

*ZERO-enabling Smart networked control framework for Agile cyber
physical production systems of systems*

**D7.9 - Dissemination, communication & standardization activities
report.R2**

Topic	HORIZON-CL4-2021-TWIN-TRANSITION-01-08
Project Title	ZERO-enabling Smart networked control framework for Agile cyber physical production systems of systems
Project Number	101057083
Project Acronym	Zero-SWARM
Deliverable No/Title	D7.5 - Dissemination, communication & standardization activities report
Contractual Delivery Date	M15
Actual Delivery Date	M18
Contributing WP	WP7 - Impact Maximization: Exploitation, Communication, Dissemination & Standardization
Project Start Date, Duration	01/06/2022, 30 Months
Dissemination Level	Public
Nature of Deliverable	R

Document History			
<i>Date</i>	<i>Version</i>	<i>Author</i>	<i>Description</i>
25.10.2023	0.1	K. Kot (IDSA)	1 st draft version of the full deliverable
27-10-2023	0.2	P. Khodashenas (HWE)	Inputs on Section 4

Authors List

Leading Author (Editor)				
Surname		Initials	Beneficiary Name	Contact email
Kot		K	IDSA	Kateryna.Kot@internationaldataspaces.org
Co-authors (in alphabetic order)				
#	Surname	Initials	Beneficiary Name	Contact email
1	Castellvi	S	IDSA	silvia.castellvi@internationaldataspaces.org
2	Prasse	T	IDSA	tobias.prasse@internationaldataspaces.org
Contributors (in alphabetic order)				
#	Surname	Initials	Beneficiary Name	Contact email
1	Ibanez	AIB	FBA	arturo.ibanez@fundingbox.com
2	Krendzel	AK	HWE	andrey.krendzel@huawei.com
3	Sayyad Khodashenas	PSK	HWE	pouria.khodashenas@huawei.com

Reviewers List

List of Reviewers (in alphabetic order)				
#	<i>Surname</i>	<i>Initials</i>	<i>Beneficiary Name</i>	<i>Contact email</i>
1	Ibanez	AIB	FBA	arturo.ibanez@fundingbox.com
2	Sayyad Khodashenas	PSK	HWE	pouria.khodashenas@huawei.com

DISCLAIMER OF WARRANTIES

This document has been prepared by Zero-SWARM project partners as an account of work carried out within the framework of the contract no 101057083.

Neither Project Coordinator, nor any signatory party of Zero-SWARM Project Consortium Agreement, nor any person acting on behalf of any of them:

- makes any warranty or representation whatsoever, express or implied,
 - with respect to the use of any information, apparatus, method, process, or similar item disclosed in this document, including merchantability and fitness for a particular purpose, or
 - that such use does not infringe on or interfere with privately owned rights, including any party's intellectual property, or
- that this document is suitable to any particular user's circumstance; or
- assumes responsibility for any damages or other liability whatsoever (including any consequential damages, even if Project Coordinator or any representative of a signatory party of the Zero-SWARM Project Consortium Agreement, has been advised of the possibility of such damages) resulting from your selection or use of this document or any information, apparatus, method, process, or similar item disclosed in this document.

Zero-SWARM has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101057083. The content of this deliverable does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the deliverable lies entirely with the author(s).

Table of Contents

1. Introduction	1-7
1.1 Purpose of the document	1-7
1.2 Comparative analysis of the reports	8
1.3 Structure of the document	9
2. Aim and scope of the communication, dissemination, and standardization activities	2-9
2.1 Objectives evaluation and audience reached	2-10
2.1.1 Assessment of the objectives and adjustment to the needs of project	2-10
2.1.2 Audience-Centric Communication and Dissemination Strategies	2-14
3. Communication and Dissemination activities report	3-14
3.1 Navigating Communication Channels: Progress, Evaluation, Rates, and Outlook	3-16
3.2 Strategic Outreach: Customizing Content and Channels for Target Audiences	3-31
4. Standardization activities	36
5. Metrics, Monitoring and Planning	39
5.1 Key performance Indicators and monitoring	39
5.2 Planning of the second year of activities	41
6. Conclusion	44

List of Figures

Figure 1: Website homepage	3-18
Figure 2: Blog & news section	3-19
Figure 3: General video screenshot	3-23
Figure 4: Trials overview video screenshot	3-23
Figure 5: The overview of the newsletter	3-24
Figure 6: Photo from the Manufacturing partnership day. Hosted by EFFRA	3-26
Figure 7: Photo from GSMA Mobile World Congress	3-26
Figure 8: Photo from FYUZ 2023	3-27
Figure 9: Photo from hub.berlin The business festival for tech & digitalization	3-27
Figure 10: Second flyer layout and printed version	3-28
Figure 11: Roll-up layout and printed version	3-29
Figure 12: Impact creation and industrial influence framework	36

List of Tables

Table 1: Communication and dissemination objectives.....	2-11
Table 2: LinkedIn visitors and followers analytics	3-19
Table 3: Attended events overview.	3-25
Table 4: Planned events overview	3-27
Table 5: Planned scientific publications.....	3-30
Table 6: Key message to be disseminated, most relevant channels for each target group	35
Table 7: Standardization planning tool	37
Table 8: Indicators for monitoring & KPIs.....	39
Table 9: Planning of the second year of activities.....	42

List of Abbreviation

Abbreviation	Description
3GPP	3rd Generation Partnership Project
5G-ACIA	5G Alliance for Connected Industries and Automation
6G-IA	6G Smart Networks and Services Industry Association
AI	Artificial Intelligence
C&D	Communication and dissemination
CPSoS	Cyber Physical Systems of Systems
DIH	Digital innovation hub
ECSO	European Cyber Security Organization
EDIH	European Digital innovation hub
EFFRA	European Factories of the Future Research Association
Eoi	Expression of interest
ETP	European Technology Platform
EU	European Union
IEC	International Electrotechnical Commission
IDS	International Data Spaces
iDTA	Industrial Digital Twin Association
ISO	International Organization for Standardization
OPC-UA	Open Platform Communications - Unified Architecture
R&D	Research and Development
SDG	Sustainable Development Goals
SDO	Standards development organizations
SME	Small- to mid-size enterprise
SoA	State-of-the-art
SP	Standardization Plan
WP	Work Package

Executive Summary

This deliverable reports the Zero-SWARM project's impact maximization progress until M18. It includes activity report on communication, dissemination & standardization of the project. Exploitation of the project has been already been treated separately on another document, D7.2 - Plan for exploitation & dissemination of results (PEDR).R1.

This document was developed in close coordination with all the other project Work Packages and in the framework of Work Package 7 - Impact Maximization: Exploitation, Communication, Dissemination and Standardization. The presented information is intended to ensure that all activities have been aligned with the initial plan presented in D7.5 - Dissemination, communication, standardization activities report. Our aim is to benefit from a high level of visibility among potential stakeholders and to benefit society and industry in general. All kinds of activities related to dissemination, communication, and standardization have been carried out to accelerate the achievement of the objective. D7.9 is a tool to check the progress of the project towards this target. Like the previous document, D7.5, this document identifies communication needs and objectives, describes our understanding of them, and sets the key audiences for the project and highlights the benefits that they can expect. A separate section of the document contains details about dissemination and communication tools, including the overall progress and updated KPIs and key messages that should be delivered to the key groups of stakeholders. Moreover, the following document contains an update about the standardization activities of the project where interaction of Zero-SWARM with various standardization bodies and reference initiatives are detailed.

1 Introduction

1.1 Purpose of the document

For the Zero-SWARM project, the Mid-Term Communication, Dissemination, and Standardization Report is an essential guide that helps us navigate our outreach activities. We carefully describe the objectives, reach, and results of our dissemination and communication campaigns as well as our standardization work in this report.

At the forefront of our communication strategy lies a concerted effort to engage with our audience effectively. We have observed substantial growth in our online presence, with a notable surge in followers across various platforms. This surge not only signifies a widening interest in our project but also underscores the impact and relevance of our work. Challenges have not been absent, particularly in adapting to the evolving landscape of platforms such as Twitter. Consequently, we are refocusing our efforts towards platforms like YouTube, an influential medium that can effectively showcase the project's groundbreaking concepts and achievements.

Our diverse group of project participants, each with their unique specializations and priorities, has posed a challenge in aligning on specific term definitions, reflected in our glossary. In response, our strategy will now pivot towards fostering alignment through collaborative publications, engaging webinars, and impactful events. These initiatives aim to unify our terminology and solidify our collective understanding.

To gauge the effectiveness of our initiatives, we have identified KPIs and established a robust monitoring system. This enables us to track progress, measure impact, and make data-driven adjustments to our strategies.

Looking ahead, we outline our strategic roadmap for the upcoming year, aligning our goals with the evolving needs of the project and the broader community.

The importance of our main methods of communication—LinkedIn, our website, the Zero-SWARM Community, events, blogs, scientific publications, and articles—must be recognized as we maneuver through this crucial moment, with YouTube playing an ever-more-important role. These platforms have continuously shown to be invaluable for disseminating important details regarding the project's progress, outcomes, and achievements.

Through this report, we ai

to provide a transparent and detailed account of our progress, challenges, and strategic shifts, ultimately fortifying our commitment to advancing the Zero-SWARM project.

1.2 Comparative analysis of the reports

This part highlights the key differences between the second report and the previous one on M03 in terms of communication dissemination and standardization activities within the Zero-SWARM project.

In the first report, the emphasis was on strategic planning, defining objectives, and outlining intentions to meet KPIs and maximize impact. The second report, however, takes a more action-oriented

approach, providing a detailed account of tangible actions taken during the project. It serves as a snapshot of real achievements and represents a significant shift in perspective.

A notable change in reporting structure is the absence of a dedicated risk management chapter in the second report. Instead, challenges encountered are seamlessly integrated into each subchapter, offering a dynamic understanding of both resolved issues and potential obstacles. This adjustment aims to provide a more nuanced view of the communication dissemination and standardization landscape.

