openZDM

OPEN PLATFORM FOR REALIZING ZERO DEFECTS IN CYBER PHYSICAL MANUFACTURING

Impact Management activities – intermediate version

openZDM

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Abstract	The dissemination and communication activities and tools at M24 of the project have been updated in this document. Moreover, the exploitation strategy, a draft IPR agreement plan, and the exploitable results of the project are updated. Based on an online survey, exploitation paths per result are developed and initial elements for the business models of the key exploitable results are also defined. Standardisation efforts, specifically in ZDM and AAS modelling, aiming at facilitating the acceptance and utilization by the market of the developed tools are reported herein.
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1.0	2024-06-07	AIMEN	LMS	Submitted version

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List of Abbreviations & Acronyms

AAS	:	Asset Administration Shell
D	:	Deliverable
DIH	:	Digital Innovation Hub
EPC	:	European Patent Convention
ER	:	Exploitable Results
GA	:	General Assembly
IP	:	Intellectual Property
IPR	:	Intellectual Property Rights
KER	:	Key Exploitable Results
KPI	:	Key Performance Indicator
M #	:	Month #
NDI	:	Non-destructive inspection
SDOs	:	Standards developing organisations
SME	:	Small and medium-sized enterprises
WP	:	Work Package
ZDM	:	Zero defect manufacturing

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Executive Summary

The purpose of this document is to provide an intermediate update on the impact management activities from the openZDM project at M24. On the scope of WP6, deliverable 6.2 updates the efforts and impact of the project in communication, dissemination, exploitation and standardisation activities.

WP6 aims to maximise the visibility and to gather feedback on the project outcomes, paving the way for the exploitation and adoption of the project outcomes into future products, services, and policies in a sustainable manner and beyond the project's lifetime.

This document updates the communication, and dissemination activities of the project at M24. Moreover, the exploitation strategy and a draft IPR agreement plan and the ERs of the project are updated. Based on an online survey, exploitation paths per result are developed and initial elements for the business models of the KERs are also defined. Efforts towards collaboration with technical committees and contributions to standardization are herein described.

1 Introduction

1.1 Scope and Objectives

Deliverable 6.2 updates the impact management activities of openZDM. It covers and measures the impact of the project under the following main topics:

1. Communication and dissemination,
2. Exploitation,
3. Standardisation activities.

To understand the aim of the openZDM plan for impact management activities it is important to note the specific objectives of WP6, which are:

- Disseminate the project results via appropriate communication channels,
- Perform market, technology and IPR watch to analyse the surrounding ecosystem continuously,
- Manage the IPR and the Foreground knowledge in the project,
- Identify the 'unique selling points' concerning the rest of the products in the market and main competitors,
- Develop a strategic roadmap & business model for the openZDM platform (sales & pricing strategy),
- Facilitate the (post-project) uptake of results through the deliberate identification and management of the project's ERs,
- Prepare contributions to suitable standardisation bodies or pre-normative activities,
- Create links to other European activities in ZDM.

In alignment with the openZDM exploitation and IPR management strategy outlined in D6.1 and the project's description, several key activities have been undertaken up to M24, focusing on various aspects of business planning. Initially, the identification and assessment of core innovations were paramount, aiming to determine their potential for commercial or academic use, thereby identifying the ERs and subsequently, the KERs with the highest impact on innovation potential. In parallel, efforts were directed toward formulating robust business models for the KER and devising effective promotion strategies targeting key stakeholders, initial adopters, and potential customers. Notably, a physical exploitation workshop was conducted during the 3rd GA meeting, facilitating partner alignment on ERs and collaborative discussions on exploitation pathways.

Furthermore, an exploitation and business modelling survey were deployed, gathering valuable insights. This survey informed the selection of KERs and guided the formulation of exploitation paths, marketing strategies, and monetization models. Additionally, 23 ERs were identified, with a focus on NDI systems, from which 8 KERs were chosen based on their commercial viability, market demand, and partners' perspectives. These selections were supported by thorough market and competition analyses, delineating key target markets, customer segments, and stakeholder groups, thereby shaping tailored value propositions and distribution strategies for each result, ensuring alignment with the technical specifics of openZDM. This assessment also encompassed considerations of IP ownership and how each result would be exploited individually or jointly post-project.

Also, the standardization activities started at M19 of the project, with an initial identification of the existing standards and the potential contributions for standardization in the project. Two main subjects were identified as prone to standardization, ZDM and AAS modelling. Efforts towards collaboration with technical committees and contribution to standardization were also performed and are further described.

1.2 Structure of the document

This document is divided into three main sections, per the activities developed under this WP:

1. Section 2: Update on Communication and Dissemination activities (M6 – M24),
2. Section 3: Update on Exploitation activities (M6-M24),
3. Section 4: Standardization activities (M19-M24).

In section 2 the communication and dissemination activities at M24 are described, with an overview of the different tools and channels used in the openZDM project and achievements, highlighting the efforts to build awareness and share our findings widely with stakeholders and the general public.

In section 3, we've updated the openZDM projects draft exploitation and IPR management plans, with an overview of the project's KERs, market analysis and openZDM business model.

Section 4 goes over the standardization activities of the project and its effort to facilitate the acceptance and utilisation by the market of the different solutions developed in the openZDM project.

1.3 Impact Management activities overview

The strategy for impact management activities within the openZDM project was structured in D6.1 and includes three distinct phases: market awareness, market positioning, and market outreach. In alignment with the project's overarching goal of providing an innovative solution for manufacturing sustainability through the development of an open platform for ZDM, each phase was carefully tailored to address specific objectives and target audiences (Figure 1).

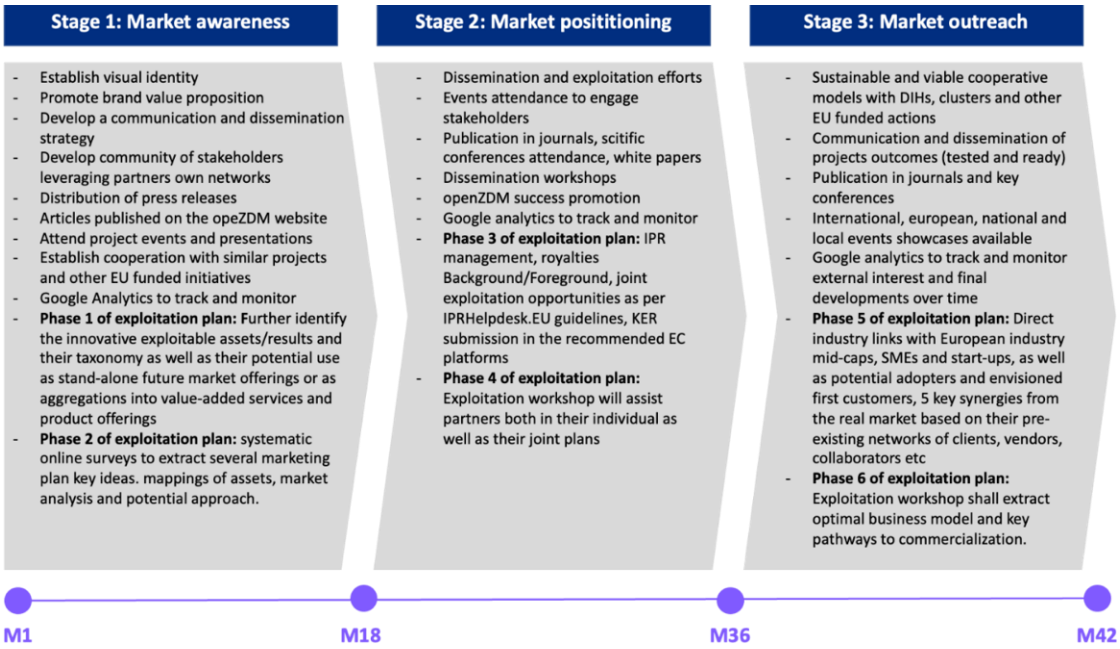

Figure 1: Stages of dissemination, communication, and exploitation actions

The communication, dissemination and exploitation plan are deployed to align with the market-driven phased approach, focusing on fostering societal awareness through different activities and channels. The market awareness phase which was deployed from the project start-up until M18 focused on establishing the openZDM brand as a referent of innovative initiatives for ZDM activities. The actions undertaken in this period are closely linked with the dissemination of project results through appropriate communication channels. And preliminarily identifying the priorities in exploitation activities and exploring the current state of the market looking for gaps and needs that could potentially be addressed by the openZDM solution.

For the current market positioning phase, the established regular collaboration plan among partners continues to ensure effective communication and dissemination of project updates and announcements through a comprehensive communication plan that includes updates on the website, social media channels, project newsletter, content creation in online platforms, creation of printable materials and participation in events, supported by linking and engagement with similar initiatives at a European level. Updates and activity descriptions are provided monthly via the project-wide established meeting and supported by close contact via email by all consortium members, resulting in close collaboration to ensure excellence in technical and non-technical approaches to the topics of interest for the project stakeholders.

Simultaneously, the dissemination strategy which took a more prominent role in this phase across openZDM partners, aims towards a cohesive approach to contributing to research and innovation and fostering the potential exploitation of project results within the European Manufacturing ecosystem. This strategy operates at multiple geographical levels, leveraging local, regional, national and European-wide partnerships to highlight the diverse benefits and value proposition of the solution developed by the openZDM consortium

The exploitation strategy, overseen by the consortium, outlines methodologies activities and tools for effectively exploiting the innovative services, processes, and components developed within the project. Central to this strategy are the innovation management and exploitation plan, which delineates paths to market and the IPR management strategy. Through collaborative engagement, all partners contribute to the identification and validation of exploitation plans, ensuring the seamless integration of project outcomes into the broader industrial landscape. Continuously analysing market, technology, and IPR landscapes to refine positioning strategies and maintain competitiveness.

Standardisation activities have started in M19 of the project. Up to now, work has been developed to identify and contribute to standard developing organizations in the topics of interest of the openZDM project. The project has been actively involved in different that promote the standardisation of ZDM and AAS. Therefore, we aim to facilitate the acceptance and utilisation by the market of the different solutions developed in the project.

2 Update on Communication and Dissemination Activities

During the first 24 months of the project, communication and dissemination efforts have been integral to fostering widespread understanding and engagement with our approach regarding ZDM. The openZDM consortium has executed a comprehensive communication and dissemination strategy aimed at amplifying awareness, capturing the interest of targeted stakeholders, and engaging a broader non-technical audience.

Our approach, outlined in D6.1, has been supported by planned activities. These actions have been characterised by compelling messaging, designed to effectively convey the essence of the openZDM concept, methodology, benefits, and objectives. The plan created for both a technical and non-technical audience has been instrumental in increasing awareness and spreading the word about the adoption of the openZDM framework and in driving transformative change within the European manufacturing ecosystem.

In alignment with the impact management strategy, the project's communication and dissemination efforts will continue to evolve around the project's progression through its three phases: market awareness, market positioning, and market outreach. Building upon the foundation laid in the initial phase, our strategy will focus on refining messaging and outreach tactics to deepen understanding and engagement among the identified stakeholders. This includes further leveraging participation in external conferences, workshops, fairs, and other events, as well as the organisation of project-specific events tailored to key ecosystem players and end-users. Additionally, the project will intensify efforts to mobilise DIHs, and industry associations and foster collaboration with similar projects and initiatives to maximise the impact of our dissemination activities.

As the project advances into the market positioning phase, our communication strategy will pivot towards highlighting the unique value proposition of openZDM within the broader manufacturing landscape. This will entail targeted communication campaigns at specific industry segments supported by market research and analysis made in alignment with the innovation management and exploitation plan. By effectively articulating the benefits of openZDM, we aim to position the project as a leader in driving innovation and sustainability within manufacturing.

In the final phase of market outreach, our communication efforts will move towards expanding the reach and visibility of openZDM on a larger scale. By engaging with a diverse array of stakeholders we will work to solidify openZDM's position as a transformative force in shaping the future of European manufacturing.

2.1 Communication activities

Over the past 24 months, our communication activities within openZDM have been instrumental in driving awareness, engagement, and adoption of the ZDM approach. These efforts have fostered widespread understanding and interest in our innovative framework, positioning openZDM as a catalyst for transformative change within the European manufacturing ecosystem. For this, we present an overview of the status of our communication KPIs that provide further insight into the efforts and impact of the activities deployed in Table 1.

Table 1: Overview of the communication activities and their status at M18 and M24.

Communication tools & channels	Communication activities	KPIs	Status [M18]	Status [M24]
Project website	Online project website designed and developed by F6S, updated throughout the project.	Website ready by M02 >7.000 visitors by M42	1494 visitors	2069 visitors
Social media channels	Online presence on social media channels such as LinkedIn, Twitter, spreading the news about the project.	>1000 stakeholders >200 monthly impressions	397 stakeholders 66,299 impressions	528 stakeholders 95,718 impressions
Newsletters	Newsletters will be circulated via email lists providing an overview of the main project activities and outcomes.	>6 newsletters >1000 contacts reached	3 newsletters 117 contacts reached	3 newsletters 117 contacts reached
Video Clips	Multimedia video podcasts presenting the project, its innovation, and its key outcomes.	>3 videos produced >2.000 views on YouTube	4 videos produced 259 views on YouTube	7 videos produced 443 views on YouTube
Printed materials	Brochures, leaflets, flyers for events, roll-up banners, and posters, are also	>2.000 printed copies distributed	360 printed copies 4 roll-up banners/posters	610 printed copies distributed

Communication tools & channels	Communication activities	KPIs	Status [M18]	Status [M24]
	available online for printing through the project's website.	>4 roll-up banners/posters		5 roll-up banners/posters
Public events	Public events with public, schools and higher education institutions to inform them about the project and its impact on the everyday life.	>4 public events >3 open days at schools >100 participants/event	7 public events	9 public events
Newspapers, magazines	Non-technical articles and press releases in local newspapers and magazines to reach a broader audience providing visibility of the project and its main achievements.	>3 press releases in newspapers and magazines	1 press release	2 press releases 8 press release clippings
Digital Innovation Hubs (DIH)	Promotion of project results in various DIH to amplify the project's outreach for early adoption.	>30 DIHs contacted	To be started	To be started
Fora & Blogs	Promotion of periodic non-technical reports (publications) to fora and blogs to create awareness of the openZDM potential and features.	>5 publications to blogs >5 blogs/fora to post	Publications to externa blogs to be started 13 owned publications	Publications to externa blogs to be started 25 publications on owned blog
Other projects and activities	Liaison with other projects to coordinate the activities of openZDM considering the ongoing activities in other projects. For these reasons, liaison delegates will be identified.	>8 relevant projects to liaise	2 relevant projects liaised	3 relevant projects to liaise

After the analysis of the KPIs, it is worth noting that while the website was ready by M2, the visitor count stands in 2069, while the goal is to achieve 7,000 visitors by M42. To increase the visibility of the openZDM project, a multi-faceted approach will be adopted. Enhancing online presence through website optimization (SEO strategy), active social media engagement, and content marketing can significantly boost visibility.

