discuss the key research and technical challenges we have addressed, describe the typical use cases, and outline the next steps we plan to take. To make the newsletter more attractive and draw the attention of a wider audience, we include many pictures showing the architecture or user interface of the selected COGNITWIN components.

After the first 18 months of activity, we are now entering a new phase in which the components will be generalized to be used not only in at least two COGNITWIN use cases, but also to make them available to other plants in the same sector or even to transfer them in other process industries.

Enjoy the reading & contact us if you have questions or suggestions!

Best regards
The COGNITWIN project

Figure 3: Screenshot of the content page of second newsletter.

2.7.3 Project Video

Figure 4: Screenshot of the project video.

The project has prepared a video to demonstrate the project concept. A screenshot of the video is shown in Figure 4. The video is available on YouTube at the following link.

https://www.youtube.com/watch?v=N8xQpmYdabA

2.7.4 LinkedIn

The project has regularly posted updates in its LinkedIn page (Figure 5). This page is available at the following URL:

https://www.linkedin.com/company/cognitwin

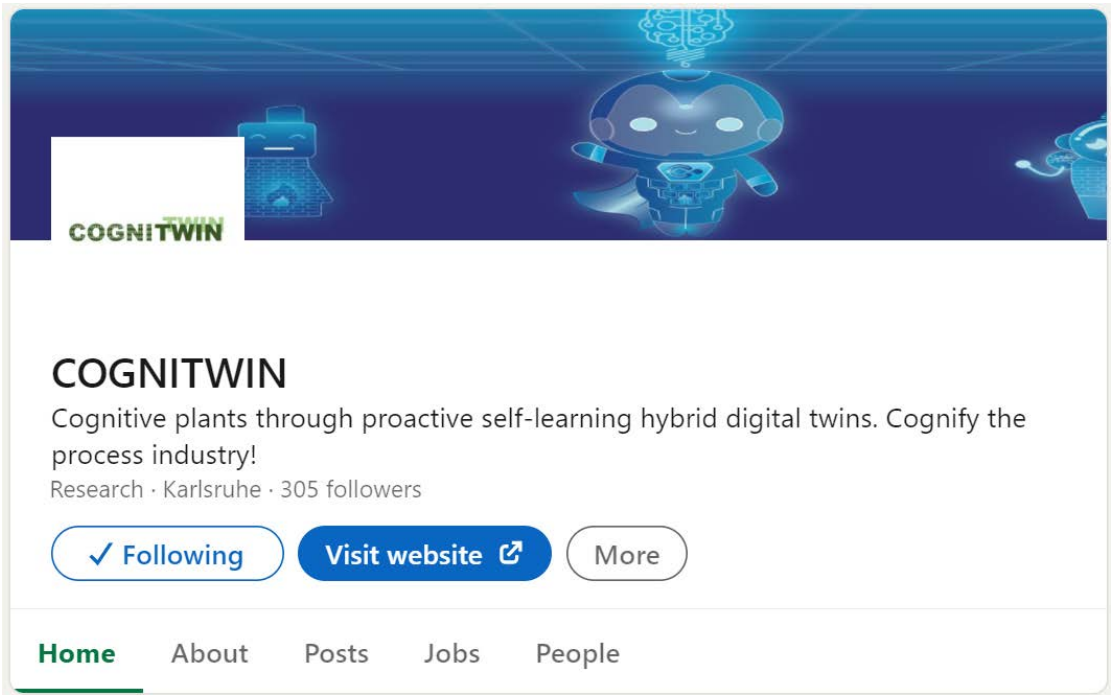

Figure 5: Screenshot of the LinkedIn page.

Until 31th August 2021, it has posted 62 posts and gained 305 followers. These updates mainly belong to information from project use cases, main outcomes, updates from project meetings, introduction of project participants, publications, participation in events.

2.7.5 Twitter

Figure 6: Screenshot of the twitter handle

The project is also regularly posting updates from its twitter handle (Figure 6). This twitter handle is available at the following URL:

https://twitter.com/cognitwin

Until 31st August 2021, the twitter handle has tweeted 62 posts and gained 50 followers.

2.8 Special Issue

Project partners Dr. Ljiljana Stojanovic and Dr. Arne Berre are guest editors of a special issue "Cognitive Digital Twins: Challenges and Opportunities for Process and Manufacturing Industries" @ Information MDPI. Deadline for manuscript submissions was 20 August 2021.

2.9 Blog

Scortex has published a blog post "Batch Norm Folding: An easy way to improve your network speed" on 30-June-2020 at the following link:

https://scortex.io/batch-norm-folding-an-easy-way-to-improve-your-network-speed/

3 KPIs

Table 4: Current status of the proposed KPIs for dissemination activities in COGNITWIN project.

Dissemination Activity	Target Audience(s)	KPI	Current Status
White Papers	All stakeholders	>=3	Basis for White papers established with 2 flyers + 1 video + 2 newsletters
Demonstrator	Industry	>=7	6 pilot demonstrators + 6 technology/Toolbox demonstrators
Participation in Exhibitions	Industry, IT service providers	>=2	None (due to Covid-19 restrictions)
Participation in Workshops	Industry, IT service providers	>=4	2 (with other SPIRE projects)
Participation in Conferences	Industry, IT service providers	>=4	4 (with publications) + 6 (only presentations)
Organisation of Workshops with External Exploitation Partner	Industry	>=2	0 (Planned for next phase)

Presentations to Potential Customers	Industry	>=10	0 (Planned for next phase)
Organisation of Workshop, Conference, Special Session	Research community	>=3	2 (Project workshops with other SPIRE projects (ref. above) + journal special issue editing
Journal Publications	Research community	>=5	3
Book chapter Publications	Research/Industry	>=1	2
Conference Publications	Research community	>=20	4
Dissemination outside EU	Industry, IT service providers	>=3	1 (Industrial Internet Consortium + Digital Twin Consortium)
Participation in Clusters	Members of EU Projects in process industry and AI/ML	>=10	2 (SPIRE Project cluster + BDVA)
Liaisons with National Initiatives (e.g., I4.0, IDS, etc.)	Manufacturers, Policy Makers, Integrators of Industrial Solutions	>=10	4

4 Future Actions

SINTEF is one of the registered Digital Innovation Hubs from the Horizon 2020 period – and is also involved in the preselected Norwegian European Digital Innovation Hub for AI application for Digital Europe. When the new European Digital Innovation Hubs for AI are being established during 2022, the COGNITWIN project will have an available information package that can be used to disseminate and contribute with results from the COGNITWIN project through this network of DIHs, which are planned to have local DIHs in all European countries.

SINTEF is further a member in various Digital Innovation Hub networks, such as the AI Digital Innovation Hubs Network (https://ai-dih-network.eu/) and the European Federation of Data Driven Innovation Hubs (EUHUBS4DATA), https://euhubs4data.eu/ and will also through these to promote results from COGNITWIN in various European countries. We will work together with the other SPIRE Cognitive Plant projects that we already have initiated collaboration with in order to reach the DIHs and communities that in particular focus on the Process industry.

5 Conclusions

This report presented an overview of the dissemination and communication activities carried out in the first 24 months of the COGNITWIN project. The project has been actively formally disseminating

its results through articles in journals, books, and conference proceedings while also communicating to a broader audience through presentations in conferences, webinars, and events with sister projects. Updates from the project have been regularly posted on its website and social media channels and various public dissemination materials have been created. The project has also participated in cluster events and liaised with various national initiatives. Finally, the status of achieved KPI's reflects that the communication and dissemination activities are on track.