As we find ourselves in the middle of the project lifespan, the second report acts as a bridge between strategic planning and real-time implementation. Beyond highlighting achievements, it offers insights into the learning curve of communication activities and sets the stage for future steps. This underscores our commitment to transparency and continuous improvement. In summary, the second report signifies a substantial evolution, moving from a strategic outlook to a detailed account of actions taken. The restructuring of content enhances the report's depth, providing stakeholders with a holistic view of the project's communication dynamics.

1.3 Structure of the document

The following document consists of five chapters providing the comprehensive overview of the activities conducted within the scope of communication, dissemination and standardization activities.

- The **Introductory** chapter describes the purpose of the document as well as the structure of the document with the short description of each chapter.
- The chapter under title **Aim and scope of the communication, dissemination, and standardization activities** describes the Zero-SWARM project's goals for communication and distribution, the shift and advancement of the methods, objectives and steps. It emphasizes calculated adjustments made to satisfy changing audience demands. Transdisciplinary techniques for carbon-neutral and digitally enhanced production are important strategies. Accomplishments include increased project exposure and participation across several platforms. Along with setting short-, mid-, and long-term objectives, the chapter emphasizes adaptation for long-term impact. It also lists the target audience segments for customized communication tactics.
- The next part: **Communication and Dissemination activities report**, which highlights the extensive communication and dissemination efforts of the Zero-SWARM project. It emphasizes engagement with a diverse audience and the examples of the tailored content. The project actively participates in various conferences and events to showcase its innovations. The chapter concludes with an overview, reporting, challenges and following steps of the project's communication channels, including LinkedIn, website, events, blogs, scientific publications, and visual materials, demonstrating a commitment to effective dissemination of Zero-SWARM's achievements.
- **The chapter on Standardization** provides a report on the progress of the project on the interaction with various standardization and reference initiatives. An updated version of the Zero-SWARM Standardization Planning Tool has been included in this chapter where the status of each action item is detailed.
- The chapter that follows is **Metrics, Monitoring and Planning** offers a thorough examination of the Key Performance Indicators (KPIs) for the project. Color-coded indicators are used to offer a visual depiction of progress. Comments offer current status and context, enabling

informed decisions and adjustments for continued success. It presents the detailed schedule for activities for the Zero-SWARM project's second year. A methodical strategy seeks to optimize impact and reach, precisely coordinating efforts for a more sustainable future.

- The chapter **Conclusion** briefly sums up the information provided in the document.

2 Aim & scope of the communication, dissemination & standardization activities

The essence of our communication and dissemination objectives remains largely unchanged, with a notable adaptation that responds to the specific needs of our target audience and a thoughtful reconsideration of our channel usage.

With its transdisciplinary, human-centered, and goal-oriented methodology, Zero-SWARM is dedicated to paving the way for production that is carbon-neutral and digitally enhanced. Open swarms, a private 5G network, an active information continuum, and the development of digital twins are all used in this journey. Our communication strategy has altered to reflect the changing environment while our mission has remained constant.

Despite the inherent complexity of our work, we make an effort to make our project comprehensible to a broad range of stakeholders, including those from distant or competing manufacturing divisions. With the goal of building a strong and active community that will assure the project's continuous legacy even beyond its formal conclusion, our published content is designed to be both educational and appealing to a broad public audience.

Our communication and dissemination efforts still are motivated by a dual goal: to centralize the adoption of new technological solutions through a variety of channels and tools, and to broadly disseminate their potential impact by building a community that cuts across borders and industries. The future of technology standards and 5G-based innovation will be influenced by our continued dedication to clear communication, creating value, and sharing our project's accomplishments and problems. By doing this, we establish the groundwork for high-impact usage of our results.

A key feature of the Zero-SWARM project is its strategically placed trial nodes across three European regions: North (Finland and Sweden), Center (Germany), and South (Spain and Italy). This geographic diversity increases our ability to disseminate information and promotes the blending of varied communities, all of which profit from Zero-SWARM's priceless resources.

As the project progresses, our understanding of how to effectively communicate our current achievements continues to evolve. Our scope will also grow as a result of partnerships with other projects from the same call. The selection of events in which we participate is of utmost importance, as it offers a platform to provide greater visibility to our stakeholders, with a strong emphasis on showcasing our technological advancements and trial outcomes.

Our ultimate goal is to enable dispersed zero-waste plastic production for a circular economy, the development of a zero-error automated industry, and the promotion of circular manufacturing practices. We are committed to capturing the interest of a wide audience, involving important players, and fundamentally transforming the landscape of green manufacturing through smart distribution efforts and fruitful collaborations with regional projects. All prospective stakeholders are invited to participate in this trip, making it a group effort that can change people.

2.1 Objectives evaluation and audience reached

2.1.1 Assessment of the objectives & adjustment to the needs of project

The Zero-SWARM project has made great progress in achieving its short-term goals since moving from the first stage to the second. The project's major goal is to maximize impact through an effective communication and dissemination plan. It is crucial that the efforts of all work packages are widely shown in order to promote full community engagement and participation.

Our main objective is to make sure that the results of our labor serve society as a whole, not just the industrial industry. This is accomplished through exchanging information and using our services. Speaking about the overall objectives achieved within the first year of the projects and we may divide them into two categories and analyze the outcomes of actions:

1. Advancement in visibility and branding usage:

To maintain a consistent and expert brand image throughout our internal and external communications, we have created a thorough kit of visual identity products.

Active social media promotion has greatly expanded the audience for our project, and our partners have helped us by promoting Zero-SWARM on their personal websites and accounts.

Our participation in a variety of events and networking opportunities, both physical and virtual, has not only increased visibility but has also fostered valuable connections with potential collaborators and stakeholders.

The interaction with decision-makers at all levels of public administration has been effective in fostering fruitful debates and dialogues that have advanced a better comprehension of the project's goals and potential policy consequences.

Rigorous tracking of the efficiency of our dissemination channels has allowed us to fine-tune our strategies, ensuring our messages reach the right audience with the greatest impact.

The adjustment of reviewing and updating of visual identity kit justification and maintaining a consistent brand image suggests that a periodic review of the visual identity kit is necessary. As goals evolve, the visual representation should align with the refined objectives, ensuring that the brand image remains relevant and communicates the project's current values effectively.

2. Content production and Engagement fostering:

We have successfully increased knowledge of the project's main goals, principles, challenges, and activities, ensuring that our mission is understood.

In order to provide stakeholders looking for information about Zero-SWARM with a comprehensive resource, our project website has been assiduously filled with pertinent and instructive content.

Each distinct stakeholder group has been taken into account while creating content, ensuring that our communications speak to their particular interests and concerns.

Stakeholders have given efforts to increase interest in creating a "green," climate-neutral, circular, and digitalized industry a lot of attention and support.

The acknowledgment of social media promotion's success highlights its importance. Continuous analysis and optimization ensure that the strategies remain aligned with the evolving preferences of the audience, maximizing impact and sustaining the expanded audience reach.

To highlight the distinctive features and results of each project trial, we have treated each one as a different mini-campaign of communication and dissemination. Recognizing the need to address specific interests and concerns of distinct stakeholder groups emphasizes the importance of customization. The adjustment involves a continued effort to tailor content to various audiences, ensuring that communications resonate with each group.

The ongoing addition of new terms and explanations to our project vocabulary has guaranteed that all stakeholders fully comprehend our work, making it more approachable.

Our focus on advancing a people-centered strategy has been strengthened, emphasizing the project's commitment to moral and socially responsible activities.

In addition to raising our exposure, active involvement in stakeholder events and industry fairs has provided beneficial face-to-face networking and dissemination possibilities. While active involvement in stakeholder events and industry fairs is beneficial, the suggestion to explore additional face-to-face opportunities indicates a desire for broader networking. Diversifying networking avenues beyond traditional events can lead to increased dissemination possibilities and valuable connections.

We are now setting a course for long-term goals in keeping with our desire for the project's success to last beyond its short lifespan. Today, we are actively devoting time and energy to achieving goals that go beyond the finance of the project. After reviewing and analyzing the past period of the project, the mid-term and long-term goals and objectives mostly remained unchanged but were also complemented by some others.

As the project evolves its objectives, or, rather, the actions, that should be taken to achieve them, and our goals get more tailored and include now:

Table 1: Communication and dissemination objectives

	Specific objectives	Relevant specific items and activities
Midterm objectives	Popularization of the achieved results, their benefits and adoption opportunities	Constantly update the website
		Fill the social media account with relevant content and photos
		Make the trial results visible by recording the videos and publishing them
		Distribute the printed materials
		Raise awareness among the community to make each partner promote the project and its solutions on private social media space
		Emphasize the "zero"-policy of the project by showcasing the zero-emission, zero-waste manufacturing
		Highlight the uniqueness of each trial

		Enrich the glossary with the concepts and definitions explained in a simple way to make it comprehensive and attractive for representatives of different scope, broadening the target audience
		Facilitate matchmaking possibilities for SMEs via the Zero-SWARM Community
		Actively engage with educational institutions among our partners and not only and produce greater amount of scientific publications as well as co-organize educational events
		Organize interactive webinars and physical or virtual demonstration events where stakeholders can experience the project's innovations firsthand and interact with project team members
		Publish the interviews with the experts from the consortium and not only
		Implement a robust monitoring and evaluation system to track the effectiveness of dissemination efforts, allowing for data-driven adjustments and improvements
Midterm objectives	Explain the challenges and vulnerability areas of project's solutions and their adoption if found	Develop whitepapers that present the challenges and vulnerabilities in a more accessible and non-technical manner, making them understandable to a broader audience.
		Minimize the negative impact on the project success by showcasing how to overcome the issue
		Describe risk management options
		Understand and disseminate the scope of the challenge for each stakeholder
		Share real-world case studies that illustrate specific challenges encountered during the implementation of project solutions, along with lessons learned and mitigation strategies
		Create visually engaging infographics that highlight key challenges and vulnerability areas, making complex information more digestible for a wide audience
		Launch targeted social media campaigns to raise awareness about the challenges and vulnerabilities, encouraging dialogue and sharing of best practices
		Collaborate with relevant industry experts or organizations to produce joint reports that analyze challenges and propose solutions within the project's context