Social media channels have been successful, with 528 stakeholders engaged and 95,718 impressions generated. However, the target of over 1000 stakeholders has not been met yet, indicating the need for more targeted and consistent social media content to increase engagement and reach. For the upcoming period, synergies will be leveraged synergies with similar European-funded activities and partner networks to increase the reach of the content created by the project.

The production of video clips has surpassed the target, with 7 videos produced, but the view count on YouTube remains moderate at 443 views. To enhance the impact of these multimedia assets, strategies to boost visibility and shareability are being explored and more content regarding the five pilots is under analysis to generate interest in key stakeholders and show the impact the solutions will have in operational conditions.

Printed materials have seen moderate distribution, with 610 printed copies distributed and 5 roll-up banners/posters produced. While these materials contribute to offline visibility, further dissemination efforts will amplify their reach at events and exhibitions.

Public events have exceeded the target, with 9 events organised and a variety of participants engaged in external events which have proven to be successful in stakeholder engagement. This indicates strong community interest and opportunities for continued outreach through similar events.

Two press releases have been issued. However, 8 press release clippings demonstrate initial success in garnering media coverage. Strengthening relationships with external outlets (including support from consortium members) and improving the frequency of press releases could enhance the visibility and awareness of openZDM.

DIH outreach is yet to be initiated. Prompt action is needed to engage with relevant DIHs and leverage their networks to accelerate dissemination efforts, for this action a value proposition for engagement needs to be clearly defined and an exploration of releasing a beta version of the system for external use and feedback is explored.

Promotion of publications to blogs and fora has not yet commenced, highlighting a potential opportunity to increase awareness for openZDM. Nevertheless, the consortium has shown commitment to creating content for the project's website in a series of articles and interviews that have helped to reach stakeholders in the ecosystem.

Liaison with other projects and activities has seen progress, with 3 relevant projects identified for collaboration. In the coming months, a strategy will be deployed to strengthen partnerships and coordination with relevant initiatives which will be essential for maximising synergies and amplifying the impact of openZDM.

In conclusion, while some communication activities have shown promise, there is room for improvement in several areas to ensure the widespread adoption of the openZDM framework. Ongoing monitoring and adaptation of communication strategies will be key to driving engagement. Strategic alliances with industry leaders and European initiatives can extend reach and credibility. Building user communities and maintaining regular updates and newsletters will also foster deeper user engagement and satisfaction.

2.1.1 Communication tools and channels

2.1.1.1 Website

As of M24, the openZDM website, accessible at www.openzdm.eu, remains the main entry point for disseminating project information. The website continues to be regularly updated by the communication manager to ensure relevance and accuracy. Tailored to address all identified stakeholders, the website provides comprehensive information on the project's key points. Visitors can explore details on the openZDM activities and developments, alongside engaging with several calls to action strategically placed on the site. The website includes:

- **Home page:** The homepage offers a comprehensive overview of our initiative's mission to innovate in the manufacturing ecosystem. A banner describing the project's general goal is at the top of the page then the informative video provides an in-depth look into how openZDM is reshaping production processes. A dedicated pilot's section to gain insight into the openZDM's real-world deployments across various industrial sectors can be found. A call to action to explore the About openZDM page can be accessed, as well as a link to the Insights section. Lastly, another call to action for subscription to the project's newsletter can be seen.
- **About:** This section elaborates on the concept of openZDM, its methodology and main objectives. Includes a subtab on the consortium where visitors can explore more about the partners that are involved in openZDM.
- **Pilots:** This section serves as a focal point for showcasing the practical application and impact of openZDM. This section is organized into five subsections, each offering a comprehensive overview of a specific pilot project. Within these subsections, visitors can find detailed descriptions of the role of each pilot, the specific manufacturing challenges addressed, the methodologies employed, and the expected goals. Additionally, insights into the anticipated impact of each pilot on the manufacturing landscape. Each subsection also offers a brief representation of the company leading the pilot, providing context and credibility to the project.
- **Insights:** In this section stakeholders and interested parties can delve into the landscape of manufacturing, focusing on ZDM. Here, we curate the updates, and news from the project activities providing a resource for staying informed about recent developments. This section features interviews, newsletter highlights, event recaps, and a diverse selection of contributions from the consortium partners spanning both technical and non-technical topics.
- **Results:** This page serves as a comprehensive repository of the outcomes and scientific contributions coming from openZDM. Here, visitors will find the documented public deliverables, offering transparent insights into our progress, methodologies, and outcomes. Our collection of scientific publications showcases the research activities conducted within the project, contributing substantively to the discourse surrounding ZDM and its impacts. Complementing these learning tutorials, are designed to provide practical guidance and educational resources for implementing openZDM principles effectively.
- **Resources:** This page serves as a repository of communication materials about the openZDM initiative. Here, the press materials, brand guidelines, and communication resources can be accessed.

As shown in Figure 2, the openZDM website received 1,141 new users over the past 24 months, with traffic coming from referrals, organic social, organic search, and direct sources. Referral traffic, although contributing only 54 new users, had the highest engagement rate at 68.6% and an engagement session per user of 1.54, indicating that these users are highly interested and tend to explore more pages. Organic social, despite bringing in 192 new users, showed the lowest engagement rate at 48.55% and a brief average engagement time of 44 seconds, suggesting that content might not be sufficiently captivating for social media visitors.

	First user prim...Channel Group)	New users	Engaged sessions	Engagement rate	Engaged sessions per user	Average engagement time
		1,141 100% of total	1,229 100% of total	55.69% Avg 0%	1.05 Avg 0%	6m 05s Avg 0%
1	Referral	54	83	68.6%	1.54	2m 17s
2	Organic Social	192	117	48.55%	0.61	44s
3	Organic Search	57	48	55.81%	0.84	41s
4	Direct	838	980	55.78%	1.13	7m 51s

Figure 2: OpenZDM Website analytics - Users

The organic search brought in 57 new users with a moderate engagement rate of 55.81% and the lowest average engagement time of 41 seconds, indicating that users may not be finding what they expect or require more engaging content. Direct traffic, contributing the majority with 838 new users, had a strong engagement rate of 55.78% and the highest average engagement time of 7 minutes and 51 seconds, showing that these users are the most engaged and spend more time on the site.

To improve user acquisition and engagement, the strategy to optimise and diversify content will focus on regularly posting project updates and industry news. Tailoring content for social media, enhancing SEO efforts with relevant keywords, and building partnerships for high-quality referral traffic can also provide an increase in users.

As shown in Figure 3, the website received 5,889 views from 1,118 users, with an average of 5.27 views per user and an overall average engagement time of 6 minutes and 19 seconds. The homepage is the most visited page, with 1,788 views and 696 users, but it has a relatively low average engagement time of 1 minute and 2 seconds. Pages like results and insights show strong engagement, with 4.26 and 2.24 views per user respectively, and higher engagement times, indicating they are of significant interest to users.

	Page path and screen class	Views	Users	Views per user	Average engagement time	Event count All events
		5,889 100% of total	1,118 100% of total	5.27 Avg 0%	6m 19s Avg 0%	16,360 100% of total
1	/	1,788	696	2.57	1m 02s	5,501
2	/results/	499	117	4.26	1m 06s	1,203
3	/about/	329	158	2.08	53s	908
4	/pilots/	280	132	2.12	41s	741
5	/insights/	269	120	2.24	1m 09s	726
6	/partners/	216	153	1.41	29m 32s	599
7	/stag/	204	4	51.00	9m 17s	548
8	/resources/	135	87	1.55	32s	346
9	/results_filter/scientific-publications/	133	34	3.91	1m 03s	339
10	/pilots/vwae/	106	52	2.04	1m 07s	289

Figure 3: openZDM Website analytics - User engagement

Notably, the partners' page has an unusually high average engagement time of 29 minutes and 32 seconds, which may indicate that the interest of external stakeholders is also positioned on the valuable contributions of the consortium members and the overall reputation in the market. The stag page, with its extremely high views per user (51.00) and substantial engagement time (9 minutes and 17 seconds), might be under specific testing or review. Pages like about and pilots have moderate views and times, suggesting a need for more engaging or informative content to retain users.

To enhance user engagement, the homepage will be optimised with more engaging content and clearer navigation. Key pages like results and insights will continue to provide high-value content to maintain user interest. Investigating anomalies in the partners and stag pages is essential to ensure data accuracy and understanding of user behaviour. Diversifying content across all pages with interactive elements such as videos and infographics will help boost engagement and retain users longer.

As shown in Figure 4, the openZDM website attracts a diverse user base, with Portugal leading in user numbers followed closely by the United Kingdom and Spain, indicating strong local interest and effective outreach efforts. Italy and the United States share the same user count, reflecting significant engagement driven by their respective manufacturing sectors and technological advancements. Additionally, Greece and the Netherlands show considerable interest, likely influenced by regional collaborations and innovative industrial landscapes.

To optimize engagement, targeted content and outreach strategies will be developed, leveraging local industrial partnerships and regional interests in manufacturing innovations. This approach can further strengthen the project's global appeal and foster deeper connections with stakeholders across Europe and the United States, enhancing the impact and visibility of openZDM.

2.1.1.2 Social media

In alignment with our communication strategy and target audiences, openZDM has worked to increase its presence across various social media channels (LinkedIn - Figure 5, and Twitter/X - Figure 6). Active engagement on platforms enables us to effectively raise awareness about the project's mission, showcase project-related activities, and drive traffic to the website. For this purpose, social media channels are used to foster meaningful connections, amplify messaging, and contribute to the broader discourse surrounding ZDM.

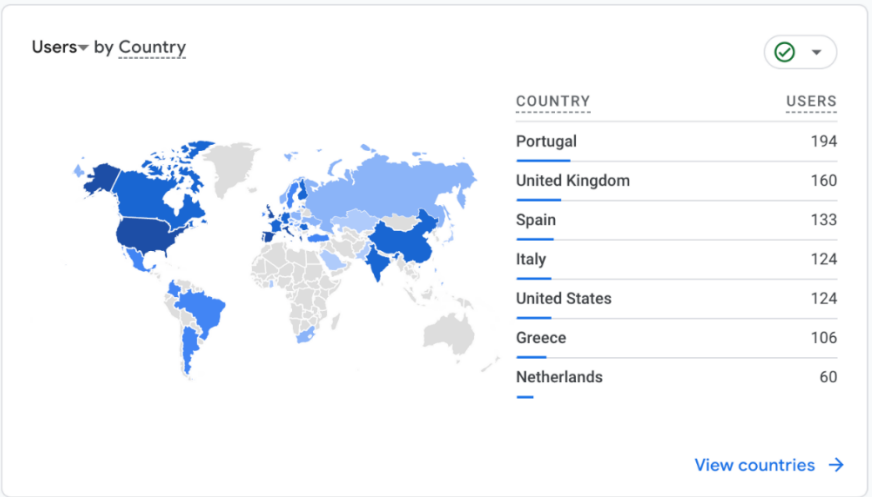

Figure 4: openZDM Website analytics - Users by country

In the past year, a consistent growth in organic followers can be seen. The openZDM LinkedIn page has accumulated a total of 478 followers (Figure 5). This reflects the overall reach and interest generated by the project among professionals and stakeholders on LinkedIn. In the past year, the LinkedIn page has gained 247 new followers. This indicates that more than half of the current followers are new, demonstrating a significant growth in interest and engagement. On average, the project has been attracting approximately 20.6 new followers each month. Growth indicates a sustained interest and effective engagement strategy. Organic growth can be attributed to the quality and relevance of the content shared and effective networking and communication strategies.

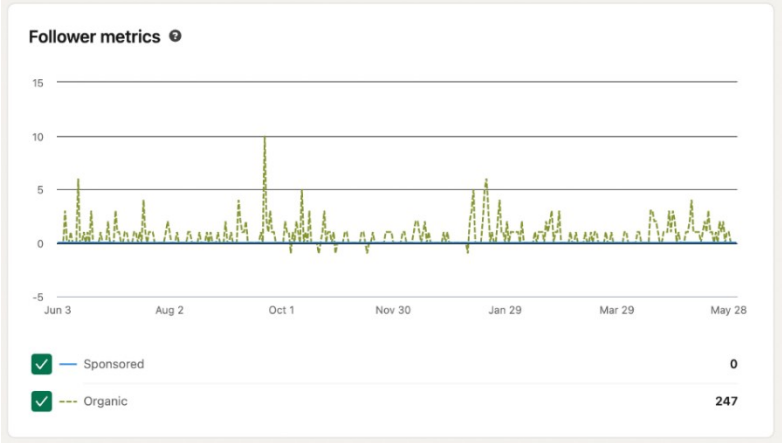

Figure 5: LinkedIn analytics - Followers metrics

By analysing the follower growth and implementing targeted strategies based on these insights, openZDM can continue to enhance its visibility and engagement on LinkedIn. For the upcoming period, the aim is to continue to optimise and diversify content to maintain and accelerate growth.

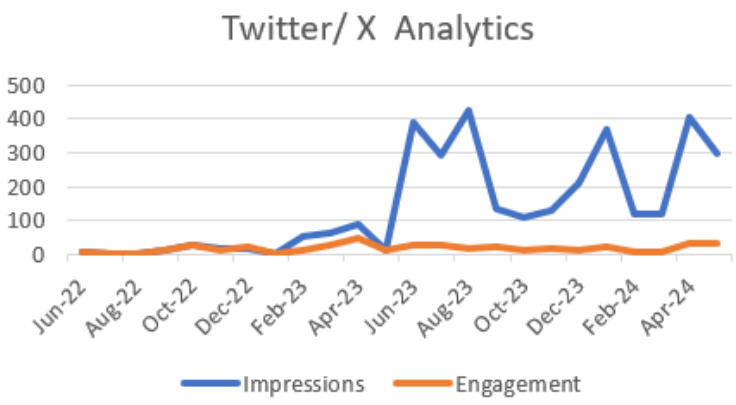

Figure 6: Twitter/X Analytics

The data from Twitter/X (Figure 6) shows fluctuations in impressions and engagement over the months from June 2022 to May 2024. There are noticeable peaks and dips in both metrics throughout the timeline. Notable trends include a significant increase in impressions and engagement in April 2023, followed by a decrease in the following months. Similarly, there are spikes in activity in June and July 2023, and then a decline in August before another increase in September. Overall, there is a general upward trend in impressions and engagement over the two years, with occasional fluctuations.

To better understand these fluctuations, further analysis is needed to identify potential factors driving the increases or decreases in impressions and engagement. This could include examining the content shared during peak months, any specific events or campaigns that might have influenced user activity, as well as any changes in Twitter algorithms or platform features that could have impacted visibility and engagement – the changes in the platform might showcase some unreliability due to the ownership migration. The ongoing strategy will focus less

on this platform due to the many changes it has gone under and rely more on other platforms that showcase more targeted engagement with relevant stakeholders.