		Participate in industry-specific conferences, seminars, or roundtable discussions to present findings and engage with a wider audience of professionals
Long-term objectives	Ensure the sustainability of Zero-Swarm solutions, keep the awareness and relevancy of the project after the end of funding	Make the website content accessible and comprehensive for general public
		Create a stable and closely connected community, which could be interested in sustaining the project for some years after its end.
		Create value in shared knowledge to the upskilled specialists
		Ensure high quality scientific publications, which are highly informative and unique enough to stay influential and relevant for an extended period of time
		Raise awareness of urge to apply the Zero-SWARM solutions to move faster towards climate neutral and smart manufacturing and society as a whole
		Make project resources and findings openly accessible to the public and relevant stakeholders through online platforms, repositories, and databases
		To leverage on the Zero-SWARM Community to reinforce collaboration and networking between initiatives supporting 5G technology
		Create detailed documentation that outlines the project's methodologies, findings, and solutions. This can include technical reports, user manuals, and case studies
		Send out regular newsletters and updates to project stakeholders and interested parties to keep them informed about ongoing activities, achievements, and developments
		Collaborate with academic institutions, industry partners, and research organizations to continue research and development efforts related to the project's solutions
		Continue to participate in relevant industry events, conferences, and trade shows to showcase project outcomes and foster networking opportunities
		Projects: Implement demonstration projects that showcase the practical applications and benefits of the project's solutions in real-world scenarios
		Strengthen partnerships with organizations, associations, and networks that share an interest in sustainable solutions, ensuring ongoing support and collaboration
		Collect and share testimonials and user stories from organizations that have successfully implemented the project's solutions

		Launch targeted public awareness campaigns to inform the broader public about the project's contributions to sustainability and industry innovation
		Explore opportunities for securing long-term funding or partnerships to sustain project activities beyond the initial funding period
		Regularly assess and evaluate the impact of project solutions to ensure they remain relevant and address evolving needs and challenges

As the project progresses, it must remain adaptable to evolving priorities and adjust its activities accordingly to achieve its goals and ensure long-term success and sustainability.

2.1.2 Audience-Centric Communication & Dissemination Strategies

The success of the Zero-SWARM project depends critically on effective communication and dissemination. An overview of the many audiences that have been addressed and involved through focused communication initiatives is provided in the report.

- **SMEs:** by selecting and disseminating targeted information on the project's official Website, the initiative strategically targets SMEs. This content focuses on creative ideas that improve operational efficiency and release latent revenue potential in order to meet the practical demands of SMEs.
- **Large Businesses:** product demonstrations, active involvement in industry events, and regular updates provided on the project's own LinkedIn profile are used to attract big businesses. Their pursuit of novel products and improved operating approaches is in line with this strategy.
- **Research Community, Academia, and Organizations:** scientific excellence and research engagement are priorities for the project. Scientific publications and insightful presentations are shared at prestigious academic conferences. Furthermore, the project disseminates its research findings through its website, providing a platform for meaningful engagement, collaboration, and knowledge exchange with the research community, academia, and relevant organizations.
- **Technology Solutions and Service Providers:** the project makes use of webinars to show how service and solution providers may easily incorporate their products into the project's innovations. This not only demonstrates how their products may be used in real life, but it also creates new opportunities for creative partnerships and business models.
- **Other EU Initiatives:** collaboration activities, joint publications, and active engagement in common activities all help to facilitate cross-project communication (currently Zero-SWARM project collaborates with RE4DY and 5G-Timber projects). These initiatives use the unique knowledge of other initiatives to maximize the combined impact of EU programs.
- **Citizens:** through educational initiatives and awareness-raising content, the project's dedication to sustainability and public awareness is demonstrated. The project increases public understanding and support for its transformative objectives by highlighting its role in creating a sustainable future.

3 Communication & Dissemination activities report

With the main goals of disseminating its novel concepts, encouraging collaboration, and tackling numerous problems, the Zero-SWARM project has been actively involved in a wide range of communication and distribution projects. These initiatives have been crucial in highlighting the project's successes and its benefits to society at large, particularly in the context of cutting-edge technical advancements.

Zero-SWARM has used a variety of communication platforms to share its developments, successes, and milestones in an effort to reach a large and diverse audience. To a broad range of stakeholders, including scholars, practitioners, industry experts, and the general public, the project has successfully exposed its new concepts, technologies, and techniques.

This has been accomplished by actively taking part in business-related conferences, workshops, seminars, and exhibitions. Notable presentations have also been made at illustrious events including the EuCNC & 6G Summit, the DSA Summer International Conference, the Small Cells World Summit 2023, and Hannover Messe. By handing out educational flyers at these occasions, the initiative also increased its visibility by disseminating vital details about the consortium members and project goals. These events offered priceless chances to demonstrate the project's creative ideas, interact with peers and business leaders, and offer attendees insightful information through the distribution of educational materials.

Zero-SWARM has contributed significantly to the scientific community through a number of research articles spanning a wide range of project-related topics, in addition to taking part in industry events. A list of these articles may be seen on the project's official website, and they demonstrate the consortium's breadth of expertise and the depth of its research. So far we made the following publications:

- G. Lazaridis, P. Khodashenas, A. Drosou, P. Chatzimisios, D. Tzovaras and A. Krendzel, "Digital & Green Transitions of the European Manufacturing Sector through beyond 5G-enabled technologies & innovations," 2022 IEEE Conference on Standards for Communications and Networking (CSCN), Thessaloniki, Greece, 2022, pp. 91-91, doi: <https://doi.org/10.1109/CSCN57023.2022.10051028>
- Ana Larrañaga, M. Carmen Lucas-Estañ, Sandra Lagén, Zoraze Ali, Imanol Martinez, Javier Gozalvez, An open-source implementation and validation of 5G NR configured grant for URLLC in ns-3 5G LENA: A scheduling case study in industry 4.0 scenarios, Journal of Network and Computer Applications, Volume 215, 2023, ISSN 1084-8045, <https://doi.org/10.1016/j.jnca.2023.103638>
- G. Lazaridis, A. Drosou, P. Chatzimisios, D. Tzovaras, "Securing Modbus TCP Communications in I4.0: A Penetration Testing Approach Using OpenPLC and Factory IO," 2023 IEEE Conference on Standards for Communications and Networking (CSCN), Munich, Germany, 2023, (*In the process to be published*)

Consistent usage of LinkedIn publications has been a key component of the project's communication strategy. These ongoing blogs have been a lively forum for sharing knowledge, updates, and insights. Announcements about new partners, recaps of events, and thorough research findings have all been covered. The initiative has successfully encouraged teamwork, disseminated insightful information, and engaged a growing community of followers interested in its advancement through these posts.

Additionally, the official Zero-SWARM project website is constantly being updated with new material and acts as a hub for all project-related data, including news articles and blog posts. These updates offer a forum for in-depth information exchange, project updates, and viewpoints on its progress. The project's online presence is improved by the expanding library of blog posts and news articles, which is available at <https://zero-swarm.eu/> and acts as a useful resource for stakeholders and the general public.

All of these communication initiatives aim to promote an involved and active community, which is closely aligned with the project's goal of community building. To foster a sense of community and a sense of shared purpose, Zero-SWARM connects with its stakeholders via a variety of venues. The communication efforts of the project are designed to foster connections, promote knowledge exchange, and promote cooperation among people and groups with a shared interest in the project's goals.

The project has also welcomed cooperation with other innovative projects, realizing the potential for mutual influence and profit. Innovation has been sparked by the #HORIZON-CL4-2021 call in a number of different businesses. In a recent blog post, Zero-SWARM examined cooperation with RE4DY and 5G-TIMBER, two separate projects born from the same call.

These efforts all aim to use cutting-edge technology to revolutionize their respective sectors. In addition to 5G-wood, which uses 5G to transform the EU wood industry, and RE4DY, which focuses on expanding data autonomy in the manufacturing sector, Zero-SWARM is committed to altering the manufacturing landscape with 5G technology.

The combined efforts of these programs are intended to increase their impact and hasten the accomplishment of their objectives.

3.1 Navigating Communication Channels: Progress, Evaluation, Rates, and Outlook

At the forefront of our communication strategy, it's crucial to highlight the remarkable growth we've witnessed in our outreach efforts. The numbers of followers across our platforms are continually on the rise. There have been plenty of requests to present Zero-SWARM, speak as experts, or attend events. This increase in attention highlights the significance and effect of our work.

In tandem with our steadfast commitment to communication excellence, the Community of Zero-Swarm project, strategically built on the platform provided by our esteemed partners, significantly enhances our outreach initiatives. This collaborative effort serves to reinforce the impact of our communication and dissemination actions, fostering a broader understanding and appreciation for the innovative ideas and successes encapsulated within the Zero-Swarm project. Deliverables D 7.3, D 7.4, and D 7.8 contain a thorough description of the goals, actions, and KPIs relevant to our communication plan. These in-depth studies offer a detailed understanding of the observable results and tactical subtleties that characterize our methodology.

Our proactive attitude is evident, despite the fact that our path has not been without challenges, notably in responding to the shifting landscape of platforms like Twitter where we have observed diminishing returns. We're refocusing on YouTube, a cutting-edge platform that can successfully highlight the project's innovative ideas and successes.

The broad group of project participants, each with their own specializations and priorities, have made it difficult to agree on particular term definitions, which presents a parallel difficulty in our glossary. Recognizing this, our strategy will now focus on fostering alignment through collaborative publications, engaging webinars, and impactful events.

As we navigate these strategic shifts, it's essential to emphasize that our primary communication and dissemination channels remain unwavering: LinkedIn, Website, Events, Blogs, Scientific Publications, and Articles, with YouTube taking a prominent role. Throughout the reporting period, these channels have not only maintained their effectiveness but have consistently proven invaluable in conveying vital information regarding the project's status, results, and accomplishments. Further insights into the tools and channels employed will be elaborated in the subsequent chapters.

3.1.1 Website

The Zero-SWARM project's website (<https://zero-swarm.eu/>) has witnessed substantial growth and development, marked by strategic additions and improvements. Notably, the introduction of distinct tabs for "Blog," "News" and "Events" has enhanced navigation and content accessibility. Additionally, the incorporation of a dedicated section for "Publications" provides a valuable resource for downloading and pre-reading essential project documents. Despite these enhancements, the website maintains its role as a comprehensive platform, offering a thorough overview of the project's objectives and goals.

With approximately 20 blog posts and a continuous stream of news updates, the website now garners an average of five unique visitors per week. This success is attributed to consistent promotion through social media channels and inclusion in printed materials, reinforcing its visibility and reach.

Since some KPIs were not achieved (see the table in the respective chapter) the following action items are necessary to be taken:

- Review the created content and make it more valuable and up-to-date.
- Optimize for search engines.
- Promote on social media more actively.
- Collaborate with partners and other projects for backlinks.
- Improve user experience.
- Monitor analytics.
- Consider paid advertising.
- Engage in relevant online communities.

One notable challenge lies in content curation, requiring content to be both comprehensive and accessible to a wide audience, catering to diverse stakeholder groups. This hurdle is effectively addressed through a collaborative effort, involving communication and dissemination task leaders alongside representatives from other work packages. Their contributions not only furnish the latest updates but also offer valuable feedback on the chosen communication strategy.

A substantial amount of the content is focused on trial presentations, and the blog section notably features items that relate to these presentations. These presentations are enhanced by vibrant visuals

and thorough analyses of their solutions, advantages, and social implications. The website makes a big point of emphasizing the project's focus on green digital transformation.

In this phase of consolidation, maintaining an updated website is paramount. This entails regular content updates, with a specific focus on trial-related information. The platform's resources will also be enriched by the addition of more written content, videos, and produced materials. Including details on upcoming events and relevant news will ensure that the audience remains well-informed and engaged. Finally, expanding the blog section will be pivotal in raising awareness about the project's revolutionary endeavours.

The Zero-SWARM website continues to serve as a dynamic and informative hub, exemplifying the project's commitment to effective communication and dissemination of its ground-breaking achievements.

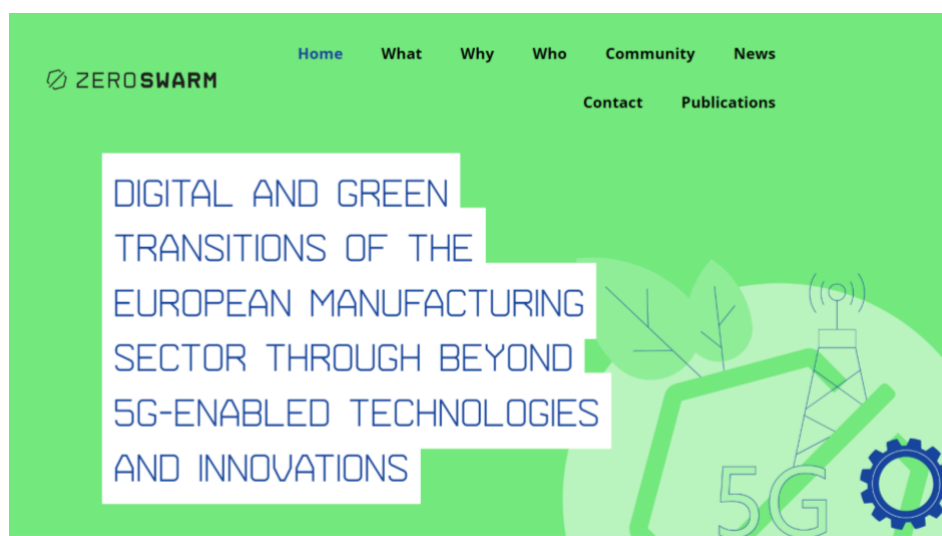


Figure 1: Website homepage

3.1.2 Blog posts

The objectives outlined in the initial plan for the project's blogs have been successfully realized. The blogs serve as a dynamic platform providing regular updates on project progress, offering detailed insights into the development process, conducting thorough analyses of trials and their outcomes, and disseminating a broad spectrum of information. They facilitate seamless communication with pertinent stakeholder groups, offering a space for announcements and publications aligned with our pursuit of sustainability development goals.

The blog content is strategically categorized into three main directions: Trials Overview, Publications of Articles by Partners, and Other Educational Materials. The project also disseminates news updates in addition to blog posts. These mainly include summaries of partner activities related to the project as well as reports on our involvement in events. With the KPI of having 1 blog post per month – it was overachieved.

Moving forward, our emphasis will be on expanding the volume of blog articles. Content-wise, we will prioritize highlighting the green digital transformation and showcasing tangible solutions applicable to stakeholders. To address market needs effectively, we will tailor content to align seamlessly with industry requirements and supplement them. These upgrades enhance our communication efforts even further.

The fundamental difficulty still lies in content acquisition, as was emphasized in the preceding chapter. It will be difficult to overcome this obstacle without our partners' close cooperation. Additionally, it can be difficult to determine whether information is relevant to all of the many actors in an industry. A thorough analysis of the project's presented material is essential given the broad range of companies and their unique interests.

Blogs and news updates for the project serve as crucial instruments in our communication strategy, to sum up. They help us efficiently communicate important information, encourage participation, and advance our sustainability development goals. The planned content extension and refinement initiatives are completely in line with our commitment to providing useful information to all concerned parties.

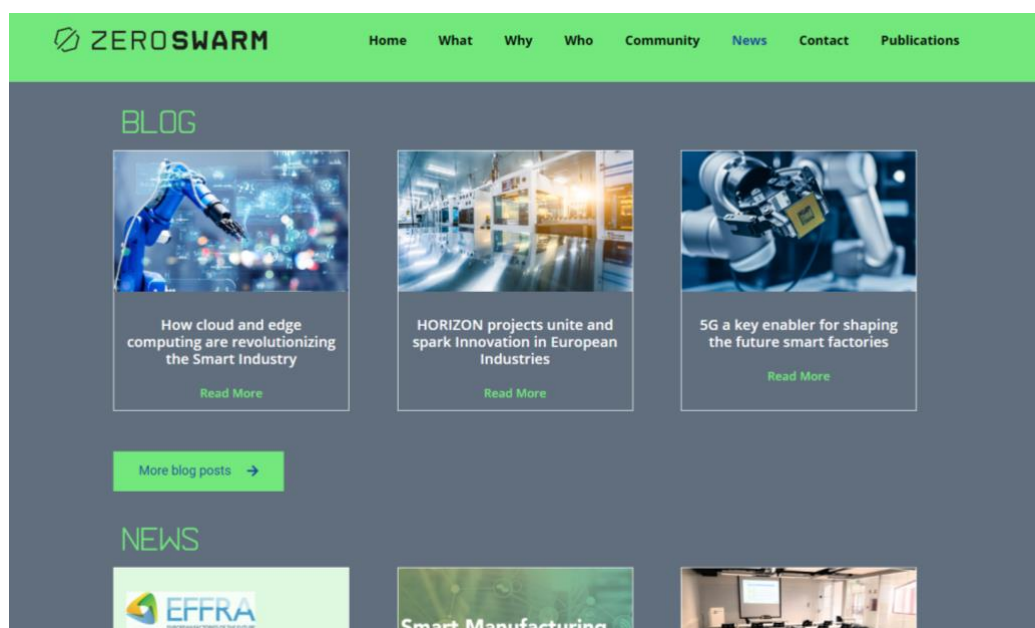


Figure 2: Blog & news section

3.1.3 LinkedIn

Various The Zero-SWARM LinkedIn page (<https://www.linkedin.com/company/zeroswarm/>) has proven to be a highly impactful tool for project development, with notable engagement and reach. Over the reporting period, the page garnered 1,117 Page views, 466 Unique visitors, and more than 350 followers, as well as an average of 600 impressions per post. These metrics underscore the significance of LinkedIn as a key platform for the project's outreach efforts.

The following table provides the overview of the analytics of the followers and the visitors within the reporting period up to M15:

Table 2: LinkedIn visitors and followers analytics

By job functions	By company size	By industry	By location
Visitors' analysis			
Business Development 162 (14.6%)	11-50 employees 185 (16.7%)	Research Services 177 (16%)	Spain 250 (22,6%)

Research 121 (10.9%)	51-200 employees 171 (15.4%)	IT Services and IT Consulting 134 (12.1%)	Germany 203 (18,2%)
Engineering 115 (10.4%)	10,001+ employees 137 (12.4%)	Computers and Electronics Manufacturing 96 (8.7%)	Italy 34 (3,09%)
Program and Project Management 104 (9.4%)	1-10 employees 107 (9.7%)	Restaurants 76 (6.9%)	Istanbul, Turkey 121 (1.8%)
Marketing 78 (7%)	501-1000 employees 100 (9%)	Telecommunications 68 (6.1%)	Other countries 54,31%
Consulting 58 (5.2%)	1001-5000 employees 63 (5.7%)	Fundraising 60 (5.4%)	
Information Technology 54 (4.9%)	201-500 employees 62 (5.6%)	E-Learning Providers 45 (4.1%)	
Operations 38 (3.4%)		Higher Education 44 (4%)	
Education 37 (3.3%)		Business Consulting and Services 33 (3%)	
Sales 30 (2.7%)		Automation Machinery Manufacturing 25 (2.3%)	
Follower metrics			
Engineering 40 (11.4%)	51-200 employees 72 (20.5%)	Research Services 52 (14.8%)	Germany 196 (27,8%)
Program and Project Management 39 (11.1%)	11-50 employees 65 (18.5%)	IT Services and IT Consulting 45 (12.8%)	Spain 30 (8.5%)
Business Development 38 (10.8%)	10,001+ employees 38 (10.8%)	Telecommunications 31 (8.8%)	Greece 18 (5.1%)
Research 36 (10.2%)	1001-5000 employees 38 (10.8%)	Higher Education 29 (8.2%)	Turkey 9 (2.6%)

Information Technology 28 (8%)	1-10 employees 29 (8.2%)	Business Consulting and Services 12 (3.4%)	Other countries 32,6%
Education 22 (6.3%)	201-500 employees 27 (7.7%)	Non-profit Organizations 11 (3.1%)	
Operations 17 (4.8%)	501-1000 employees 22 (6.3%)	Software Development 11 (3.1%)	
Marketing 14 (4%)	5001-10,000 employees 13 (3.7%)	Professional Organizations 10 (2.8%)	
Sales 14 (4%)	Others 48 (13.6%)	Wireless Services 9 (2.6%)	
Administrative 10 (2.8%)		Automation Machinery Manufacturing 9 (2.6%)	

The objective of the LinkedIn account development for the project remains consistent during the consolidation period.