Overall, LinkedIn has proven to be an effective channel for connecting with professionals in the manufacturing industry, showcasing promising results about engagement and visibility. However, despite dedicated efforts, challenges have risen concerning achieving significant traction on Twitter/X. As we evaluate our communication strategies for future activities, we'll prioritize channels that offer a higher return on investment.

As part of our comprehensive communication and social media strategy, openZDM has developed and implemented various campaigns aimed at increasing awareness, driving traffic, and engaging stakeholders. These campaigns are designed to align with our audience. Some campaigns have already been successfully deployed, generating positive outcomes, and providing meaningful interactions with our audience. These campaigns include: the openZDM kick-off campaign (June 2022); the press release campaign (July 2022); the awareness campaign (August 2022); the newsletter campaign (November 2022); the website launch campaign (November 2022); the partners' introduction campaign (December 2022 – June 2023); the pilots' introduction campaign (February – March 2023); the about openZDM innovative technologies campaign (July 2023); the openZDM experts about Sustainable Manufacturing campaign (August – October 2023); the series of Interviews campaign (October 2023 – March 2024); the openZDM animated video campaign (January 2024 - February 2024); the openZDM Pilots' animated video campaign (February 2024 - April 2024); the women in Manufacturing campaign (March 2024); the series of Academic Interviews campaign (March 2024 - April 2024); the press release campaign (April 2024).

2.1.1.3 Newsletter

Throughout the various sections of the website and featured on social media, interested parties are invited to subscribe to the openZDM newsletter, providing a direct channel to receive the latest insights and updates on the project.

To date, three newsletters have been published (0, 0, 0), offering subscribers a comprehensive overview of key project activities and outcomes. Utilizing Mailchimp as our platform of choice, we will develop a total of six newsletters, each crafted to deliver valuable information and insight. The first newsletter was sent in Month 6 of the project, strategically timed to coincide with the launch of the openZDM website, with the overarching goal of increasing project awareness and promoting engagement with our platform. The second and third newsletters served as updates on the project developments, highlighting the articles featured by partners and the events attendance which has proven to be one of the most effective communication activities to increase awareness around the project activities and developments. In the future, the newsletter will serve as a vital tool for maintaining ongoing communication, fostering community engagement, and sharing noteworthy developments with our stakeholders.

2.1.1.4 YouTube channel

Six videos are available on openZDM's YouTube channel (Figure 7). These multimedia presentations offer comprehensive insights into the project. Leveraging the power of video and considering that engagement with videos is more successful in online actions, the aim is to effectively communicate the essence of openZDM to all stakeholders. These videos represent a significant milestone in openZDM's commitment to transparency and engagement, providing viewers with a dynamic visual representation of developments. Moving forward, we remain committed to developing additional videos, and further expanding our video library targeting all stakeholders.

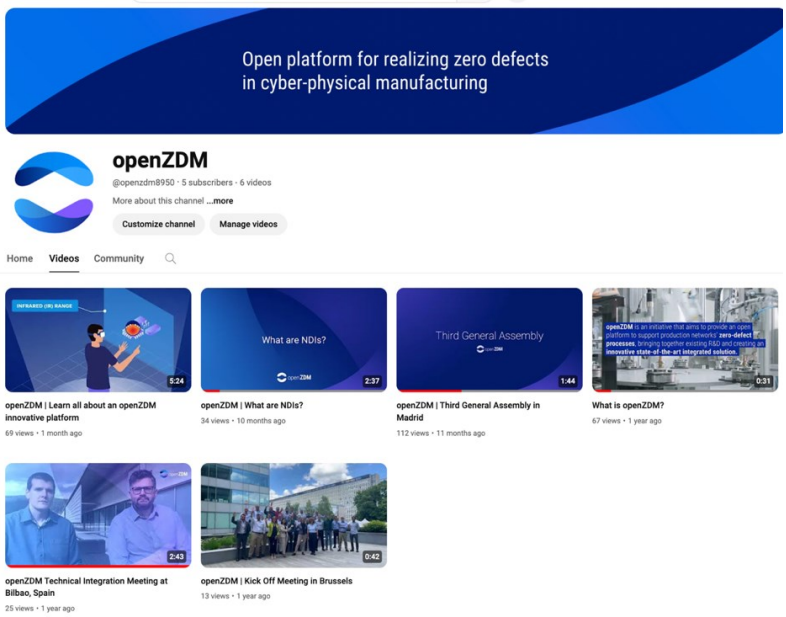

Figure 7: openZDM YouTube channel

2.1.1.5 Marketing materials

Regarding marketing materials, posters, brochures, and flyers have been developed, that have been curated to effectively communicate the project (Figure 8). Intended for use in both internal and external events, as well as individual meetings, these materials serve as invaluable assets for disseminating key information about openZDM to our diverse audience.

Poster

Roll up

Three-folded leaflet

Stickers

Keychain, tote bag and phone holder

Figure 8: openZDM Marketing materials

Additionally, marketing materials including tote bags, keychains, button pins, and phone holders have been developed, aimed at enhancing openZDM visibility and engagement. All materials, including the introduced promotional items, are conveniently accessible for printing through the project's internal repository, facilitating easy dissemination to stakeholders and access to consortium partners.

2.1.1.6 Public events

To date, openZDM has attended a total of nine public events, each offering valuable opportunities to engage with industry stakeholders, showcase our project's progress, and exchange insights with peers. These events include Industrial Technologies 2022, the European Manufacturing Conference 2022, The EU Leadership of the Manufacturing Industry Arrives to Budapest with I4MS Digital Game-Changers, the World Manufacturing Forum 2022, the ZDMP Cluster Workshop, the FORD Collaboration Event by TECNALIA 2023, the EFFRA Annual Event - Manufacturing Partnership Day 2023, the IDTA - WG Use Cases Presentation, and the EFFRA - Manufacturing Partnership Days 2024 (Figure 9). Active participation in these events highlights openZDM's commitment to fostering collaboration, sharing knowledge, and driving innovation within the manufacturing ecosystem.

Figure 9: openZDM presentation at EFFRA Manufacturing partnership Days 2024

Activities around the organisation and hosting of open days at schools have not started yet. However, openZDM is fully committed to prioritising and executing this initiative in the upcoming period. The objective is to host a minimum of three open days at schools, with an anticipated participation of over 100 attendees per event. These open days will serve as invaluable opportunities to engage with students, educators, and the wider community.

2.1.1.7 Press releases

Two press releases thus far have been successfully published including the first following the project kick-off in July 2022, and the second in March 2024, highlighting the proof of concept of the openZDM platform (Figure 10). Eight press clippings have been accumulated further reinforcing the visibility of openZDM within the media landscape. Moving forward, openZDM remains committed to its goal of creating a minimum of four press releases to be published in local newspapers and magazines. These efforts aim to reach a broader audience and provide visibility of the project and its key milestones.

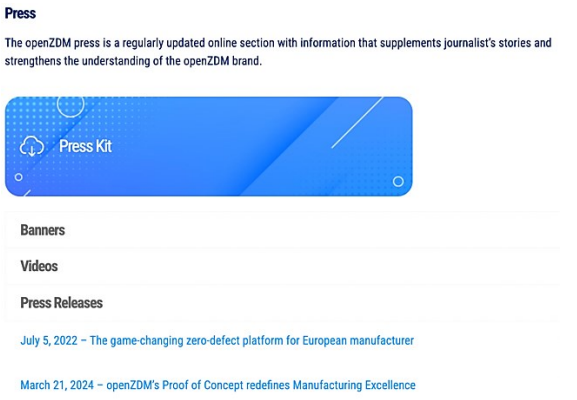

Figure 10: Press dedicated page on openZDM website

2.1.1.8 DIHs and Liaison with other initiatives

Regarding the promotion of project results in various DIHs to amplify the project's outreach for early adoption, a beta version of the openZDM system is under development. This beta version will serve as a concrete result that can be shared with DIHs and their networks. The primary objective is to gather valuable feedback from these key stakeholders within the manufacturing sector. By engaging DIHs and their networks, the aim is to assess potential improvements to the system and ensure its alignment with industry needs and standards.

Efforts in liaising with similar projects or initiatives in the manufacturing sector to coordinate activities in alignment with openZDM's objectives have shown significant results. The project has actively engaged with a diverse range of projects, including ZDMP, EFFRA, 4ZDM cluster, ENGINE, FLASH-COMP, Platform-ZERO, TURBO, ZDZW, IDTA and CEN/CENELEC. Through these engagements, which include participating in one-on-one meetings as well as events, collaboration has been fostered, insights have been shared, and synergies to advance common goals within the manufacturing domain have been leveraged.

2.1.1.9 Fora & Blogs

The goal to promote periodic non-technical reports to external fora and blogs has not yet been achieved with zero publications to date against a target of six. However, significant progress in creating blog posts for the openZDM website has been made, surpassing the initial KPI of six with a total of 25 posts (Table 2). While openZDM continues to work towards increasing its presence on external platforms, the focus on generating engaging content for the openZDM website has been successful. Moving forward, openZDM remains dedicated to expanding its outreach efforts to external fora and blogs.

Table 2. openZDM owned blogposts

Date	Name
12/2022	How's industry 4.0 disrupting the European Manufacturing Ecosystem?
01/2023	Embracing Sustainability in Manufacturing: The European Commission's Green Deal Industrial Plan
02/2023	Improving Quality Control in the Manufacturing Industry through Digital Twins
04/2023	The openZDM Platform in a world driven by the 4th Industrial Revolution
06/2023	OpenZDM is assessing 4 innovative technologies that will elevate the manufacturing industry
07/2023	What is an NDI system for zero defects?
05/2023	Discover the concept behind the openZDM innovative platform – step by step
06/2023	openZDM is assessing 4 innovative technologies that will elevate the Manufacturing industry
06/2023	openZDM Third General Assembly: Empowering the Manufacturing Industry
09/2023	Deep learning techniques for advanced image processing in manufacturing processes
10/2023	The role of Asset Administration Shell standard in zero defects manufacturing
11/2023	The role of data analytics tools in zero defects manufacturing
11/2023	Insights from Aptiv: Exploring the future and sustainability in Manufacturing
12/2023	Insights from Sonae Arauco: Exploring the future and sustainability in Manufacturing
12/2023	Insights from Vidrala: Exploring the future and sustainability in Manufacturing
01/2024	Insights from VDL Weweler: Exploring the future and sustainability in Manufacturing
01/2024	Insights from Volkswagen Autoeuropa: Exploring the future and sustainability in Manufacturing
02/2024	Advancing Manufacturing Excellence: an Exploration of Zero Defects and First-Time-Right Production
03/2024	Insights from Università Politecnica delle Marche: Exploring the future and sustainability in Manufacturing
03/2024	openZDM is proud to be supporting women in STEM
03/2024	Insights from University of Porto: Exploring the future and sustainability in Manufacturing
04/2024	Insights from Polytechnic Institute of Braganca: Exploring the future and sustainability in Manufacturing
04/2024	Save the date: openZDM at Control 2024 in Stuttgart, Germany
04/2024	openZDM is empowering young Engineers through the Manufacturing Hackathon
05/2024	openZDM at The Manufacturing Partnership Days 2024

2.2 Dissemination activities

Through the measurement and analysis of the dissemination KPIs (Table 3), insights into the performance of activities can be gathered, for the identification of strengths and optimisation strategies mitigating challenges.

Table 3: Dissemination KPIs overview

Measure	Target KPIs	Status [M18]	Status [M24]
Technical publications	>5 technical articles >2 white papers	1 technical article No white papers	1 technical article No white papers
Scientific publications	>15 publications in scientific journals One book release	3 scientific publications Book release to be started	10 scientific publications Book release to be started
Scientific Conferences	>15 publications and/or presentations delivered in major conferences	3 articles and/or presentations delivered at major conferences none published yet	5 publications or presentations delivered at major conferences

Measure	Target KPIs	Status [M18]	Status [M24]
Trade fairs/ exhibitions	>10 participations in major events/trade fairs >5 banners/ posters	2 Participation in major events/trade fairs 7 banners/posters	2 major events/trade fairs 7 banners/posters
Workshops through associations, communities and clusters	>2 technical workshops >2 workshops presenting use case results	3 technical workshops Workshops presenting use case results to be started	16 internal technical workshops Workshops presenting use case results to be started
Training	>2 online training tutorials >3 presentations to schools/ universities	No training tutorials 2 presentations to schools/universities	2 online training tutorials 2 presentations to schools/universities
Standards	>4 SDOs involved >4 standardisation contributions	Task not started	2 SDOs involved 1 Standardisation contribution

As seen in Table 3, while progress has been made towards achieving the dissemination KPIs, there is still room for improvement, especially in categories such as technical publications and presentations to scientific conferences. To address the discrepancies in achieving the targeted KPIs, several proactive steps will be taken to enhance project dissemination, engagement, and collaboration. Firstly, there should be a renewed focus on producing technical and scientific publications, with dedicated effort allocated to writing and publishing articles and white papers. Collaboration with industry experts and academic partners can be leveraged to increase the quality and quantity of publications.

Additionally, efforts should be intensified to secure speaking opportunities and participation in major conferences and trade fairs, fostering networking and visibility within relevant communities. Workshops presenting use case results will be prioritized and scheduled as part of the open days in schools indicator, by M36.

Furthermore, initiatives to provide online training tutorials will be expanded, tapping into educational networks to broaden the project's reach and impact. Lastly, active involvement in SDOs was initiated, with targeted contributions aimed at shaping industry standards and frameworks to align with project goals and objectives. By implementing these next steps, the project can better position itself for success and maximize its impact across technical, scientific, and industrial domains.

2.2.1 Dissemination tools and channels

2.2.1.1 Technical publications

Regarding technical publications, one has been published, titled "What is an NDI system for zero defects?". While this accomplishment marks a step forward, it also highlights the need for further efforts to meet the target of six technical publications. Through these publications, the aim is to share insights, innovations, and advancements within the realm of ZDM.

2.2.1.2 Scientific publications

Regarding scientific publications, openZDM has made significant contributions, with a total of 10 publications achieved thus far (Table 4). These publications represent rigorous research and insightful findings that come out of the project's outcomes, contributing to the general knowledge surrounding ZDM. Currently, five articles are pending for review and publication in magazines or journals.

Table 4: openZDM Scientific publications

Date	Title
06/08/2023	Integration of Non-Destructive Inspection (NDI) systems for Zero-Defect Manufacturing in the Industry 4.0 era
06/06/2023	Beam Straightness Measurement with Laser Triangulation System: a steel industry use case
06/06/2023	A robot-based inspecting system for 3D measurement
05/10/2023	A process-level LCA for evaluating the contribution of digitalization in the greening of a manufacturing system
05/03/2023	A methodology to assess circular economy strategies in manufacturing using process eco-efficiency
21/06/2023	A hybrid digital twin approach for proactive quality control in manufacturing

Date	Title
04/08/2023	3D point cloud analysis for product quality inspection: A steel parts use case
29/08/2023	Quality control in manufacturing through temperature profile analysis of metal bars: A steel parts use case
29/08/2023	Data analytics and AI for quality assessment in manufacturing: Challenges and Opportunities
04/05/2024	An approach to implementing the proactive asset administration shell: A steel industry use case.