1. Increasing the Number of Followers:

To achieve this, we continue to actively engage with the LinkedIn community by sharing relevant content, participating in discussions, and responding promptly to comments and messages. An example of this is our recent engagement, which is a trial presentation, targeting industry influencers, resulting in a 10% increase in followers over the last month. The plan is to have more of the interactive engagements to increase the number of followers.

2. LinkedIn Campaign on Trials and Results:

We will continue to highlight ongoing trials and their outcomes through dedicated LinkedIn campaigns. For instance, our recent post on the efficacy of Zero-SWARM 5g enabled remote quality control for zero defect resilient manufacturing garnered significant attention, with a reach of over 640 impressions. The amount of publication related to trials should be enhanced as this type of content regularly gathers the biggest number of impressions.

3. Active Events Dissemination:

Attending and participating in industry events provides an excellent opportunity for exposure. We will actively share updates, photos, and key takeaways from these events. A recent example includes our participation in the Manufacturing partnership day organized by EFFRA, where we generated over 550 impressions.

4. Maintaining a Regular Blog Post Sharing:

We understand the importance of consistently providing valuable content to our audience.

5. Focus on Showcasing and Partner Presentation:

Highlighting collaborations and partnerships is crucial for establishing credibility. We have been actively showcasing our collaborations with renowned research institutions, energy providers and projects from the same call like RE4DY and 5G Timber.

6. Promotion of the Webinars and other platforms:

Since video production is going to play more significant role for communication of the solutions of the project – it is crucial to ensure the visibility and decent promotion of other channels, where the videos are going to be placed.

The strategies outlined above have proven to be effective in achieving our objectives for LinkedIn account development. By maintaining consistency and leveraging the platform's features, we are confident in further elevating Zero-Swarm's presence and influence within the industry. We will continue to monitor and adapt our approach to ensure sustained growth and engagement.

3.1.4 Webinars & video materials

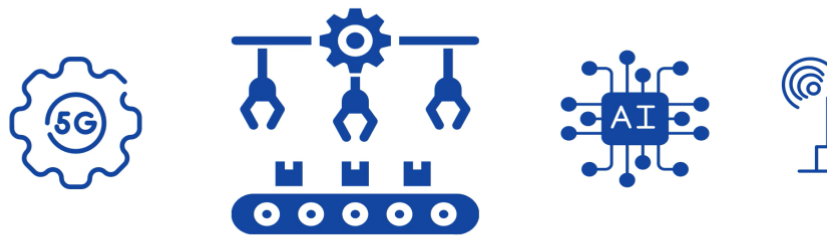
We begin the creation of a series of webinars in collaboration with other EU projects, regardless of their call origin, in the spirit of information dissemination and cooperative advancement. The ultimate goal of this program is to produce top-notch instructional materials by highlighting particular key points within Zero-SWARM and encouraging collaboration among partners.

With an emphasis on topical areas like IoT integration, smart manufacturing, Industry 4.0 innovative materials, data-driven techniques, and renewable energy integration, the purpose of these webinars is to promote collaboration and knowledge exchange among various EU projects. In addition, we intend to create a video for each trial that will fully describe the trial, highlight the answer, and offer the visuals required to comprehend its application.

Diverse viewpoints, methodologies, and ideas are brought together through collaboration with other EU projects. This diversity enhances the information and gives participants a comprehensive comprehension of the subjects covered. We may get specialist expertise that complements our own through collaboration with other projects. This guarantees that the webinars are thorough and provide extensive insights. Joint webinars provide us the chance to broaden our network among others working on EU projects. This greater exposure may result in new partnerships, financing chances, and initiatives for knowledge-sharing.

Each webinar will be meticulously curated to deliver high-quality, research-backed content. This will not only enhance the knowledge base of participants but also contribute to the broader educational landscape in the field of sustainable energy.

Furthermore, we want to report that two videos have already been produced. These videos serve to explain the project overall and highlight the specific focus of each trial. They can be utilized by all partners during events as additional visual materials, enhancing presentations and discussions.



Smart assembly in cabinet production

Project funded by Horizon Europe, Grant Agreement #101057083

Figure 3: General video screenshot



Figure 4: Trials overview video screenshot

3.1.5 Newsletter

The first Zero-SWARM project newsletter was successfully launched. With thorough information on project advancements and the exciting activities of our partners, this first issue was sent to our respected community members.

The newsletter covered a wide range of topics, including the most recent initiatives of the partners in the Zero-SWARM project as well as advancements made in our sustainable energy solutions. It acted as a forum for the dissemination of important information and the promotion of interaction among the people in our community.

The initial newsletter's reception was overall positive. Our community was engaged, as evidenced by the significant opening rate of 35% and the click rate of 5% that we observed.

We are pleased to share our plans for upcoming newsletters. Together with the RE4DY and 5G Timber initiatives, we want to create a cluster newsletter in December using our combined knowledge and updates. The synergies between our programs are highlighted by this collaborative endeavor, which promises to yield a wealth of knowledge.

We've also set our sights on a newsletter for the following year as we look to the future. This will act as a crucial forum for communicating our advancements and successes to the larger community.

To amplify our outreach efforts, we have introduced a subscription button on our website. This strategic addition is designed to increase the pool of recipients and followers, ultimately enhancing the reach and impact of our newsletters.



Figure 5: The overview of the newsletter

The strategic steps to enhance the performance of the newsletter are:

- Tailor content to each segment to increase engagement and relevance.
- Gather relevant content from partners.
- Include visuals, concise writing,
- Establish a regular sending schedule to maintain audience interest and expectation.
- Experiment with different elements (subject lines, content format) to optimize performance.
- Track open rates, click-through rates, and conversion rates to identify trends and areas for improvement.
- Solicit feedback from subscribers to understand their preferences and adapt content accordingly.
- Ensure the newsletter is mobile-friendly to accommodate users on different devices.

3.1.6 Events

Throughout the reporting year, the Zero-SWARM project participated actively in a wide range of activities. These events primarily encompassed gatherings attended by our esteemed partners, where the project's objectives were integrated into the agenda or featured as part of the collaborative booth. Additionally, there were specific sessions dedicated to highlighting the project's significance and contributions to the forefront of discussions.

One noteworthy event was the International Summer Conference organized by the Decision Science Alliance. This conference provided an invaluable platform to delve into the critical role of the Cyber-Physical Systems of Systems (CSoS) and the technological layers acting as pivotal enablers for decision-making and control in the cloud-to-edge paradigm. The presentation served as a focal point, shedding light on the project's innovative endeavours.

The table below provides a detailed overview of the events in which the project was represented, both by our esteemed partners and directly by the Zero-SWARM project itself.

Table 3: Attended events overview.

No	Event Title	Place of Dissemination	Date(s)	Zero-SWARM Partners Involved
1	FYUZ2022	Madrid, Spain	08-09.04.2022	ACC
2	Smart City Expo World Congress 2022	Barcelona, Spain	07-08.11.2022	UBI
4	SPS Nürnberg 2022	Nürnberg, Germany	08-10.11.2022	NX-SE
5	Wireless Congress: Systems and Applications	Munich, Germany	16-17.11.2022	FhG
6	Germany Connected	Berlin, Germany	06.12.2022	OPT
7	GSMA Mobile World Congress	Barcelona, Spain	28.02 - 03.03.2023	UBI, i2CAT, HWG
8	Hannover industry fair 2023	Hannover, Germany	17-21.04.2023	NX-SE, ABB, IDSA, NEU
9	Interpack 2023	Duesseldorf, Germany	04-10.05.2023	PERK
10	Small Cells World Summit	London, UK	23-24.05.2023	ACC
11	DSA International Summer Conference	Milan, Italy	29-30.05.2023	RWG
12	The future of Decision Making: Conscious Data Driven Decisions via AI and Math-Optimization	Milan, Germany	09.06.2023	RWG, HWE
13	hub.berlin The business festival for tech & digitalisation	Berlin, Germany	28-29.06.2023	IDSA
14	Manufacturing partnership day. Hosted by EFFRA	Brussels, Belgium	26.09.2023	IDSA, CERTH, HWE
15	Data Spaces Discovery Day	Naples, Italy	16.10.2023	IDSA
16	Tutorial on "Advanced topics in 5G networks across industry cross-border corridors"	Aalborg, Denmark	30.10.2023	HWE, OPT, CERTH

The Zero-SWARM project's extensive participation in a range of events demonstrates its dedication to promoting significant partnerships, sharing vital data, and highlighting its critical role in the development of control and decision-making systems in the cloud-to-edge environment. Through these interactions, we have expanded our network and contributed to the collective pursuit of cutting-edge solutions in the field. One of the most important events is, without a doubt, the Manufacturing Partnership Day hosted by EFFRA. This event provided the project with the opportunity to participate in a fair and deliver a keynote address for one of our partners. The project representatives were able to disseminate the results of their work and establish connections with other relevant research projects in the industry branch.

We provide a visual representation of the Zero-SWARM project's active participation in numerous events. These pictures are indicative of the fruitful discussions and cooperative efforts that have defined our involvement over the reporting period. Each photograph encapsulates a moment of shared knowledge, innovation, and the collective pursuit of excellence.



Figure 6: Photo from the Manufacturing partnership day. Hosted by EFFRA



Figure 7: Photo from GSMA Mobile World Congress



Figure 8: Photo from FYUZ 2023



Figure 9: Photo from hub.berlin The business festival for tech & digitalization

The Zero-SWARM initiative will be generating an impact in a number of upcoming events as we work to promote collaborative innovation and share the cutting-edge innovations of our project.

This table provides a rundown of all the forthcoming events where our esteemed partners will be prominently showcasing the project.

Table 4: Planned events overview

No.	Event Title	Place of Dissemination	Date(s)	Zero-SWARM Partners Involved
1	Reepack Annual Sales Meeting: 35 WW Dealers, 50/70 Participants	Seriate, Italy	05-06.11.2023	REPK
2	FYUZ 2023	London, UK	09-11.11.2023	ACC
3	SPS Nürnberg 2023	Nürnberg, Germany	14-16.11.2023	NX-SE
4	Germany Connected	München, Germany	5. - 6. 12.2023	OPT

3.1.7 Visual & printed materials

Flyers, brochures, and roll-ups are just a few of the distribution tools that the Zero-SWARM initiative is producing. This medium serves as a crucial channel for disseminating the project's outcomes, reliably summarizing important information about the specific project call, elaborating on the achieved accomplishments, proposing solutions, and further incorporating hyperlinks and QR codes to make it easier for readers to navigate to the community platform, subscribe to newsletters, visit websites, and connect on LinkedIn.

The project resulted in two flyers with an emphasis on important details. These act as brief marketing tools that are specifically designed to offer key insights into the Zero-SWARM initiative.



Figure 10: First flyer layout and printed version



Figure 10: Second flyer layout and printed version

The project's first flyer provides detailed information, and it was actively used by project partners both during the project's debut and in the early stages of consolidation. It graphically shows the geographical distribution of the initiatives as well as their main goals and overall objectives. On the other hand, the secondary flyer is a crucial part of the advertising and communication during the early stages of trials. It provides a thorough summary of the trials, their key aspects, supporting infrastructure, and important findings from the executed experiments. Together, it acts as a smart addition to the project website, audio-visual materials, and a variety of additional channels of communication.

Roll-ups are used to support promotional activities during physical events. They act as imposing, visually appealing banners that are intended to grab attention and express key points about the project. The currently used roll-up maintains standard proportions and does an excellent job of increasing exposure at events where Zero-SWARM's presence justifies a larger audience. The creation of a larger banner might be necessary in order to participate in upcoming events. However, collaborative partners are currently harnessing the current roll-up with ease and effectiveness.



Figure 11: Roll-up layout and printed version

Attribution of these items has no limits and includes partners. Additionally, the flyers are accessible to all users and visitors by being made available for download on the website. Partners are encouraged to use these printed materials in settings where their participation could considerably increase the promotion of Zero-SWARM irrespective of whether those settings don't directly relate to the project.

The wise selection of content for the creation of auxiliary materials and the seamless integration of partners into the co-creation process are the primary challenges in this context. However, given the steadfast dedication of all partners to carrying out tasks within their own work packages, these obstacles are easily overcome. The key is in the skilful synthesis and presentation of content that is thorough and visually apprehending, ensuring its resonance with a wide audience. At least two more flyers are planned to be produced in relation to upcoming activities- Thematic content will be

discussed throughout the production process, with a likely emphasis on the recent trial conduct milestones and the project's accumulating exploitable outcomes.

The clearly defined dissemination plan put forward in this discourse inspires faith in the Zero-SWARM project's wide-ranging influence, which extends to both the realms of physical events and the virtual domain. The body of materials already in existence offers a strong foundation on which to build upcoming promotional initiatives.

3.1.8 Scientific publications

The Zero-SWARM project produced a considerable amount of academic writing, as precisely intended. These papers act as the foundation of our effort to produce cutting-edge information in a variety of fields, such as artificial intelligence, 5G wireless communication, and others. This effort aims at accelerating the dissemination of useful ideas and insights.

We have chosen a diverse strategy to achieve this goal. The writing and distribution of white papers and articles is one important part. To guarantee that the knowledge being given is of the highest quality and relevance, this process is thoroughly planned. We hope that each member, many of which are renowned research organizations, will submit at least one publication over the course of the project because of the robust research environment inside our consortium.

We have purposefully selected a broad range of top-notch publications and significant conferences for the dissemination of our scientific and technological content in order to increase the effect of our contributions. This carefully considered selection guarantees that our work is seen by a large and discriminating audience and promotes deep involvement in the academic and professional sectors.

We acknowledge the value of online materials in the current digital era, alongside more conventional modes of distribution. As a result, we are creating thorough materials for disseminating the trials that include the technical components of the project and offer helpful advice on Zero-SWARM prototypes. These tools will be crucial in helping stakeholders understand the nuances of our inventions.

Additionally, a dedicated table will list all upcoming publications until the end of 2023:

Table 5: Planned scientific publications.

No.	Title	Approximate date	Zero-SWARM Partners Involved
1	Business Impact of IoT in Manufacturing Industries	Tbc	UBI
2	Configured Grant Scheduling for the Support of TSN Traffic in 5G and Beyond Industrial Networks	45200	UMH
3	Securing Modbus TCP Communications in I4.0: A Penetration Testing Approach Using Open PLC and Factory IO	6-8 November	CERTH

The Zero-SWARM initiative is dedicated to increasing the transfer of information among many fields. Our commitment to academic and technical excellence is demonstrated by the creation of high-calibre scientific articles. We are prepared to make important contributions to the fields of artificial intelligence, 5G communication, CPSoS, Cybersecurity etc. and beyond as we move forward on our

anticipated timeframe. We anticipate that our work will continue to have an impact on the larger academic and professional sectors.

3.2 Strategic Outreach: Customizing Content and Channels for Target Audiences

This chapter offers a thorough analysis of the customized communication tactics that the Zero-SWARM project used to interact with various stakeholder groups. Specific essential messages and core information are communicated to each target group using the most appropriate channels of communication. The table below provides this data in an organized and comprehensible manner for the reader, together with the communication routes that have been determined to be pertinent for each group. These strategies are designed to ensure meaningful interactions and collaborations in pursuit of sustainable production practices.

	Target group	Key message	Core content & activities	Most relevant channels
TG1	SMEs	Invite SMEs to participate at Zero-SWARM as early adopters through EoI to express their needs from one side and from the other side to validate and uptake the project results	Tailored Workshops: Interactive sessions addressing the specific challenges faced by SMEs in the context of sustainability and green production. Case Studies: Showcasing successful implementations of Zero-SWARM solutions within SMEs, highlighting the tangible benefits and ROI. Early Adopter Program: Offering SMEs the opportunity to engage directly with Zero-SWARM technologies and provide valuable feedback.	Website: Providing a comprehensive view of the Zero-SWARM project, highlighting how SMEs can benefit from early adoption. Webinars: Offering in-depth sessions to showcase practical applications and benefits of Zero-SWARM solutions for SMEs.
TG2	Large companies	Invite them to participate at Zero-SWARM community to express their real-life needs	Industry Reports: In-depth analyses of industry trends and challenges, with insights on how Zero-SWARM innovations can address them. Solution Demonstrations: demonstrations of Zero-SWARM technologies and trials, and their potential impact on large-scale industrial operations. Executive Briefings: Personalized sessions with project leaders, focusing on strategic alignment and co-creation opportunities.	LinkedIn: Engaging industry leaders with regular updates, demonstrating how Zero-SWARM aligns with their operational challenges and objectives. Events: Actively participating in industry gatherings to provide hands-on demonstrations and engage in direct discussions with large companies.
TG3	Research community, academia, and organizations	Open results of Zero-SWARM to EU academic communities to foster co-creation, info, and knowledge exchange	Research Collaborations: Facilitating joint research projects, leveraging the expertise of academic partners in areas aligned with Zero-SWARM goals. Workshops: Sharing cutting-edge research findings and technical insights from Zero-SWARM trials and experiments. Knowledge Exchange Forums: Creating platforms for academics and researchers to engage in meaningful discussions on sustainable production.	Blog Posts: Providing in-depth insights and technical details on Zero-SWARM trials and experiments, appealing to the research community's appetite for detailed information. Webinars: Hosting sessions to share cutting-edge research findings and foster meaningful discussions among academia and researchers.

TG4	Technology Solutions and Service provider	Zero-SWARM is constantly looking for top-quality technology providers, to strengthen its offer with the latest technologies on the market	Integration Guides: Comprehensive resources illustrating how third-party solutions can seamlessly integrate with Zero-SWARM technologies. Partner Showcases: Highlighting successful collaborations between Zero-SWARM and technology providers, showcasing innovative applications. Innovation Challenges: Encouraging providers to propose novel solutions that complement Zero-SWARM's objectives.	YouTube Channel: Utilizing visual storytelling to showcase how third-party solutions can seamlessly integrate with Zero-SWARM technologies, providing a dynamic and engaging experience. Webinars: Demonstrating the compatibility and opportunities for creative partnerships with technology providers.
TG5	DIH's	Zero-SWARM will open its results and best practices towards DIH's and allow them to offer better value to their customers. DIHs can suggest relevant regional SMEs to EoI call for early adopters	Best Practice Guides: Offering DIHs insights on how to leverage Zero-SWARM results to enhance their offerings to regional SMEs. Collaboration Opportunities: Facilitating partnerships between DIHs and relevant SMEs to encourage early adoption of Zero-SWARM solutions.	Community Building Platform: Creating a dedicated space for DIHs to connect, collaborate, and access resources related to Zero-SWARM, fostering a sense of community and shared purpose. Newsletter: Providing a curated digest of updates tailored to the needs and interests of DIHs, ensuring they are informed and engaged.
TG6	Associations & Reference Initiatives	Zero-SWARM has already a track-record here. We will collaborate with them, share project results, and make them available for all members	Joint Publications: Collaborative reports and whitepapers showcasing the collective impact of Zero-SWARM and partner initiatives. Knowledge Sharing Events: Co-hosted workshops and seminars to disseminate best practices and shared insights.	Printed Materials: Distributing tangible resources at industry events and direct outreach efforts, reinforcing the project's progress and impact. Website: Serving as a hub of information, offering a comprehensive view of the Zero-SWARM project and its collaborative efforts with partner initiatives.