2.2.1.3 Scientific conferences

The openZDM project has actively participated in scientific conferences, delivering a total of five publications or presentations to date (Figure 11). These conferences serve as pivotal platforms for sharing our research findings, insights, and advancements in ZDM with a broader academic audience. Moving forward, we remain dedicated to leveraging these relevant forums to disseminate our research and foster collaboration within the scientific community, ultimately driving meaningful progress in the field of manufacturing.

DMIS 2023

2023 IEEE INTERNATIONAL WORKSHOP ON Metrology for Industry 4.0 & IoT

International Conference on Learning Factories

Forum delle Misure 2023

Figure 11: openZDM events participation

2.2.1.4 Trade fairs and exhibitions

The project has participated in two major events/trade fairs to date (Figure 12, Figure 13). At these events, we have showcased our innovative solutions, engaged with industry stakeholders, and shared insights on the ZDM approach.

Figure 13: Techchill Milano 2022.

Figure 12: Control Messe 2024.

We have created seven posters, effectively communicating key messages. While our current progress demonstrates active engagement within the industry, there remains room for further participation to meet our target of 10 participants in major events/trade fairs. Moving forward, we are committed to expanding our presence at this type of event, leveraging them as opportunities to foster collaboration within the manufacturing sector.

2.2.1.5 Training tutorials

So far, we have developed one online course available on the project website titled 'Data Analytics Tutorial' providing learners with resources to understand openZDM concepts and methodologies (Figure 14). Additionally, a hackathon for students has been hosted, serving as another valuable training opportunity. The documentation produced during this event will serve as a comprehensive resource for participants, further enhancing their learning experience. These training tutorials will be made publicly available on the website and their impact will be tracked with the project's analytics tools. Through ongoing initiatives and collaborations, we aim to achieve the proposed KPI of over 2 learning tutorials, for this purpose, we have selected key consortium members and assigned topics for future training.

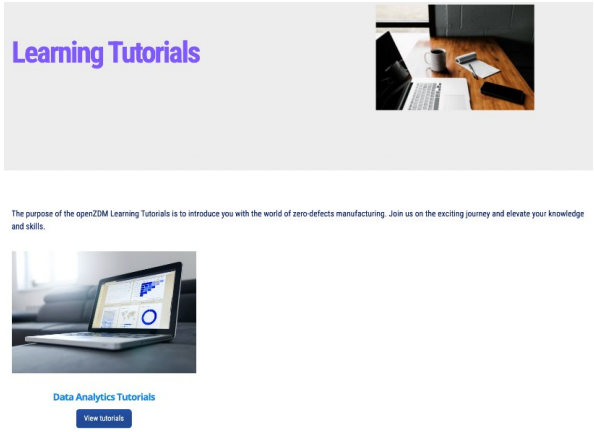

Figure 14: Dedicated section for Training Tutorial on the openZDM website

2.2.1.6 Open data access

The openZDM community on Zenodo (Figure 15) serves as a comprehensive repository for openZDM's research outputs, datasets, and other scholarly contributions. Here, a diverse range of materials is curated, including technical and scientific publications, conference presentations, and workshop materials, providing a centralized platform for dissemination and collaboration.

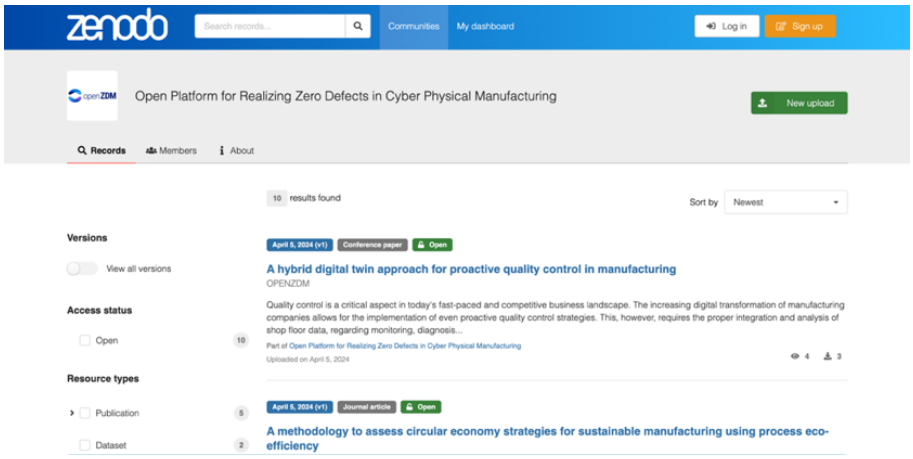

Figure 15: openZDM Zenodo community

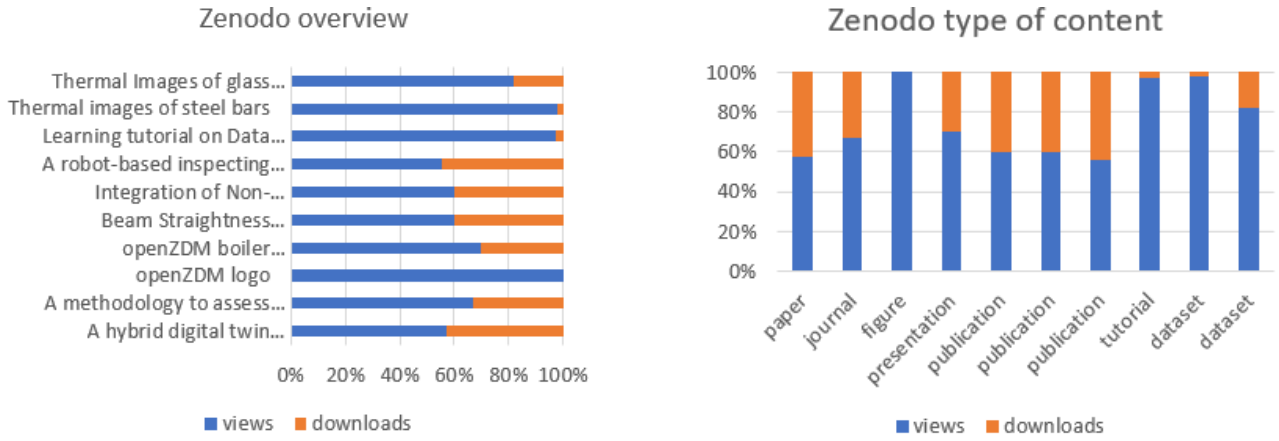

Figure 16: openZDM Zenodo analytics

Table 5: openZDM Zenodo content overview

Input	Type	Views	Downloads
A hybrid digital twin approach for proactive quality control in manufacturing	paper	4	3
A methodology to assess circular economy strategies for sustainable manufacturing using process eco-efficiency	journal	4	2
openZDM logo	figure	7	0
openZDM boiler presentation	presentation	70	30
Beam Straightness Measurement with Laser Triangulation System: a steel industry use case	publication	6	4
Integration of Non-Destructive Inspection (NDI) systems for Zero-Defect Manufacturing in the Industry 4.0 era	publication	9	6
A robot-based inspecting system for 3D measurement	publication	5	4
Learning tutorial on Data Analytics	tutorial	36	1
Thermal images of steel bars	dataset	139	3

The data from Zenodo provides insights into the engagement levels of various types of content hosted on the platform, measured by views and downloads (Figure 16 and Table 5). The openZDM boiler presentation is the most viewed and downloaded content type, with a substantial 70 views and 30 downloads, indicating a strong interest in accessing this format. This suggests that the presentation serves as a popular medium for disseminating project findings and insights. Additionally, datasets also attract significant attention, with 139 views, although downloads are comparatively lower at 3, implying that users may be interested in exploring the datasets but not necessarily downloading them for immediate use.

Among publications, papers and journals exhibit moderate engagement levels, each gathering 4 views and 3 downloads, indicating a steady interest in accessing scholarly articles and research papers. However, figures, despite having a higher view count at 7, have not registered any downloads so far. Tutorials also display a noteworthy engagement level, with 36 views, but only 1 download.

Overall, the data underscores the importance of diverse content formats in catering to different user preferences and needs. While presentations and datasets attract significant attention, there is potential to further optimise engagement with other content types such as figures and tutorials by tailoring them to meet the specific requirements and interests of the audience.

In addition to hosting openZDM's data and publications, the aim is to actively engage with external repositories such as IEEE DataPort and the EU's open data portal to further enhance the accessibility and visibility of our work. As a next step, we are exploring opportunities to leverage these additional platforms to broaden the reach of our research outputs and facilitate greater collaboration within the broader scientific and technical community. Through these efforts, we aim to foster open and transparent access to research data and findings, promoting innovation and knowledge exchange.

2.3 Key outcomes and observations for next period

Building upon the strategies and achievements outlined so far in this section, our next steps will focus on increasing the progress across dissemination, engagement, and impact. To enhance our dissemination efforts, we will intensify our focus on technical and scientific publications, aiming to meet the proposed KPIs while ensuring the quality and relevance of our contributions.

Our strategy to engage key target groups will involve a multifaceted approach with attendance to events and directly reaching contacts in our consortium networks, these actions will be aimed at fostering inclusivity and maximizing impact. We have successfully engaged with academic and research communities through the dissemination of publications, presentations at conferences, and collaborations with universities. Additionally, our partnerships with industry stakeholders have facilitated knowledge exchange and technology transfer, driving innovation and practical applications of our research.

To address gender considerations, we are committed to promoting diversity and gender equality across all project activities. The openZDM project has already featured a dedicated article on the website highlighting the number of female researchers involved in the project and social media actions to feature in equal amount of female and male perspectives on opinion articles and interviews. We actively seek to involve and empower women in leadership roles, research teams, and decision-making processes, ensuring their voices are heard and valued.

Moreover, we prioritize inclusive language and communication strategies to create an environment that is welcoming and accessible to all individuals. Through these, we aim to cultivate a diverse and inclusive project community that leverages the unique perspectives and talents of all its members to achieve our shared goals.

To address the challenges presented in the dissemination activities and related to open access to the project's results we will expand our presence at conferences and trade fairs, leveraging these platforms to showcase our innovations, foster collaboration, and raise awareness within the manufacturing ecosystem. Furthermore, we will continue to develop training initiatives, offering accessible resources to key stakeholders with the knowledge and tools needed to drive progress in zero defects manufacturing. Through these concerted efforts and ongoing collaboration, we are committed to creating a significant impact on the outcomes and results of openZDM.

3 Update on Exploitation activities

3.1 Progress towards the openZDM exploitation and IPR Management plan

In alignment with the openZDM exploitation and IPR management strategy, as it was outlined in D6.1 and the project's description of the action, several exploitation-related activities have been implemented up to M24. The aim of these activities covered several areas of business planning. First, the effort was allocated to identify and conclude on the core innovations that have the potential to be used either for commercial or academic purposes, namely the ERs of the project, and scan which of them have the greatest impact in terms of innovation potential, partners' business views, and market trends, namely the KERs. By doing this, we also covered IP aspects and addressed how each of the ERs will be exploited and how partners wish to use their results after the end of the project (individual/ joint exploitation plans). This led to a more concrete idea of how to set up the business models of the KERs, and how to effectively promote them to key stakeholders/ initial adopters/ customers.

3.1.1 List of exploitation activities undertaken

- **The exploitation and IPR Management strategy have been implemented**: The exploitation and IPR management strategy of the project has been followed and most of its activities up to Phase 4 have been implemented. As described in D6.1, and the updated exploitation and IPR management strategy, the phases of innovation management and IPR strategy are currently under implementation, while we have also conducted activities (i.e., market research, initial business model aspects) to address the business modelling phase. Visibility of project results is undergoing since we have identified the key channels to use.
- **Exploitation Workshop**: A physical exploitation workshop was held during the 3rd GA meeting of openZDM, where partners aligned on ERs and discussed exploitation pathways.
- **Exploitation and Business Modelling Survey**: A three-week exploitation survey was designed targeting the consortium, which informed the selection of KER, and devised exploitation paths, marketing strategies, and monetization models. The survey received 25 responses from all consortium partners.
- **Identification of ERs**: 23 ERs were identified, primarily focusing on NDI systems with significant commercialization potential. From these, 8 KERs were selected based on business feasibility, market demand, and partners' views.
- **Individual and Joint Exploitation Paths for ER and per consortium partner**: Initial exploitation paths for each ER, particularly NDI tools, were mapped out, including strategies like direct sales, licensing, partnerships, and integration into existing processes.
- **Market and competition analysis** for the openZDM innovations, highlighting the key target markets, their size and core trends that currently exist.
- Defined the **customer segments and stakeholder groups** who could act as initial adopters.
- Defined the **value proposition per ER**, meaning that we tried to quantify the business benefits that each result brings to the potential customers.
- Defined **how the results could reach the end customers**, **via which channels**, and **delivery models**, and made specific **monetisation strategies per ER and the openZDM platform** that serve the technical specificities.

3.1.2 Survey on Exploitation and Business Modelling

All partners participated in the online survey, focusing on individual viewpoints to capture diverse perspectives. Multiple participants from each organization ensured comprehensive insight gathering for holistic exploitation

planning. The survey incorporated methodologies like the value proposition canvas for needs and benefits and indirectly addressed the business model canvas. Marketing strategies such as the marketing plan, marketing mix, and elements from the innovation radar questionnaire were also integrated. The survey assessed their understanding and commitment to project results with key questions including (i) Knowledge and Contribution, (ii) Deployment Timeframe, (iii) Result Potential, (iv) Market Focus and Size, (v) Competition Analysis, (vi) Target Customers and Adopters, (vii) Value Proposition, (viii) Resource Dependency, (ix) Promotion Channels, (x) Selling Model, (xi) Protection and Restrictions, (xii) Sustainability, (xiii) General Comments. The survey process involved distributing the survey and providing guidelines and support to project partners on how to complete it, collecting responses, and analysing data for actionable insights, ensuring a well-informed exploitation plan.

3.2 openZDM ERs, services and products, customer segments, value proposition, sales models, and IPR protection

Based on project progress and the exploitation survey, we present the updated list of openZDM ERs, now comprising 23 innovations across software, hardware, or combined components (Table 6 - Table 24). Delivery models for each ER vary, with options including standalone modules, integration into the openZDM platform, or bundling with other services. Primarily targeting B2B markets, especially large corporations like car manufacturers, these ERs are offered as "modifiable off-the-shelf" products or subscription-based services, with some available remotely as a Service. Additionally, we've analysed potential protection measures for each ER via the survey, laying a foundation for IP protection crucial for future exploitation and commercialization efforts.