TG7	Standardization bodies and regulators	Zero-SWARM partners are already contributing to many standardization bodies. We will continue pushing our project outcomes there. Also, we will continue working with the key associations defining scenarios and supporting the industry in their twin transition	Policy Briefings: Providing insights into how Zero-SWARM aligns with industry standards and regulatory frameworks, contributing to the twin transition. Technical Contributions: Sharing technical documentation and specifications with standardization bodies to influence industry norms.	Policy Workshops: Engaging with standardization bodies and regulators in focused workshops, demonstrating how Zero-SWARM aligns with industry standards and regulatory frameworks. Events: Actively participating in industry gatherings and regulatory forums to directly contribute to discussions on shaping industry norms.
TG8	Policy makers	Engaging with the policy makers through the EDIHs network in EU. Also, Zero-SWARM partners have influential role in key national and regional platforms	Policy Workshops: Engaging policy makers in discussions on how Zero-SWARM innovations align with broader policy objectives for sustainability and industrial transformation. Impact Reports: Showcasing the projected impact of Zero-SWARM on key policy areas, such as carbon reduction and resource efficiency.	LinkedIn: Engaging with policy makers through professional networking, sharing updates and insights on how Zero-SWARM contributes to broader policy objectives. Policy Briefings: Providing detailed insights into the project's impact on key policy areas, such as carbon reduction and resource efficiency.
TG9	Other EU initiatives	Definition of a set of activities aligned with a liaison strategy with synergies and collaboration with existing European project sand wider initiatives which could include events, workshops, joint white papers, webinars among others	Joint Workshops and Seminars: Collaborative events to share insights, experiences, and best practices in achieving common EU objectives. Co-authored Publications: Producing joint reports and whitepapers that highlight synergies and the combined impact of Zero-SWARM and partner initiatives.	Joint Workshops and Seminars: Collaborating on events to share insights, experiences, and best practices, amplifying the collective impact of Zero-SWARM and partner initiatives. Co-authored Publications: Producing joint reports and whitepapers, showcasing synergies and the combined impact of Zero-SWARM and partner initiatives.

TG10	Citizens	Zero-SWARM is open and sees value in every private person interested in learning more and indirectly benefiting for the general well-being of the citizens of the Eu and their sustainability goals	Educational Webinars and Videos: Raising awareness about sustainability, green production, and the role of Zero-SWARM in creating an eco-friendlier future. Community Engagement Initiatives: Encouraging citizens to participate in discussions, workshops, and events focused on sustainable practices. By tailoring content to the specific interests and needs of each target group, Zero-SWARM aims to foster meaningful engagement and collaboration towards a more sustainable future.	YouTube Channel: Using visual storytelling to create educational content, raising awareness about sustainability, green production, and Zero-SWARM's role in an eco-friendlier future. Community Building Platform: Fostering a community of environmentally-conscious citizens to engage in discussions, workshops, and events focused on sustainable practices.
-------------	----------	---	--	---

Table 6: Key message to be disseminated, most relevant channels for each target group

Four essential content clusters serve as the foundation for our communication strategy and serve as the anchor for our focused engagement initiatives. The following four pillars summarize the crucial information that has to be shared with our varied audience:

- **Project Overview and Mission:** This encompasses vital information about the Zero-SWARM project, elucidating its vision, mission, policy framework, and the overarching goal of ushering the industrial landscape towards sustainable, green production. It offers a thorough comprehension of the main goals and tenets of the project.
- **Technical Advancements and Progress Reports:** It covers the dissemination of technical information, trial updates, and the development of different technical solutions. It explores the nuances of important project goals, such as building an AI-enabled operations management system, establishing a zero-touch framework, and developing a cloud-edge platform.
- **Accomplishments, Impact, and Adoption Opportunities:** This category encompasses the dissemination of technical accomplishments, breakthroughs, and the potential impact of Zero-SWARM. It draws attention to early adoption chances while highlighting the advantages that the project's innovations can have for industry and society.
- **Lessons Learned and Risk Management:** This pillar explores the priceless lessons discovered via project trials and outcomes, illuminating best practices and repurposing techniques. It discusses the difficulties and dangers that arise when conducting experiments and illustrates how they are handled to guarantee ongoing advancement.

The foundation for customizing content for certain target audiences is provided by these four pillars and was identified in the previous report as a part of overall communication strategy. Our goal is to maximize the impact of the Zero-SWARM project and promote community growth by staying true to these fundamental content clusters. We are prepared to successfully connect and involve our stakeholders through the wise use of a wide range of communication channels and frequent, methodical changes, leading us towards a more inventive and sustainable future.

4 Standardization activities

Creating impact on various standardization bodies is an important target for the Zero-SWARM project.

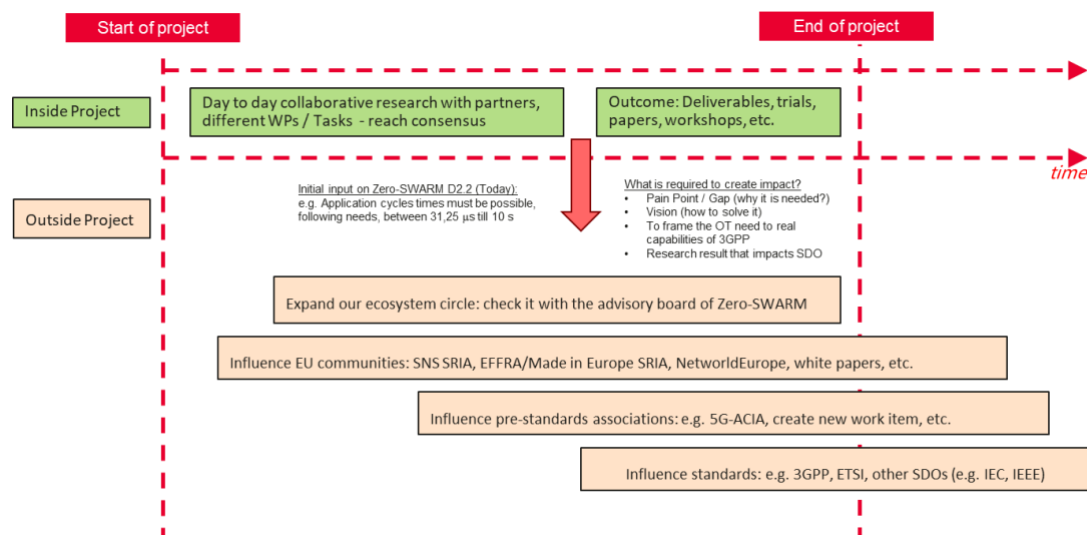


Figure 12: Impact creation and industrial influence framework

As stated in D7.5, the project has designed an impact creation and industrial influence framework that includes interaction with the Standards developing organizations (SDOs) in various technical domains, i.e. telecom, industrial automation, etc. Figure 13 (above) presents this framework.

In D7.5 we have explained a metrological approach to interact with SDOs and we identified the position of the project with respect to the full lifespan of standard documents. According to this methodology, Zero-SWARM outcomes could only be used on the pre-development phase which is the very early stage of standardization process which focuses on due diligence, research, and permitting.

In D7.9 using the Zero-SWARM Standardization Planning Tool (Table 7) we will present the current status of our interactions with different SDOs.

Table 7: Standardization planning tool

Standardization Planning Tool					
#	Item / idea	Relevant SDOs / reference initiative	Partners involved	Status	Remarks
1	Interaction between numerous edge sites/clouds	3GPP	HWE	Initial discussion	Suggest to further check with verticals/operators on how strong (urgent/priority) they would like to address the requirements Suggest promoting the requirements in SA1 as the starting point for study in 3GPP
2	N3 Offloading Point controlled by verticals without exposing to public network	3GPP	HWE	Initial discussion	The requirements from verticals are valid, even though this is addressed in 4G, however it is agreed that this requirement is not addressed in 5G. It is positive to go with this direction, please further progress the solutions that need 3GPP standardization.
3	Wired data path to MEC bypassing the 5G UPF	3GPP	HWE	Initial discussion	For wired data path to MEC bypassing the 5G UPF, it should not have any 3GPP impacts. It is a product implementation option, currently MEC product can support UE access via WIFI.
4	Cross layer scheduling optimization based on RAN feedback	3GPP	HWE	Initial discussion	As discussed in D3.1, UE-network-UE communication by means of time synchronization between two RANs

5	5G offering with higher cell capacity over lower latency and higher deterministic industrial connectivity	3GPP	HWE	Initial discussion	As discussed in D3.1, Padding procedure for Ethernet frames and UE-network-UE communication by means of packet loss coordination between two RANs
6	Integration of 5G VN and legacy LAN for a wider 5G LAN-type service	3GPP	HWE	Initial discussion	As discussed in D3.1, Support integration of 5G VN and legacy LAN and Exposure of 5G capabilities for industrial applications.
7	Support of redundant user plane paths based on multiple UEs at 3GPP layer to adapt to Ethernet industrial redundancy protocols	3GPP	HWE	Initial discussion	As discussed in D3.1, Support of native redundant UP paths without relying on upper layer protocols
8	OPC UA & 5G interworking: CAMARA Quality on Demand (QoD) interface for OPC UA integration	Linux Foundation	i2CAT	Initial discussion	As discussed in D3.1, CAMARA itself is an API which is not normally part of standard but it might cause changes on NEF which is under 3GPP
9	Data-based & AI-driven zero-touch management mechanisms	3GPP	i2CAT	Initial discussion	As discussed in D3.2, A variety of communication services instances provided by multiple NSIs
10	5G NPN Reference Management Architecture	3GPP	i2CAT	Initial discussion	As discussed in D3.2, a breakdown of Zero-SWARM's reference management architecture of the 5G NPN which, at a very top level, includes a network service provisioning subsystem, a network telemetry subsystem, and an AI engine subsystem for life-cycle management.
11	5G/OPC UA FX integration	5G-ACIA	ABB, HWE	Initial discussion	Joint workshop between OPC-UA FX and 5G-ACIA to discuss requirements

5 Metrics, Monitoring & Planning

5.1 Key performance Indicators and monitoring

In this chapter, we delve into a comprehensive analysis of the project's Key Performance Indicators (KPIs). The table provided below offers a visual representation of our progress.