Table 6: ER #1: Laser line triangulation system – low temperature

ER Name (#1)	**Laser line triangulation system – low temperature**
Description	Laser line triangulation systems for measuring bar straightness down to 0.2 mm over a length up to 900 mm. It consists of triangulation sensors for low temperatures.
Type	NDI
Lead Partner(s) (Point of reference)	UNIPVM
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Enhanced quality control and thus reduction of resource usage and time, leading to improved efficiency and cost reduction.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As a service bundle, in combination with other ERs in the project.
IPR protection	• No specific protection but will only be available upon request; Trade Secret

Table 7: ER #2: Thermal camera before descaling

ER Name (#2)	**Thermal camera before descaling**
Description	Two infrared cameras, for high-temperature metal parts, provide information on a) temperature gradients, and b) steel bar position concerning the furnace induction coil. This result refers to the thermal camera before descaling.
Type	NDI
Lead Partner(s) (Point of reference)	UNIPVM
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Enhanced quality control and thus reduction of resource usage and time, leading to improved efficiency and cost reduction.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As a service bundle, in combination with other ERs in the project.
IPR protection	• No specific protection but will only be available upon request; Trade Secret

Table 8: ER #3: Thermal camera after descaling

ER Name (#3)	Thermal camera after descaling
Description	Two infrared cameras, for high-temperature metal parts, provide information on: a) temperature gradients, and b) steel bar position concerning the furnace induction coil. This result refers to the thermal camera after descaling.
Type	NDI
Lead Partner(s) (Point of reference)	UNIPVM
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Enhanced quality control and thus reduction of resource usage and time, leading to improved efficiency and cost reduction.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As a service bundle, in combination with other ERs in the project.
IPR protection	• No specific protection but will only be available upon request; Trade Secret

Table 9: ER #4: Laser line triangulation system – high temperature

ER Name (#4)	Laser line triangulation system – high temperature
Description	Laser line triangulation systems for measuring bar straightness down to 0.2 mm over a length up to 900 mm. It consists of triangulation sensors for high temperatures.
Type	NDI
Lead Partner(s) (Point of reference)	UNIPVM
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Enhanced quality control and thus reduction of resource usage and time, leading to improved efficiency and cost reduction.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As a service bundle, in combination with other ERs in the project.
IPR protection	• No specific protection but will only be available upon request; Trade Secret

Table 10: ER #5: 3D dimension measurement system

ER Name (#5)	3D dimension measurement system
Description	One test station comprises a) a scanning device (either robot or linear stage), b) a laser line triangulation sensor, and c) a vision system/s (telecentric). The system will detect 3D shapes and a specific set of dimensions, defined by a specific control plan.
Type	NDI
Lead Partner(s) (Point of reference)	UNIPVM
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Enhanced quality control and thus reduction of resource usage and time, leading to improved efficiency and cost reduction.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As a service bundle, in combination with other ER in the project.
IPR protection	• No specific protection but will only be available upon request; Trade Secret

Table 11: ER #6: Vision for surface defect detection

ER Name (#6)	Vision for surface defect detection
Description	Vision model to detect defects and predict them in a container production line. SW and HW solution.
Type	NDI
Lead Partner(s) (Point of reference)	AIMEN

ER Name (#6)	Vision for surface defect detection
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Expected reduction in costs due to non-destructive and standardised quality control.
Sales delivery model	• Mainly B2B (to large corporate entities like car manufacturers). • As a service bundle, in combination with other ER in the project. • As distinct "parts" (few software modules together) instead of an "openZDM integrated platform".
IPR protection	• Design rights; Trade Secret/ NDA/ Confidentiality Agreement;

Table 12: ER #7: Off-line X-ray residual stress detection

ER Name (#7)	Off-line X-ray residual stress detection
Description	Offline NDI sending data to the platform through Digital Thread Application, relating the reference with the offline results.
Type	NDI
Lead Partner(s) (Point of reference)	AIMEN
Target customer segment	• Manufacturing OEMs in several areas • Steel Processing Industry as initial adopters
Value proposition	Expected reduction in costs due to non-destructive and standardised quality control.
Sales delivery model	• Mainly B2B (to large corporate entities like car manufacturers). • As a service bundle, in combination with other ERs in the project. • As distinct "parts" (few software modules together) instead of an "openZDM integrated platform".
IPR protection	• Design rights; Trade Secret/ NDA/ Confidentiality Agreement;

Table 13: ER #8: IoT portable laser line triangulation for gap and flush

ER Name (#8)	IoT portable laser line triangulation for gap and flush
Description	A smart portable wireless IoT instrument of gap & flush by operators in assembly lines.
Type	NDI
Lead Partner(s) (Point of reference)	USIT
Target customer segment	• Automotive OEMs and TIER1 • Wood Machine Producer • Household Appliance OEMs • Aeronautics OEMs
Value proposition	• Expected reduction in production costs • Expected reduction of inspection time • Increased data availability in production line related to manual operations
Sales delivery model	• Mainly B2B (to large corporate entities like car manufacturers). • As distinct "parts" (few software modules together) instead of an "openZDM integrated platform".
IPR protection	• Patent

Table 14: ER #9: Thermal camera for glass bottle thickness measurement

ER Name (#9)	Thermal camera for glass bottle thickness measurement
Description	Deep model thermal vision-based for defects prediction in a container production line. Software and Hardware solution.
Type	NDI
Lead Partner(s) (Point of reference)	TECNALIA
Target customer segment	• Glass Manufacturers
Value proposition	• Expected up to 70% of defective bottles detection
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform".

ER Name (#9)	Thermal camera for glass bottle thickness measurement
	• As a ready "modifiable of the shelf" product (parametrized by customers); as a service bundle, in combination with other ERs in the project.
IPR protection	• Trade Secret/ NDA/ Confidentiality Agreement; • Copyright protection (e.g., for software or user intefaces);

Table 15: ER #10: IR Thermal camera for early detection of welding process defects

ER Name (#10)	IR Thermal camera for early detection of welding process defects
Description	IR thermal camera for early detection of welding process defects. By capturing thermal images in real time, the camera detects temperature anomalies and irregularities during the welding.
Type	NDI
Lead Partner(s) (Point of reference)	COMAU
Target customer segment	• Automotive OEMs: Companies producing electric vehicles (EVs) and hybrid vehicles are a primary target. • Battery Manufacturers: Manufacturers of lithium-ion batteries, which are commonly used in EVs, would benefit from thermographic control to enhance the quality of their battery welding processes.
Value proposition	• Overall defects reduction of up to 50% • Throughput increase: up to 20-30% due to reduced need to rework defective parts • Production cost and waste reduction: up to 10-15% due to reduced scraps and time/resources needed for reworking.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform". • As part of the openZDM integrated platform. • As a service bundle, in combination with other ERs in the project. • Mainly B2B (to large corporate entities like car manufacturers).
IPR protection	• Trade Secret/ NDA/ Confidentiality Agreement;

Table 16: ER #11: 2D Camera application for welding process monitoring (detection of aesthetic defects)

ER Name (#11)	2D Camera application for welding process monitoring (detection of aesthetic defects)
Description	2D camera application for welding process monitoring. Utilizing high-resolution 2D imaging, this application monitors the welding process in real-time to detect aesthetic defects.
Type	NDI
Lead Partner(s) (Point of reference)	COMAU
Target customer segment	• Automotive OEMs: Companies producing electric vehicles (EVs) and hybrid vehicles are a primary target. • Battery Manufacturers: Manufacturers of lithium-ion batteries, which are commonly used in EVs, would benefit from thermographic control to enhance the quality of their battery welding processes.
Value proposition	• Overall defects reduction of up to 50% • Throughput increase: up to 20-30% due to reduced need to rework defective parts • Production cost and waste reduction: up to 10-15% due to reduced scraps and time/resources needed for reworking.
Sales delivery model	• As distinct "parts" (few software modules together) instead of an "openZDM integrated platform" • As part of the openZDM integrated platform. • As a service bundle, in combination with other ERs in the project. • Mainly B2B (to large corporate entities like car manufacturers).
IPR protection	• Trade Secret/ NDA/ Confidentiality Agreement;

Table 17: ER #12: Data-driven analytics for quality assessment

ER Name (#12)	Data-driven analytics for quality assessment
Description	Single SW package combining multiple AI algorithms to generate explainable data analytics for quality assessment and defects identification, capable of running upon digital twin data. It will be tested in the project pilots, getting multivariable inputs to support the various pilot applications.

ER Name (#12)	Data-driven analytics for quality assessment
Type	SW (Module - side product, standalone)
Lead Partner(s) (Point of reference)	IPB, UPORTO, HABBER TEC, LMS, TECNALIA, AIMEN
Target customer segment	• Manufacturing OEMs; Niche: Automotive industry, Steel processing industry, Glass Manufacturing Industry and Wood processing and manufacturing industry, Electric batteries manufacturing industry
Value proposition	• Cost reduction - reduce costs related to the generation of defective products by 10% or more. • Reduction in carbon emissions - reduction in 20% or more of CO2 emissions generated due to early defect detection • Defects reduction - decrease product defects through process adaptation by more than 10%.
Sales delivery model	• As a ready "modifiable of the shelf" product (parametrized by customers). • As part on the openZDM integrated platform. • As a service bundle, in combination with other ERs in the project. • Mainly B2B (to large corporate entities like car manufacturers). • Mainly B2B (to smaller corporate entities and SMEs, like software integrators / autonomous driving developers etc.). • Remotely "as a Service" deployed in our own servers (subscription-based tool).
IPR protection	• Copyright protection (e.g., for software or user interfaces); • Non-disclosure agreement (NDA)

Table 18: ER #13: Decision making toolset

ER Name (#13)	Decision making toolset
Description	Dynamic decision-making module based on digital twin information along with analytics, LCA, and NDI systems information. It assesses the current condition of a manufacturing process, evaluates alternative parameters' configurations, and proposes best-fit process/parameters adaptation.
Type	SW (Module - side product, standalone)
Lead Partner(s) (Point of reference)	LMS
Target customer segment	• Manufacturing OEMs; Niche: Automotive industry, Steel processing industry, Glass Manufacturing Industry and Wood processing and manufacturing industry, Electric batteries manufacturing industry
Value proposition	• Cost reduction - reduce costs related to the generation of defective products by 10% or more. • Reduction in carbon emissions - reduction in 20% or more of CO2 emissions generated due to early defect detection • Defects reduction - decrease product defects through process adaptation by more than 10%.
Sales delivery model	• As a ready "modifiable of the shelf" product (parametrized by customers). • As part of the openZDM integrated platform. • As a service bundle, in combination with other ERs in the project. • Mainly B2B (to large corporate entities like car manufacturers). • Mainly B2B (to smaller corporate entities and SMEs, like software integrators / autonomous driving developers etc.). • Remotely "as a Service" deployed in our own servers (subscription-based tool).
IPR protection	• Copyright protection (e.g., for software or user interfaces) • Non-disclosure agreement (NDA)

Table 19: ER #14: Digital twin toolset

ER Name (#14)	Digital twin toolset
Description	Digital twin framework for creating dynamic digital twin models and linking them to external data sources for real-time and high-fidelity real-world scenarios evaluation.
Type	SW (Module - side product, standalone)
Lead Partner(s) (Point of reference)	LMS
Target customer segment	• Software and engineering firms and developers • Technology integrators
Value proposition	• Flexible manufacturing • Fast reconfiguration

ER Name (#14)	Digital twin toolset
	• Customised-batches production • Integration of further data sources and digitalization on a given step, where previously no data was collected.
Sales delivery model	• As a ready "modifiable of the shelf" product (parametrized by customers). • As part of the openZDM integrated platform. • As a service bundle, in combination with other ERs in the project. • Mainly B2B (to large corporate entities like car manufacturers). • Mainly B2B (to smaller corporate entities and SMEs, like software integrators / autonomous driving developers etc.). • Remotely "as a Service" deployed in our own servers (subscription-based tool).
IPR protection	• Copyright protection (e.g., for software or user interfaces); • Non-disclosure agreement (NDA)

Table 20: ER #15: AAS dataset and data models

ER Name (#15)	AAS dataset and data models
Description	A type 2 AAS common data model information of the openZDM components for all the pilots' lines which will be extended to support the platform functionalities. Refers also to the dataset stemming from openZDM, which will be provided openly via ZENODO.
Type	Dataset
Lead Partner(s) (Point of reference)	AIMEN, INTRA
Target customer segment	• Any manufacturing OEM (regardless of the industry) • EU start-ups • Research and Academia
Value proposition	• Homogeneity of acquired plant data, ensuring interoperability and use of data in different applications for decision-making. • Dataset to be used in further research, spreading knowledge.
Sales delivery model	• No commercial exploitation is foreseen - open-source distribution will be used.
IPR protection	• No protection - Opensource / Creative Commons or similar

Table 21: ER #16 - #20: Pilot implementation ERs

ER Name (#16 - #20)	**ER 16 Steel parts production application** **ER 17 Automotive application** **ER 18 Glass containers production application** **ER 19 Battery trays production for EVs application** **ER 20 Wood-based panels production application**
Description	Pilot implementation of the project solutions.
Type	BOTH (SW/HW - integrated)
Lead Partner(s) (Point of reference)	VDL, VWAE, VIDRALA, APTIV, SONAE
Target customer segment	• Companies in the steel processing industry • Companies in the automotive industry • Companies in the glass manufacturing industry • Companies in electric battery manufacturing • Companies in wood processing
Value proposition	• Cost reduction as described in the individual tools • Improved efficiency in the production process due to better detection of defects • Reduced waste and emission – improved environmental impact and sustainability
Sales delivery model	• Even as a small trial / "stripped down" minimal pilot, as long as the client is captured.
IPR protection	• Trade secret

Table 22: ER #21: Knowledge for standardisation

ER Name (#21)	Knowledge for standardisation
Description	Includes the scientific knowledge created during the project, mostly in the form of research/ technical papers/ reports (deliverables), along with the project's network community and the

ER Name (#21)	Knowledge for standardisation
	knowledge and capacity gained by project partners via implementing and participating in the various project activities.
Type	Intangible
Lead Partner(s) (Point of reference)	All partners
Target customer segment	• Standardisation bodies such as the IDTA
Value proposition	• The standardisation of AAS submodels allows the development of templates that facilitate their use and ensure interoperability within companies and between partners in a value chain.
Sales delivery model	• No commercial exploitation is foreseen - open-source distribution will be used.
IPR protection	• No protection - Opensource / Creative Commons or similar

Table 23: ER #22: openZDM platform (clean version)

ER Name (#22)	openZDM platform (clean version)
Description	The openZDM platform (Clean Version) is a framework designed to support continuous quality assessment and control within manufacturing environments. This platform provides the essential infrastructure for Zero-Defect Manufacturing (ZDM) by ensuring seamless interoperability and integration through open API specifications. It allows for the plug-and-play connection of various existing zero-defect manufacturing tools and solutions, both open-source and proprietary.
Type	SW (Module - side product, standalone)
Lead Partner(s) (Point of reference)	INTRA, LMS
Target customer segment	• Manufacturing OEMs; Niche: Automotive industry, Steel processing industry, Glass Manufacturing Industry and Wood processing and manufacturing industry, Electric batteries manufacturing industry • IT technology integrators in manufacturing
Value proposition	• Integration of further data sources and digitalization on a given step, where previously no data was collected. • Enhanced interoperability. • Improved efficiency and reduced costs of digitalisation.
Sales delivery model	• As an of-the-self-platform that can be licensed to customers
IPR protection	• Copyright protection (e.g., for software or user interfaces); • Trade Secret/ NDA/ Confidentiality Agreement;

Table 24: ER #23: openZDM integrated solution

ER Name (#23)	openZDM integrated solution
Description	The openZDM Platform offers a comprehensive solution for Zero-Defect Manufacturing (ZDM) by integrating quality assessment and control within cyber-physical production systems. It ensures seamless interoperability through open API specifications, enabling the connection and coordination of diverse zero-defect manufacturing tools and systems, thus fostering sustainable manufacturing by preventing waste and enhancing production flexibility.
Type	Integrated platform as a solution embedding digital twin models, data analytics and NDIs
Lead Partner(s) (Point of reference)	All partners, to be defined via an exploitation agreement
Target customer segment	• Manufacturing OEMs; Niche: Automotive industry, Steel processing industry, Glass Manufacturing Industry and Wood processing and manufacturing industry, Electric batteries manufacturing industry
Value proposition	• Cost reduction - reduce costs related to the generation of defective products by 10% or more. • Reduction in carbon emissions - reduction in 20% or more of CO2 emissions generated due to early defect detection • Defects reduction - decrease product defects through process adaptation by more than 10%.
Sales delivery model	• Service bundles, tailored packages of NDIs and software forming dedicated product offerings for dedicated use cases (e.g., different bundles for manufacturing, steel processing, etc.)
IPR protection	• Trade Secret/ NDA/ Confidentiality Agreement;

3.3 Selection of openZDM KERs

Partners were surveyed to determine preferences for the project's ERs based on commercial value, impact, and exploitation potential, irrespective of their involvement in development. This collaborative approach aimed to align with partners' expertise and current market needs in zero-defect manufacturing. Survey results, combined with analysis by the project's exploitation manager, formed the selection of KERs outlined in Figure 17.

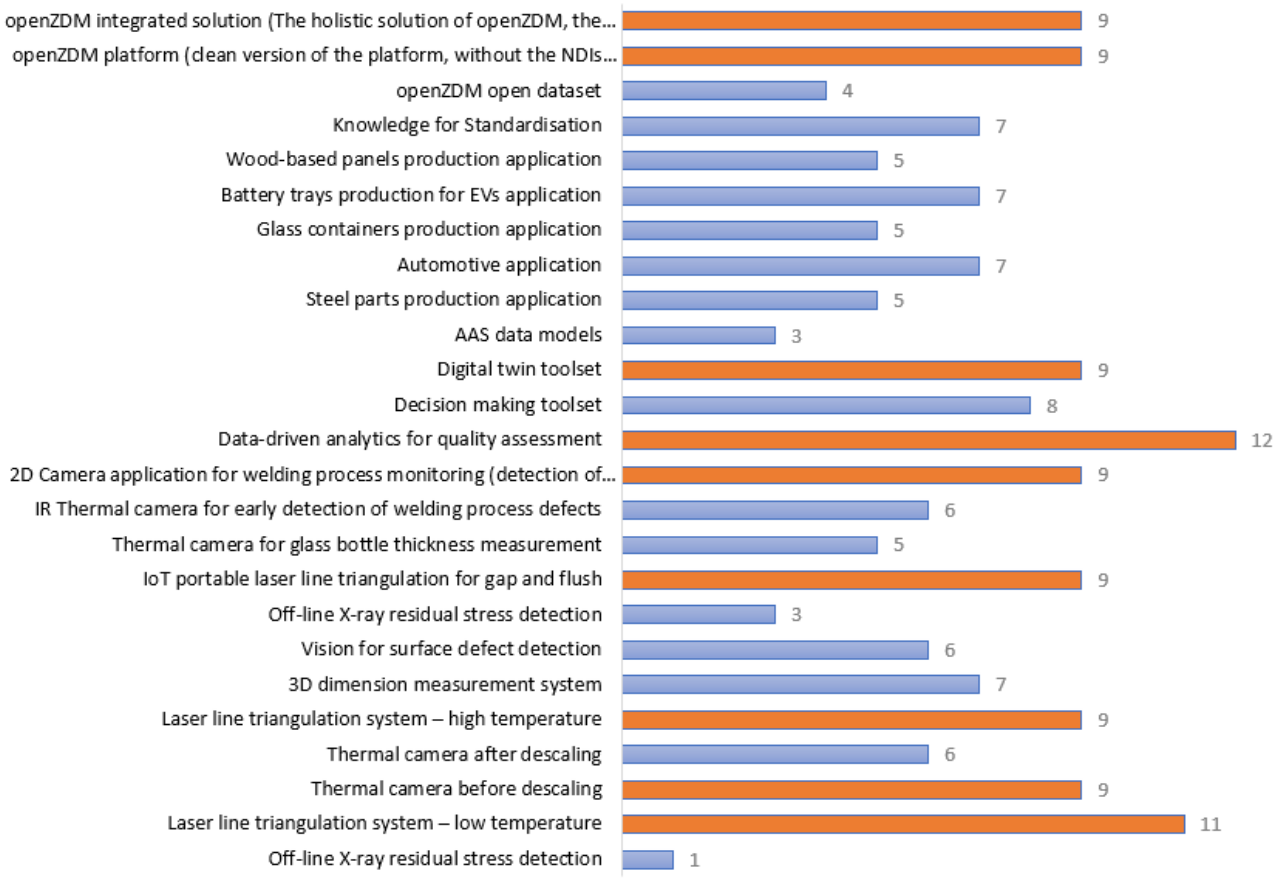

Figure 17: Survey results for the pre-selection of the openZDM KER.

Based on the survey results, the most prominent ERs in terms of exploitation potential and impact are the:

- openZDM integrated solution
- openZDM platform (software, clean version)
- Laser line triangulation system – low temperature
- Data-driven analytics for quality assessment
- Thermal camera before descaling
- 2D Camera application for welding process monitoring
- Digital twin toolset
- IoT portable laser line triangulation for gap and flush

The selected KER will serve as the project's primary innovations/tools promoted to stakeholders, including customers, collaborators, and investors. Exploitation activities will closely align with dissemination efforts, leveraging two key EC-supported channels: the Horizon Results Platform and the Innovation Radar. Uploading the list of KER to these platforms will enhance project visibility.

3.4 Market analysis

3.4.1 Target markets' size and trends

The project's ERs cover a wide range of target markets across various industries, reflecting the diverse applications and utility of the openZDM platform. Industries like automotive, manufacturing, and aerospace emerge as prominent target markets, with multiple results addressing some of their specific needs and requirements. Sectors

like construction, metalworking, and energy also feature prominently, indicating the platform's versatility and applicability across different domains. Niche markets like glass production, packaging, and furniture industries are also addressed, highlighting the platform's potential to serve specialized sectors with tailored solutions.

Target market: Automotive industry

The **automotive industry** stands out as a significant target market for the openZDM platform, with a global market size of $3.5 trillion in 2023, driven by increasing vehicle production and the adoption of advanced manufacturing technologies [1]. Key trends in this industry include the growing demand for smart manufacturing solutions to improve efficiency and quality control, as well as the integration of IoT and data analytics for predictive maintenance and process optimization.

Target market: Smart manufacturing

In the **smart manufacturing sector**, which is expected to reach almost one trillion by 2032 [2], a CAGR of 16% during the forecast period 2023 to 2032, there is a rising emphasis on digital transformation initiatives to enhance productivity and competitiveness. The adoption of Industry 4.0 technologies, including advanced sensing and monitoring solutions like those offered by openZDM, is driving market growth. Additionally, trends such as the increasing focus on sustainability and the rise of smart factories are shaping the landscape of manufacturing.

Target market: Aerospace industry

The **aerospace industry** presents another profitable market opportunity, with a projected market size of $678 billion by 2032 (a CAGR of 7.80% during the forecast period from 2023 to 2032) [3]. Key trends in this sector include the adoption of additive manufacturing technologies, the development of lightweight materials, and the integration of digital twin solutions for predictive maintenance and performance optimization. The openZDM platform's capabilities in data analytics, quality assessment, and process monitoring align with these industry trends, positioning it as a valuable solution for aerospace manufacturers.

In addition, the openZDM platform also targets niche markets such as **glass production, steel processing, and furniture industries**. While these markets may have smaller overall sizes compared to automotive and aerospace, they offer some opportunities for specialized solutions. For example, the glass production industry has increased demand for precision measurement and quality control solutions to meet stringent standards, presenting an opportunity for openZDM's thermal camera technology for glass bottle thickness measurement.

Target market: Glass production

The global **glass production** market size was valued at $106 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 5.2% from 2022 to 2030 [4]. In this industry, glass manufacturers are adopting automation and digitalization technologies, including advanced sensing and monitoring solutions, to enhance operational efficiency and product quality.

Target market: Steel processing

The global **steel processing** industry, valued at $647 billion USD in 2021, is pivotal for construction, infrastructure, automotive, and various sectors [5]. Key trends include technological advancements like Industry 4.0 adoption and a focus on environmental sustainability. Demand is driven by construction, automotive, aerospace, and manufacturing sectors, spurred by urbanization and infrastructure development. Growth drivers encompass infrastructure investments, automotive demand, urbanization, and industrialization. Challenges include overcapacity, fluctuating raw material costs, regulatory compliance, and intense competition, driving consolidation. Global trade dynamics, influenced by policies and geopolitical tensions, also impact the industry, necessitating strategic adaptation for stakeholders.

Target market: Furniture manufacturing industry

Turning to the **furniture manufacturing industry**, its global market size was valued at $ 548.38 billion in 2021 and is expected to reach $780 billion by 2030, with a CAGR of 5.1% during the forecast period [6]. This industry is witnessing a rapid shift towards e-commerce and digitalization, with consumers increasingly purchasing furniture online and seeking digital tools for product visualization, customization, and virtual room planning. Sustainability is a key focus area within the furniture industry, driving demand for energy-efficient production processes, and circular design principles that prioritize product recyclability and resource efficiency. Furniture manufacturers are also incorporating smart technologies such as IoT sensors, wireless charging capabilities, and integrated multimedia systems into their products to enhance functionality, comfort, and convenience for consumers.

3.4.2 Key Trends on the core markets targeted by openZDM

For the automotive manufacturing industry:

- Increasing vehicle production and adoption of advanced manufacturing technologies.

- Growing demand for smart manufacturing solutions to enhance efficiency and quality control.
- Integration of IoT and data analytics for predictive maintenance and process optimization.

For the smart manufacturing industry:

- Emphasis on digital transformation to boost productivity and competitiveness.
- Adoption of Industry 4.0 technologies, including advanced sensing and monitoring solutions.
- Focus on sustainability and the rise of smart factories.

For the aerospace manufacturing industry:

- Adoption of additive manufacturing technologies.
- Development of lightweight materials.
- Integration of digital twin solutions for predictive maintenance and performance optimization.

For the glass production industry:

- Demand for precision measurement and quality control to meet stringent standards.
- Adoption of automation and digitalization technologies for enhanced efficiency and quality.

For the steel processing industry:

- Technological advancements and Industry 4.0 adoption.
- Focus on environmental sustainability.
- Growth driven by urbanization, infrastructure investments, and industrialization.

For the furniture industry:

- Emphasis on sustainability, energy-efficient production processes, and circular design principles.
- Incorporation of smart technologies such as IoT sensors, wireless charging, and integrated multimedia systems for enhanced functionality.

3.4.3 Competition analysis and market insight from the openZDM exploitation survey

Through the exploitation survey, we delve into the details of market analysis, examining factors such as market maturity, competition, and demand for each ER within the openZDM project. These fields were selected because they address also the aspects of market analysis covered by the Innovation Radar questionnaire. This analysis provides invaluable insights into the diverse landscapes of emerging and mature markets, as well as opportunities for market creation, guiding our strategic approach towards effective commercialization and exploitation strategies. Moreover, the integrated openZDM platform presents a robust solution for Zero-Defect Manufacturing, offering comprehensive quality assessment and control functionalities. Key competitors in this domain include established players such as Siemens with their Siemens Digital Industries Software suite and Dassault Systèmes with their DELMIA Apriso platform. However, openZDM distinguishes itself through its interoperability, modular architecture, and focus on real-time adaptation, providing a competitive edge in addressing evolving industry needs. In general, based on the exploitation survey results, some key insights are:

- Results such as IoT portable laser line triangulation for gap and flush, 2D Camera application for welding process monitoring, and Digital twin toolset demonstrate an emerging market trend. There is a gradually growing demand for these solutions, with only a few offerings available. The market sizes for these results range from 5 to 10, indicating moderate to significant potential.

- Results like Laser line triangulation system – low temperature and Data-driven analytics for quality assessment are situated in mature markets. These markets are already supplied with many alternative products, suggesting a higher level of competition. However, there is still room for innovation and improvement. The market sizes for these results range from 5 to 8, indicating moderate to large market sizes.
- The survey results also indicate that the market size of the platform could be significant – addressing several niches and use cases (average response 7 out of 10), while the competition is mild with not many similar alternatives available (average response 6 out of 10).

In terms of market conditions, our internal analysis that the market for openZDM innovations is emerging considering that the various tools will be offered via the platform. The survey results are highlighted in Figure 18.

Figure 18: Survey results on the trends of the openZDM market

3.5 openZDM Exploitation Cases

The set of ERs and KERs have some specificities that suggest different exploitation paths for each result. The variety of the consortium's types of organisations suggests varying business needs and objectives. For instance, a research institution or a university has different exploitation paths and follows different business models compared to private companies. This implies that when designing the exploitation strategy of the project, we need to consider various models and revenue streams that align with the business specificities of each partner. To do this analysis we relied primarily on the outcomes of the exploitation workshop and the different business model practices followed depending on the organisation types. In openZDM, we can identify 4 organisation types/ exploitation paths, where each path implies the use of different business models and monetisation strategies. These strategies and models are summarised in Figure 19.