Additionally, the table includes insightful comments detailing the current status of each activity. These remarks provide up-to-date information, offering valuable context to our KPI journey. Through this analysis, we gain a deeper understanding of our project's performance, guiding us towards informed decisions and strategic adjustments for continued success.

Table 8: Indicators for monitoring & KPIs

Type of chanel	KPI planned	Results	Comment
Website	Min. 20 unique visitors a month in first year	5 unique visitors	The observed low visitor numbers, falling below set KPIs, may be attributed to an initial outreach strategy that needs re-evaluation and potential misalignment with the target audience. To address this, adjustments in marketing, emphasizing untapped channels and revising messaging, are crucial for improved visibility. Enhancing content quality and relevance, along with establishing user feedback mechanisms, will contribute to a more engaging experience, fostering increased visitor numbers in subsequent periods.
	Min. 40 unique visitors a month in second year	8 unique visitors	
	Min 1 blog post a month	1,5 blog posts a month	
Social media	Min 10 new followers each month	20 new followers	The discrepancy between the set social media KPIs and the actual results suggests a need for strategic adjustments. LinkedIn demonstrate a positive trend. However, the underutilization of Twitter indicates a need to rebalance and optimize social media efforts for more consistent engagement. We may take the decision to drop Twitter in favor of other social media platforms is justified by a combination of factors. These include observed trends of decreasing popularity on Twitter, a shift in audience behavior, challenges with Twitter's algorithm
	Min 5 tweets a month	It is barely used and the number of tweets is around 2 a month	
	Min 1 LinkedIn post a month	1-2 posts a week	

			changes, and a strategic effort to allocate resources efficiently. The decision aligns with the project's goal to engage with its audience more effectively on platforms where it can achieve better visibility and interaction
Newsletter	Min 3 newsletters in total	1 newsletter launched	The Newsletter KPIs reflect promising progress as the project unfolds. The project is well on its way to meeting the set goals. As there are more newsletters planned, there's ample opportunity to build on this momentum and further enhance engagement.
	Opening rates min 50%	35% after launching the 1st newsletter	
Podcast	Min 5 episodes in total	Any episode is produced yet	The work is in progress
Webinars	Min 5 episodes in total	3 webinars are produced so far	This positive progress indicates that the project is actively underway and aligns with the overall goal. Moving forward, the focus should remain on creating engaging content for the upcoming webinars.
Glossary	Min 50 terms in total	Around 30 terms are inserted into the glossary for the internal use	The Glossary initiative has made commendable. It's essential to acknowledge that the glossary's perceived relevance in the initial strategy was reassessed. Moving forward, efforts can be directed towards expanding the glossary content while refining its alignment with organizational needs and priorities.
Events	Min 2 organized events per year	There is 1 organised event	The Events initiative has showcased notable. There's room for growth, especially in organizing trainings/workshops, the project has demonstrated a robust presence with more than the minimum required participations in international activities and exhibitions. This positive momentum lays a solid foundation for continued success in achieving the project's goals.
	Min 2 organized trainings/workshops	Any training was organised yet	
	Min 4 participation in international activities and events in total	Already more than 8 participations	
	Min 2 participation in exhibitions in total	Already more than 2 participations	
	Min 3 posters in total	1 poster is produced	While there's still work to be done to meet all the set goals, the existing

Visual and printed material	Min 2 roll-ups in total	1 roll-up is produced	materials provide a strong foundation. With ongoing efforts, the project can continue to create impactful visual assets, ensuring alignment with the overall objectives.
	Min 8 booklets/flyers in total	2 flyers are produced	
Video materials	Min 5 videos in total	2 videos are produced	The projects is making notable progress toward the target. While the videos are not yet available for a wide audience, this phase signals a promising start. Moving forward, efforts can be focused on increasing visibility and achieving the goal
	Min 200 views of each video	The videos are not yet available for wide audience	
Scientific publications	Min 10 publications in Journals / Magazines / conferences in total	2 publications are already published and 3 are expected to be released	The Scientific Publications project has achieved significant milestones. While this progress is noteworthy, there is an opportunity to produce the first white paper to meet the KPI. By continuing to leverage valuable insights and research, the project is on track to fulfill its goals and contribute to a robust body of knowledge in the field.
	Min 1 white paper in total	Any white paper is produced yet	

5.2 Planning of the second year of activities

As we embark on the second year of the Zero-SWARM project, our focus on communication and dissemination is sharper than ever. This chapter outlines the comprehensive plan for activities aimed at reaching our target audiences and spreading the project's impactful message.

The table provided offers a broad overview, giving an approximate depiction of the activities scheduled for execution. It serves as our guiding beacon, aligning our efforts with precision and ensuring that all crucial aspects are on our radar. Through this structured approach, we aim to maximize the reach and impact of the Zero-SWARM project, ultimately propelling us towards a more sustainable and innovative future.

Table 9: Planning of the second year of activities

Channel	JUN 2023	JUL 2023	AUG 2023	SEP 2023	OCT 2023	NOV 2023	DEC 2023	JAN 2024	FEB 2024	MAR 2024	APR 2024	MAY 2024
Website					Add the subscriptions to the newsletter button	Add the chapter with the videos	Add the chapter with the trials overview					
	Enrichment and development of the website content and increase the amount of visitors											
Social media	Events promotion and reporting		Community platform and newsletter promotion			Videos and YouTube channel Promotion			Promotion of the planned webinars and trainings			
	Promotion of the trials and Eco designed architecture, specifications & benchmarking											
Newsletter	Exploitation of the partners newsletters		Launch of the newsletter	Exploitation of the partners newsletters			Launch of the cluster newsletter	Exploitation of the partners newsletters				Sending the second newslette
External events	Participation in events											
Glossary	Regular update of the glossary by adding the new items											
Podcast									First episode			Second episode
Video materials			First video	Second video						Third video		

Visual and printed materials			The second flyer	The first roll-up								
Scientific articles					Release of two articles		Release of an article				Release of an article	

6 Summary, Outcomes & Lessons learnt

The Zero-SWARM initiative has demonstrated the effectiveness in reaching our target audiences by not only meeting but frequently exceeding our Key Performance Indicators.

The accomplishments are a strong motivator for us to keep going for meaningful tasks that advance the project. We continue to prioritize the trials because we see them as essential to achieving our goals.

The increase in our project's online visibility and follower involvement on several platforms is evidence of the project's increasing relevance and appeal. We have overcome challenges and modified our tactics to better fit changing platforms and the varied priorities of our participants. The collaboration with the community building platform is still crucial for presenting our novel ideas.

Communication outcomes include continuous website growth, active blog posts exceeding KPIs, and LinkedIn as a highly impactful tool. Planned webinars and videos contribute to collaborative knowledge exchange, enhancing the project's educational landscape. The project's first newsletter was positively received, with plans for future collaborative editions. Event participation showcases the project's contributions and fosters partnerships.

In reflecting on the Zero-SWARM initiative, several critical lessons have emerged, guiding strategic decisions for increased engagement and impact.

The observed low visitor numbers on the website underscore the significance of prioritizing content quality and relevance. Recognizing this, the decision to reallocate resources and reevaluate outreach strategies aligns with observed trends, shifts in audience behavior, and challenges posed by platform algorithms. This strategic shift aims to enhance the overall visitor experience and foster increased engagement in subsequent periods.

The decision to prioritize certain channels over others stems from a strategic effort to allocate resources efficiently. In light of changing trends and challenges, focusing on platforms that resonate with the audience and provide optimal visibility is crucial. This ensures that resources are utilized effectively to maximize impact and reach.

The focus on creating engaging content for upcoming webinars is a strategic imperative. Lessons learned emphasize the importance of diversifying topics to cater to a broader audience. This approach ensures that webinars remain relevant and appealing, capturing the interest of a varied participant base and contributing to the project's overarching goals.

Notable progress has been made toward the target of producing videos. However, lessons learned stress the importance of efforts to increase visibility and make these videos available to a wider audience. This step is crucial for achieving the project's goals and ensuring that the valuable content reaches its intended audience, maximizing the impact of video materials.

Through collaborative efforts, we are fostering alignment among our participants, recognizing the importance of a unified terminology in our shared mission. Engaging webinars, impactful events, and collaborative publications have emerged as valuable tools in achieving this cohesion.

Looking ahead, our strategic roadmap is aligned with the evolving needs of the project and the broader community. We acknowledge the pivotal role of platforms like LinkedIn, our website, events, blogs,

scientific publications, and, notably, YouTube, in disseminating crucial project details. With the lessons learned and the strategic adjustments made, we are poised for even greater impact in the next phase of our journey towards a sustainable and innovative future.