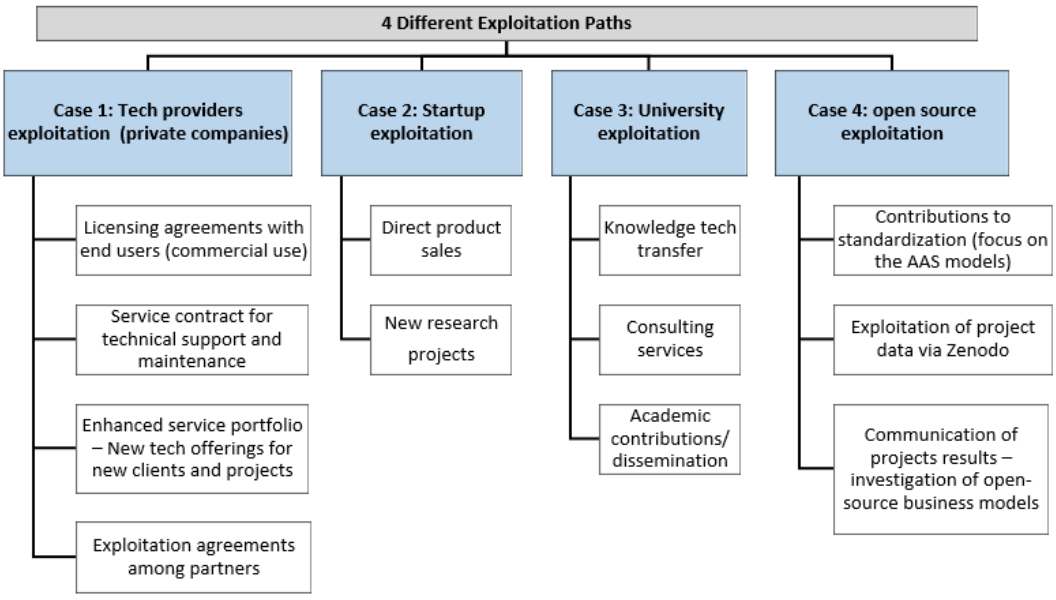

Figure 19: openZDM main exploitation paths and monetisation strategies.

- **Case 1 – Tech-providers exploitation**: Private companies of the consortium acting as technology providers can leverage licensing agreements with end users for commercial use. These agreements would pave the way for revenue generation through the provision of services such as technical support and maintenance (licencing fees to be determined on separate agreements with potential customers, pending on the usage level). Furthermore, tech providers could leverage their expertise to expand their service portfolio, introducing novel technological offerings to both existing and new clients. Collaboration is key in this domain, as we will also investigate exploitation agreements among partners to foster mutual growth and innovation.
- **Case 2 – Startup exploitation**: In the startup exploitation case within the openZDM project, start-ups in the openZDM consortium emerge as promising players with an already established product undergoing further development and pilot testing, particularly in the automotive sector. Notably, openZDM use cases could serve as initial adopters of the product, utilizing it within its production lines, thereby validating its potential for industry use. With a large EU corporation expressing interest in the novel product for NDI tools a lucrative exploitation opportunity arises, emphasizing direct product sales as the primary revenue avenue for this case, facilitated by the openZDM project. This scenario also underscores the project's role in supporting market adoption and fostering innovation-driven partnerships between startups and established industry players.
- **Case 3 - University exploitation**: The universities and research organisations of the consortium will primarily leverage an IT consulting business model, and if the opportunity arises, technology transfer to EU companies. These partners will capitalize on their intellectual assets through the dissemination of knowledge and expertise, offering consulting services to industry partners seeking specialized insights. Academic contributions and dissemination efforts play a pivotal role in advancing research and fostering collaboration between academia and industry.
- **Case 4 - Open-Source exploitation**: Apart from the commercial aspects, the knowledge and some data created in openZDM could be used for open-source exploitation. This primarily includes some datasets that will be openly available to be used for academic research or commercial purposes (e.g., training AI models in manufacturing), as well as knowledge of standardisation for AAS. Contributions towards standardization, with a focus on AAS models, serve as building blocks for interoperability and innovation. Through platforms like Zenodo, project open datasets (which can be disclosed, not including any personal or confidential information) will become accessible to a broader audience, nurturing a culture of openness and knowledge exchange.

3.5.1 Open-access data in openZDM

The project also leverages open access data created via its technical activities and pilot use case implementations, to enhance transparency and innovation within the zero-defect manufacturing domain. The types of data that could be offered openly include (non-confidential) non-destructive inspection (NDI) tool outputs, process optimization datasets, machine learning models, and technical performance metrics. Key stakeholder groups of the project such as academic researchers, manufacturing SMEs, industrial automation companies, and software developers could exploit this data. They can utilize these datasets to benchmark performance, develop and refine predictive maintenance algorithms, create innovative manufacturing solutions, and improve existing production processes. In the frame of the project's data management activities, partners will systematically analyse any pertinent datasets internally, to determine which data can be shared openly, considering the confidentiality of industrial information. Following this, selected datasets will be uploaded to the openZDM dedicated **Zenodo page**. This will ensure transparency while respecting confidentiality, particularly crucial given the industrial nature of the data involved. So far, two datasets that are characterised as 'open' have been uploaded on the project's Zenodo page, as presented in Table 25.

Table 25: openZDM Open Data on Zenodo

#	Dataset Name	Link	DOI	Type	Stakeholders targeted	Stakeholders reached so far
1	Thermal images of steel bars	LINK	10.5281/ zenodo.10056653	CSV	Steel manufacturing companies, research institutions, quality control experts	139
2	Thermal Images of glass bottles	LINK	10.5281/ zenodo.8320253	jpg	Glass manufacturing companies, research institutions, quality control experts	36

Dataset #1 consists of thermal images of steel bars captured using an Optris PI 1M thermal camera with a spectral range of 0.85-1.1 µm and a temperature range of 500 - 1800°C. Each file contains temperature matrices

of the scene, including the "hot" calibrated steel bar and the "cold" background, with images acquired during both transient and stationary stages of the manufacturing process. The dataset includes timestamps, number of images, and product types for each date of acquisition. The files are stored in CSV format and are accessible through the provided links, categorized by product type. This dataset could be utilized by researchers in materials science, manufacturing engineers, and software developers for tasks such as analyzing temperature distributions during production processes, developing predictive maintenance algorithms, and optimizing manufacturing parameters to enhance efficiency and quality control. Dataset #2 comprises thermal images of glass bottles, obtained as part of one of the openZDM project's use cases. The files are stored in a zip archive titled "5153_noID_16-03-2023.zip," with a size of 701.7 MB. Additionally, metadata is provided in a separate file named "Metadata.txt." It could be utilized by researchers in packaging design and machine learning specialists for tasks such as analyzing thermal properties during production, detecting defects or irregularities in bottle manufacturing, and training AI algorithms for automated inspection processes.

To expand our dataset repository on Zenodo, we have developed an .xslx template, and shared and discussed with project partners, to facilitate the identification and upload of additional open data. Each Work Package leader will oversee the identification process within their respective Work Package, ensuring GDPR compliance and maintaining the confidentiality of industrial data. The template includes fields for Dataset Title, Description, Dataset Owner/Contributor, Related Task(s), Dataset Format, Dataset Size, Keywords/Tags, License, Version Number, Status, Date Uploaded, DOI, and Comments, providing a framework for collecting and organizing open data contributions.

3.6 Individual Exploitation Plans per Partner

Furthermore, we also run an important exercise to investigate partners' preferred exploitation plans per ER. Partners indicated how they wished to exploit the results after the end of the project via the exploitation survey; the underlying intentions are presented in Table 26.

Table 26: openZDM Partners' Individual Exploitation Plans.

Partner	Exploitation Plan for the openZDM ERs
LMS	• Direct sales of the result. • Direct sales combined with yearly maintenance and support. • Offer consulting services via service contracts. • Provide training for the result as a service and material for training. • Perform further research and publish scientific papers in journals-conferences. • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia. • In case of joint ownership, my organisation would be willing to commonly draft an exploitation agreement. This agreement will specify the ownership status, access, and exploitation rights among involved partners after the end of the project.
VDLWEW	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners). • In case of joint ownership, my organisation would be willing to commonly draft an exploitation agreement. This agreement will specify the ownership status, access, and exploitation rights among involved partners after the end of the project.
VWAE	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners).
SONAE	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners). • Create a start-up/spin-off to exploit the result. • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia. • Perform further research and publish scientific papers in journals-conferences.
VIDRALA	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners).
INTRA	• Licensing of the result via licensing agreements. • Offer consulting services via service contracts.

Partner	Exploitation Plan for the openZDM ERs
	• Offer technical integration and maintenance services via service contracts We have in mind a funded research project where the result can be used as background IP.
USIT	• Direct sales of the result. • Direct sales combined with yearly maintenance and support.
AIMEN	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners). • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia. • Exploitation via standardisation bodies. • Perform further research and publish scientific papers in journals-conferences. • Open-source exploitation - offer the result through an open-source license (e.g., available on GitHub, Zenodo, etc.).
INDUCTION	• Direct sales combined with yearly maintenance and support.
HABBER TEC	• Offer technical integration and maintenance services via service contracts. • Direct sales combined with yearly maintenance and support.
MSI	• Direct sales of the result. • Direct sales combined with yearly maintenance and support. • Offer consulting services via service contracts. • Offer technical integration and maintenance services via service contracts. • Further exploitation needs a budget in people (manhours). • Further exploitation needs 3rd party costs (infrastructure - hardware - training venues etc.). • We have in mind a funded research project where the result can be used as background IP. • Open-source exploitation - offer the result through an open-source license (e.g., available on GitHub, Zenodo, etc.).
F6S	• Academic exploitation via publications of scientific papers, material for new courses, links between industry and academia. • Open-source exploitation - offer the result through an open-source license (e.g., available on GitHub, Zenodo, etc.).
TECNALIA	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners). • Licensing of the result via licensing agreements. • We have in mind a funded research project where the result can be used as background IP. • Perform further research and publish scientific papers in journals-conferences.
UNIPVM	• Offer consulting services via service contracts. • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia. • Perform further research and publish scientific papers in journals-conferences.
IPB	• Offer consulting services via service contracts. • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia.
COMAU	• Direct sales of the result. • Direct sales combined with yearly maintenance and support. • We have in mind a funded research project where the result can be used as background IP.
UPORTO	• Create a start-up/spin-off to exploit the result. • Academic exploitation via publications of scientific papers, material for new courses, and links between industry and academia. • Perform further research and publish scientific papers in journals-conferences. • Open-source exploitation - offer the result through an open-source license (e.g., available on GitHub, Zenodo, etc.). • We have in mind a funded research project where the result can be used as background IP.
APTIV	• Main exploitation will be internal as an end-user of the result (to establish exploitation agreements with involved partners). • Licensing of the result via licensing agreements.

Partner	Exploitation Plan for the openZDM ERs
	• Offer consulting services via service contracts. • Offer technical integration and maintenance services via service contracts. • Further exploitation needs a budget in people (manhours). • Further exploitation needs 3rd party costs (infrastructure - hardware - training venues etc.).

3.7 Initial market uptake scenarios and openZDM Business Model

For the eight KERs identified in Section 3.3, we have already considered some aspects of their business models to support their commercialisation after the project. Based on the business model canvas, we specifically focus on the core aspects of a business model, meaning (i) how the KER can be channelled/ delivered to the customer, and upon reaching the customer, (ii) how the KER could be sold to create value (monetisation strategy per KER). Moreover, before answering these questions, we added an additional dimension to our analysis, which revolves around the IPR protection measures to be used for each KER. IPR protection is essential to safeguard knowledge and exploitation rights among partners. Some further details that we considered for the results are the following:
Channels to Promote the Results per Result:

- Each KER within the openZDM may require tailored promotion channels based on its target audience and industry niche.
- For instance, results targeting the automotive sector may benefit from promotion through industry-specific trade shows, online forums, and partnerships with automotive manufacturers and suppliers.
- Results aimed at academia could leverage channels such as academic conferences, research publications, and collaborations with universities and research institutions.
- Most importantly, project ER will be shared across the openZDM use cases, internal meetings/forums and events.

Selling Models per Result & Aggregated Selling Channels:

- The choice of selling models for each result may vary depending on factors such as the nature of the solution, target market, and exploitation agreements.
- Direct sales, licensing agreements, subscription-based models, and revenue-sharing arrangements are potential selling models that will be considered.
- Aggregating selling channels can involve establishing partnerships with distributors, resellers, and online marketplaces to reach broader markets efficiently.

Considerations for exploiting the openZDM platform:

- Selling the openZDM platform as a whole requires highlighting its comprehensive suite of solutions that will be provided to diverse industries and applications.
- Leveraging a solution-based approach, and showcasing the platform's versatility, scalability, and customization capabilities can appeal to potential buyers across various sectors.
- Given the broad range of tools and application areas of the platform, it could be offered to customers as a service bundle. Customers can pick selected services to access and pay for them, and this implies automatically the creation of a service bundle, with the tools and technologies needed for that application. For instance, separate service bundles can be created for the pilot application areas, like automotive, glass production, steel processing, woo-based panels processing and electric batteries production.
- Offering flexible pricing models and ongoing updates and enhancements can enhance the platform's market competitiveness and long-term sustainability. Two models could be used: a licensing model for using the service bundle from the openZDM platform, and IT service contracts for additional functionalities and further development. Also, maintenance and local installation of the platform could be part of the licensing option.
- Collaborating with industry partners, engaging in targeted marketing campaigns, and participating in relevant industry events can amplify visibility and generate interest in the platform among key stakeholders.

Promotion Channels of the openZDM Results for Stakeholders Engagement
We also investigate the promotional channels of our business model; this is essential as it enables organizations to identify the most effective channels for reaching their target audience and promoting their products or services. That said, the understanding of the preferences and behaviours of potential customers allows project partners to tailor their marketing efforts, accordingly, maximizing visibility and engagement. The survey results, shown in Figure 20, indicate a diverse range of promotional channels that could be leveraged for the exploitation of openZDM project outcomes. Notably, the largest proportion of respondents cited their own connections, network, and

existing customers as a key promotional channel, highlighting the value of leveraging existing relationships to drive adoption. Additionally, partnerships with other openZDM partners offer opportunities for joint exploitation agreements, extending the reach of project outcomes to new markets and audiences. Academic research organizations and governmental institutions emerge as significant channels, underscoring the importance of collaborations within the research and public sectors for promoting innovation and adoption. While less common, engagement with third-party vendors, resellers, standardization bodies, and open-source platforms like Github and Zenodo also presents valuable avenues for promoting openZDM project results, facilitating broader dissemination and adoption within relevant communities.

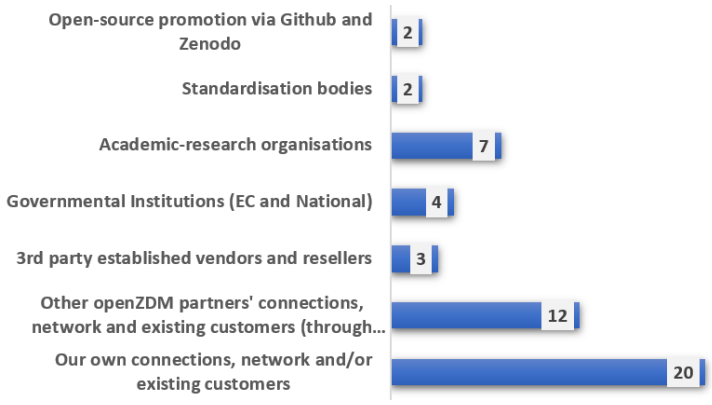

Figure 20: Survey results on the promotional channels of the openZDM ERs.

Key Target Groups and Engagement Activities

Clustered ERs	Target Groups for Exploitation	Engagement Activities/Actions
NDIs	• Manufacturing OEMs • Automotive OEMs • Steel Processing Industry	• Direct sales pitches showcasing NDI benefits • Industry-specific webinars and workshops • Participation in industry trade shows and exhibitions (e.g., Hannover Messe) • Promotion via EFFRA
Software components	• Manufacturing OEMs • Technology Integrators	• Collaboration with industry associations for promotion • Engaging with potential existing clients of industrial partners • Offering product demos and trial versions • Promotion via EFFRA
Integrated platform	• Manufacturing OEMs • IT Technology Integrators • Research and Academia	• Hosting interactive online demos of the platform • Presenting in manufacturing events media for platform exposure • Providing case studies and success stories • Collaborate with academic-research organizations and governmental institutions for promotion • Utilize open-source platforms like Github and Zenodo for broader dissemination • Share insights at the IEEE International Conference on Industrial Technology 2024 • Promotion via EFFRA

3.8 Draft Exploitation and IPR agreement plan

To ensure effective exploitation of the openZDM platform and its tools, consortium partners will try to establish an exploitation agreement. This document will outline how the platform and its ERs can be used commercially or for research post-project. It will also clarify ownership of ER and how they can be jointly or individually exploited. The agreement will set a framework for collaborative efforts, defining ownership, access rights, and use of project results and background intellectual property. It will stress maximizing commercial and societal impact while adhering to Grant and Consortium Agreements. Procedures for result exploitation, including commercialization and research/non-commercial use, will be detailed, along with provisions for confidentiality, dissemination, and IP

protection. Moreover, the agreement will establish procedures for dispute resolution, duration, termination, and amendments, ensuring clear collaboration. The following provisional plan is envisioned:

- Month 30: Share draft exploitation agreement with partners for review and feedback.
- Month 38: Legal departments of all partners review and provide input on the document.
- Month 42: Finalize and sign the exploitation agreement.

Given that the openZDM consortium is comprised of various organisations and organization types and given that several legal departments might be involved in its signature, it might be difficult to eventually sign such a document. A draft version of the agreement has been already created and partners will check it and try to align on it. If a separate agreement is not feasible in the end, all the IPR and exploitation management-related aspects of the ER will be analysed and described in detail in the last exploitation deliverable in D6.3 on M42. The provisional structure (table of contents) of the openZDM exploitation agreement that will be pursued is documented in Appendix I.

3.9 Key observations and way forward

Key Observations

Progress in Exploitation Strategy Implementation:

- The project has completed activities up to Phase 4 of the exploitation strategy, including holding an exploitation workshop, conducting market research, and devising initial business models and monetization strategies.
- 23 ERs have been identified, with a focus on NDI tools, of which 8 have been selected as KER.

Current Activities:

- Implementation of the exploitation and IPR management strategy as described in D6.1.
- Conducted a physical exploitation workshop to align on ERs and discuss pathways.
- Completed an exploitation and business modelling survey, receiving responses from all consortium partners.
- Mapped initial exploitation paths for ERs, focusing on strategies such as direct sales, licensing, and partnerships.
- Conducted market and competition analysis for the openZDM innovations and technology areas.
- Defined customer segments, stakeholder groups, value propositions, and monetization strategies per ER and the openZDM platform.

Way Forward

Based on the current progress and observations, the following activities should be implemented to ensure the effective exploitation of the openZDM project results. Activities to Be Implemented:

- Industry links and direct market feedback
- Target as a consortium to establish 5 key synergies from our existing networks, targeting mid-caps, SMEs, and start-ups in the European industry.
- Organize meetings or webinars with potential adopters and envision the first customers to present the openZDM platform and gather feedback.
- Engage with identified customer segments and stakeholders to validate the proposed business models and value propositions.
- Organize a dedicated online exploitation workshop among partners to extract optimal business models and pathways to commercialization.
- Utilize frameworks such as the Business Model Canvas (BMC), Service-Dominant Strategy Canvas (SDS), and Value Proposition Canvas to refine the strategies for each KER.
- Create detailed business models for each KER, considering factors such as pricing strategies, customer acquisition costs, and revenue streams.
- Identify potential domains and ecosystems where the openZDM platform and the ER can be replicated, in collaboration with the technical activities in WP3 and WP4. Based on the technical specificities of each ER, a table will be created that will highlight other use cases and manufacturing domains where each result can be deployed and exploited. Also, the key strategies to support each result's exploitation in other domains will be highlighted.
- Pursue the signing of the exploitation agreement by M42, following the review and approval process initiated in M30 and M38.

4 Standardisation activities

Standardisation is an important process to achieve interoperability of new technologies between the different actors in the value chain (suppliers, manufacturers, and customers). The European Union highly encourages EU-funded projects to make their results available for standardisation within various standard organizations. On the openZDM project, the standardisation activities are linked with task 6.3 which started at M19.

4.1 Methodology

The following methodology has been used to carry out the standardisation activities:

1. **Definition of objectives:** Actively contribute to the development and improvement of standards related to the 'Asset Administration Shell Structure', ensuring that project results (materials and knowledge) are integrated into future standards.
2. **Identification and analysis of existing standards:** The openZDM project focuses on two main topics of interest: ZDM, and implementing a platform based on RAMI 4.0 and AAS. To date there are no standards related to ZDM, however, there is a working group with this purpose from the European Committee for Standardisation (CEN) and European Committee for Electrotechnical Standardisation (CENELEC) - CEN/CENELEC[1].

Regarding RAMI 4.0 and AAS, the former is a standard and the latter is undergoing a standardisation process. However, AAS modelling presents an opportunity to propose the standardisation of AAS submodels to enable interoperable data sharing. Initially, efforts have been directed towards the standardisation of the submodel to describe the technical data of Non-Destructive Inspection systems (NDIs) based on machine vision systems.

To this end, the VDMA 40100-1 and VDI/VDE/VDMA 2632 standards have been identified, both of which are focused on machine vision systems. After evaluating them, the VDI/VDE/VDMA 2632 standard was chosen as the guideline for the proposed standardisation of the technical data submodel because it provides a definition of concepts that allows describing the composition of the machine vision system.

3. **Contributions to technical committees:** To this date, the openZDM project has participated in standardisation-related activities in the CEN/CENELEC working group for ZDM [2] and with the Industrial Digital Twin Association (IDTA[3]) to propose an AAS submodel for machine vision systems. These activities are further described below.

4.2 Contribution to Standardization developments

4.2.1 Contribution to ZDM with CEN/CENELEC

CEN/CENELEC working group for ZDM aims to define the basic principles of ZDM, determining if a certain technology is compatible with it and if a production complies with its principles, and is available as CWA 17918:2022.

openZDM project has been participating in this working group since March 2024, with a total of 4 partners:

- two in the Core group, responsible for technical contributions, with regular meetings every two weeks,
- and four in the consortium group, holding monthly meetings for advisory general topic discussion.

4.2.2 Contribution to AAS submodel standardisation with IDTA

The openZDM project proposes the development and use of 13 NDIs, of which 7 are based on vision techniques: 3 in the visible range and 4 in the infrared range. These NDIs based on vision techniques will be present in 3 different use cases. Since the information from these NDIs will be sent to the openZDM platform and potentially shared with other platforms such as GAIA-X, it is of interest to the project to share the information coming from these devices in a standardized way. Since the openZDM platform is built based on the AAS concept, within this task was proposed an AAS submodel for the specification of technical data of NDIs based on machine vision systems.

The entity in charge of the standardisation process is the IDTA, which acts as a central point for all stakeholders. At the time of writing this deliverable, the application for standardisation of the sub-model has been submitted to the IDTA and internal meetings are being held to reach a consensus on the definition of the concepts and possible values of these concepts to be modelled in the proposal. The participation of the openZDM project in this standardisation activity is described below:

- The project has contacted the person responsible for IDTA for the AAS submodel standardisation process,
- The form for the standardisation of the AAS submodel has been filled out,

- Internal meetings have been held between project members to draft a proposal,
- A draft of the standardisation proposal has been sent to IDTA.

4.3 Steps moving forward

The next steps to be taken in the next 6 months within the task of standardisation activities are:

- The openZDM project will continue its participation in the CEN/CENELEC working group to define the basic principles of zero-defect manufacturing, contributing expertise by project members.
- The AAS submodel standardisation process is an iterative process in which feedback is usually received from IDTA on the submodel design, so it is expected that this process will continue in the coming months.
- Contacting other entities/SDOs to enable the openZDM project to participate in other standardisation activities. For this, 2 other opportunities for participating in standardisation initiatives were identified: **STAND4EU** [7] identifies the bottlenecks that hamper the interaction between research and innovation and standardisation and will formulate remedies and recommendations that will close the gap between research and standardisation actors and processes. **HSbooster** is a 30-month European Commission initiative that will provide the European Standardisation Booster. The booster provides expert services to European projects to help them increase and valorise project results by contributing to the creation or revision of standards.

5 Conclusions

This deliverable highlights the comprehensive efforts undertaken to advance our project's objectives and foster meaningful engagement with key stakeholders addressing communication, dissemination, exploitation and standardisation activities. Through a combination of strategic partnerships, targeted outreach, and inclusive practices, we have made significant strides in providing meaningful impact for our research outputs, fostering collaborations, and promoting knowledge exchange.

Our success in engaging academic, industry, and community stakeholders highlights the project's relevance and impact within the European manufacturing ecosystem, while also positioning it for continued growth and sustainability. Moving forward, we remain committed to building upon these achievements and further strengthening our project community. With the ongoing efforts to expand our network of collaborators, enhance the accessibility and visibility of our project’s results, and deepen our engagement with diverse stakeholder groups.

Additionally, we recognize the importance of continually evaluating and refining our strategies to ensure alignment with trends, stakeholder needs, and broader societal goals. By embracing continuous improvement and inclusivity, we are aiming to maximize the impact of openZDM and contribute meaningfully to advancing knowledge and innovation.

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Appendices

Appendix I: Structure of IPR and Ownership Identification Agreement

Description: This Memorandum of Understanding (MoU) for the Exploitation Agreement shall establish the terms and conditions related to intellectual property rights, ownership, and exploitation of results for the openZDM project among the participating partners. It outlines definitions, ownership rights, exploitation methods, confidentiality, intellectual property protection, and dispute resolution mechanisms.

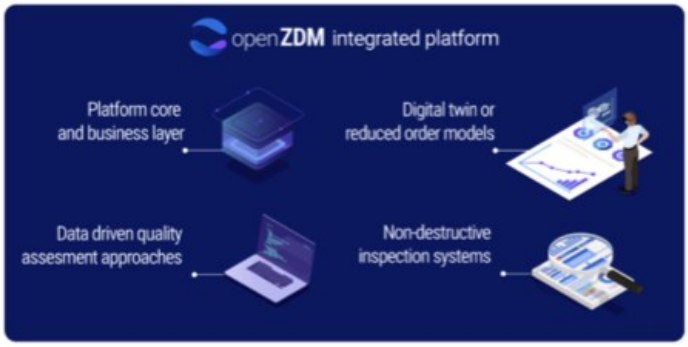
Structure of the document:

- **Recital**: Introduction and context of the MoU, including project details and parties involved.
- **Article 1 - Definitions**: Clarifies key terms used throughout the agreement such as Intellectual Property, Results, and Background Intellectual Property.
- **Article 2 - Background**: Describes the background intellectual property relevant to the project and the access rights to it.
- **Article 3 - Results**: Lists the specific results of the project and their descriptions.
- **Article 4 - Ownership and Access Rights**: Details the ownership structure (sole or joint) and the associated rights and obligations.
- **Article 5 - Exploitation**: Specifies the rights and processes for exploiting project results, including commercial and non-commercial use.
- **Article 6 - Confidentiality** - Dissemination: Sets out the confidentiality obligations of the parties and conditions for dissemination of results.
- **Article 7 - Intellectual Property Protection**: Covers the protection, filing, and prosecution of intellectual property, including responsibilities and cost-sharing.
- **Article 8 - Duration, Termination, and Amendments**: Outlines the duration of the agreement, termination conditions, and procedures for amendments.
- **Article 9 - Applicable Law and Settlement of Disputes**: Defines the governing law, dispute resolution process, and arbitration procedures.
- **Article 10 - General**: Includes miscellaneous provisions such as adherence to agreements, press releases, and the legality of provisions.
- **Signatures**: Section for authorized representatives of each party to sign and formalize the agreement.

Appendix II: 1st Newsletter

Welcome to the openZDM world

The open platform for realising zero defects in cyber-physical manufacturing



What do we do?

openZDM aims to provide an open platform solution for European manufacturers that delivers high-quality products, minimises waste, and energy consumption while maximising efficiency and return on investments. Trough five industrial pilots in real-life operational conditions the initiative will test and finalize the technological tools and facilitate the adoption of the **openZDM** solution. Additionally, by focusing on the "grand challenge" of **sustainable manufacturing** **openZDM** intends to significantly improve the production sustainability of cyber-physical production systems.

Discover more

Highlights

openZDM website is officially live

Take a quick look at our freshly launched website and find out all

Second General Assembly Meeting

The past 22 and 23 November, the openZDM team gathered in beautiful

Figure 21: 1st Newsletter.

Appendix III: 2nd Newsletter

openZDM

Digital Manufacturing Industrial Summit

Through the eyes of the openZDM team

If you are coming from the world of engineering or manufacturing, Digital Manufacturing Industrial Summit (DMIS), organised from 25th to 27th of April in Valencia (Spain) and hosted by Universitat Politècnica de València (UPV), was the place to be! At this event, key Digital Manufacturing stakeholders joined to network and discuss the latest trends on the field. **Networking with other (zero defect) manufacturing key players and enthusiasts is something we aim at, so of course we were there, too.**

Discover more

Stay in the manufacturing loop

Read the most recent openZDM blog articles

How is Industry 4.0 disrupting the European manufacturing ecosystem?

The **Industrial Revolution** has been changing over the centuries with faster and faster technological innovations. In this article, learn more about the Fourth Industrial Revolution, its aspects, trends, benefits and inevitable impact.

Improving Quality Control in the Manufacturing Industry through Digital Twins

In the fourth Industrial Revolution, Digital Twin solutions are constantly emerging in smart factories. Within this article, we discover the concept behind Digital Twins and why it has a great potential to improve the Quality Control process of a manufacturing business.

Figure 22: 2nd Newsletter.

Appendix IV: 3rd Newsletter

openZDM

Interview with the openZDM Project Coordinator

It was our greatest pleasure to interview Dr Nikos Nikolakis, openZDM Project Coordinator and to learn more on his standpoint about manufacturing trends and the role of the openZDM project in this innovative industry.

Here is what we found out. 🙌

openZDM Video

Learn all about our innovative platform

The Manufacturing Partnership Day

Through the eyes of the openZDM team

The manufacturing industry is at the forefront of innovation and technological advancements, shaping the way products are designed, produced, and delivered to consumers. To gain insight into the latest trends, strategies and opportunities in manufacturing, we were eagerly looking forward to The Manufacturing Partnership Day, where openZDM Coordinator talked about openZDM's approach in pursuit of Zero-Defect Manufacturing.

Figure 23: 3rd Newsletter.


openZDM