Deliverable 5.3

Annual dissemination, standardization and marketing report v2

WP5: Impact Creation, Solutions Scale-up and Exploitation

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Document History

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Executive Summary

This document presents the dissemination, standardization and marketing activities conducted in the scope of the second year by the project partners. It highlights key outcomes as well as achieved milestones through online and offline dissemination and communication outlets of the project (e.g., social media channels – Facebook, LinkedIn and X, website, newsletters, etc.) as well as the participation in events and clustering activities. Additionally, it presents the scientific publications in peer-reviewed conferences and journals as well as the newly developed material that is being utilized during the project. In summary, it presents all evolutions and progress conducted between months 12 (January 2024) and 24 (December 2024) building upon the deliverables D5.1 Dissemination, Standardization and Marketing Plan and D5.2 Annual dissemination, standardization and marketing report v1.

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Acronyms and Abbreviations

Acronym	Description
AAS	Asset Administration Shell
AI	Artificial Intelligence
DPP	Digital Product Passport
DT	Digital Twin
CRIS	Circular and Resilient Information System
D&C	Dissemination and Communication
EC	European Commission
EEIG	European Economic Interest Grouping
EFFRA	European Factories of the Future Research Association
EU	European Union
IDO	Industrial Data Ontology
IIC	Industrial Internet Consortium
IoT	Internet of Things
IS	Information Systems
ISO	International Standards Organization
KPI	Key Performance Indication
MILP	Mixed Integer Linear Programming
PSM	Process Simulation and Modelling
SMEs	Small and Medium Enterprises
SRM	Secondary Raw Material
ZDM	Zero Defect Manufacturing
WEEE	Waste from Electrical and Electronic Equipment
WP	Work Package

1   Introduction

1.1   Purpose and Scope

This document constitutes the second version of the report that results from Task 5.1 – Industrial and Scientific Dissemination Activities, which started from Month 1 of the project, intending to orchestrate all Plooto dissemination and communication activities targeting industrial and scientific communities based on the strategy and plan defined in deliverable D5.1 Dissemination, Standardization and Marketing Plan. It reflects the progress during M12-M24 and, in parallel, briefly presents the cumulative respective results from M1-M12 for continuity. Furthermore, this document also reports the results from Task 5.3 Standardisation Industry Commons Initiatives in a similar manner. Lastly, this document provides the list of all scientific publications made by the Plooto partners during the second year as well as the status of all KPIs relevant to dissemination and communication.

1.2   Relation with other deliverables

This deliverable is the second of the three (3) versions of the annual dissemination, standardization and marketing that report on the corresponding activities accomplished by the Plooto consortium each year. As such, this deliverable follows the strategy and plan defined in D5.1 Dissemination, Standardization and Marketing Plan.

1.3   Structure of the document

The rest of the document is divided into six chapters:

- **Chapter 2** describes the communication activities conducted up to month 24.
- **Chapter 3** describes the dissemination activities conducted up to month 24 showcasing events and scientific publications.
- **Chapter 4** presents the work relevant to the standardization activities.
- **Chapter 5** aggregates the dissemination and communication KPIs and reports their status
- **Chapter 6** concludes the deliverable and presents the next steps

2 Communication Activities (M12 – M24)

2.1 Project Website

The Plooto website (Plooto-project.eu) serves as the main online channel for raising awareness about the project. During the M12-M24 period, it has been consistently updated with more content reflecting the current evolutions of the project in due course. The main changes are reflected in the News&Events section, where 24 new blogposts have been created and shared in the second year of the Plooto project, highlighting the key progress made in the respective period. Most of the blogposts have been written with the support of all partners and are as follows:

1. Digital Product Passport – A Pathway to Circularity and Sustainability in Modern Manufacturing
2. 2nd Plooto Newsletter
3. Enabling sustainability and resilience in industries through the value chains' circularity and digitalisation
4. Advancing sustainability in industrial supply chains by embracing circular approaches & digital transformation
5. Optimization of Zero Defect Manufacturing Strategies: A Comparative Study on Simplified Modeling Approaches for Enhanced Efficiency and Accuracy
6. A Systematic Analysis for Mapping Product-Oriented and Process-Oriented Zero-Defect Manufacturing (ZDM) in the Industry 4.0 Era
7. A Readiness Level Assessment Framework for Zero Defect Manufacturing (ZDM)
8. Human Factors in the Design of Advanced Quality Inspection Systems in the Era of Zero-Defect Manufacturing
9. Envisioning maintenance 5.0: Insights from a systematic literature review of Industry 4.0 and a proposed framework
10. A Rula-based Assessment Framework based on Machine Vision and Zero-Defect Manufacturing 4.0 Initiative
11. D&C for EU Funded Projects: Towards an Integrated Omnichannel Dissemination and Communication Framework
12. Ljubljana Consortium Meeting
13. 3rd Plooto Newsletter
14. REUSE OF UNCURED PREPREG WASTE FOR DRONE PRODUCTION
15. Plooto is almost at its half point – a message from Maggioli
16. Frontier Innovations on Plooto Analytics
17. AEGIS on the Plooto Blockchain
18. TUV AUSTRIA HELLAS on Plooto process verification
19. TUC on Elevating Process Simulation, Traceability and Circularity Assessment of Industrial Value Chains through the HEU Plooto project
20. IDC on DPPs for circular economy and market readiness

There were mainly three types of blogpost created: (a) blogposts from a partner presenting their involvement in the project anf the progress of their activities, (b) blogposts that present an accepted scientific publications, and (c) news and updates of the ongoing works of the consortium.

Indicative blogposts are presented in Figure 1: Indicative blog posts.
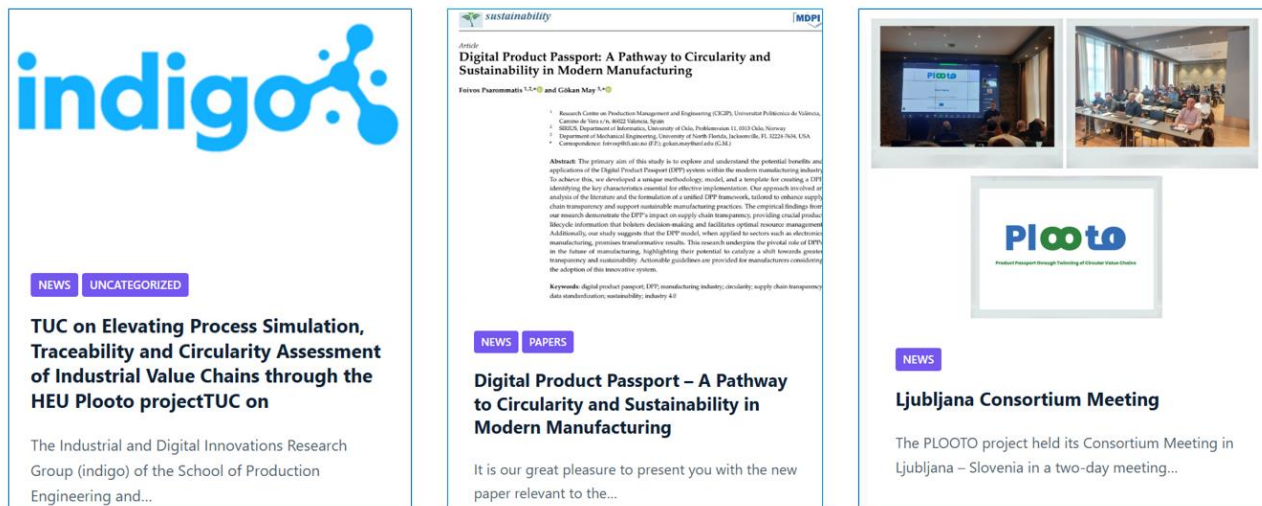
Figure 1: Indicative blog posts

Additionally, a new page was created (https://www.plooto-project.eu/deliverables/) to upload all the material produced in the course of the project, namely the public deliverables, scientific publications and related material that have been made available for interested third parties to the Plooto project.

The diffusion of the project website between M12-M24 can be seen in Figure 2. In summary, the website reached additional new users through various approaches (e.g. direct, referral, search), which showed interest in all aspects of the project (evident in the views by page) and from different places worldwide. As such, during the first two years of the project, the total number of users is 1400 (Year 1) and 1500 (Year 2), leading to **2900** for M1-M24 (as of 10th Dec 2024)
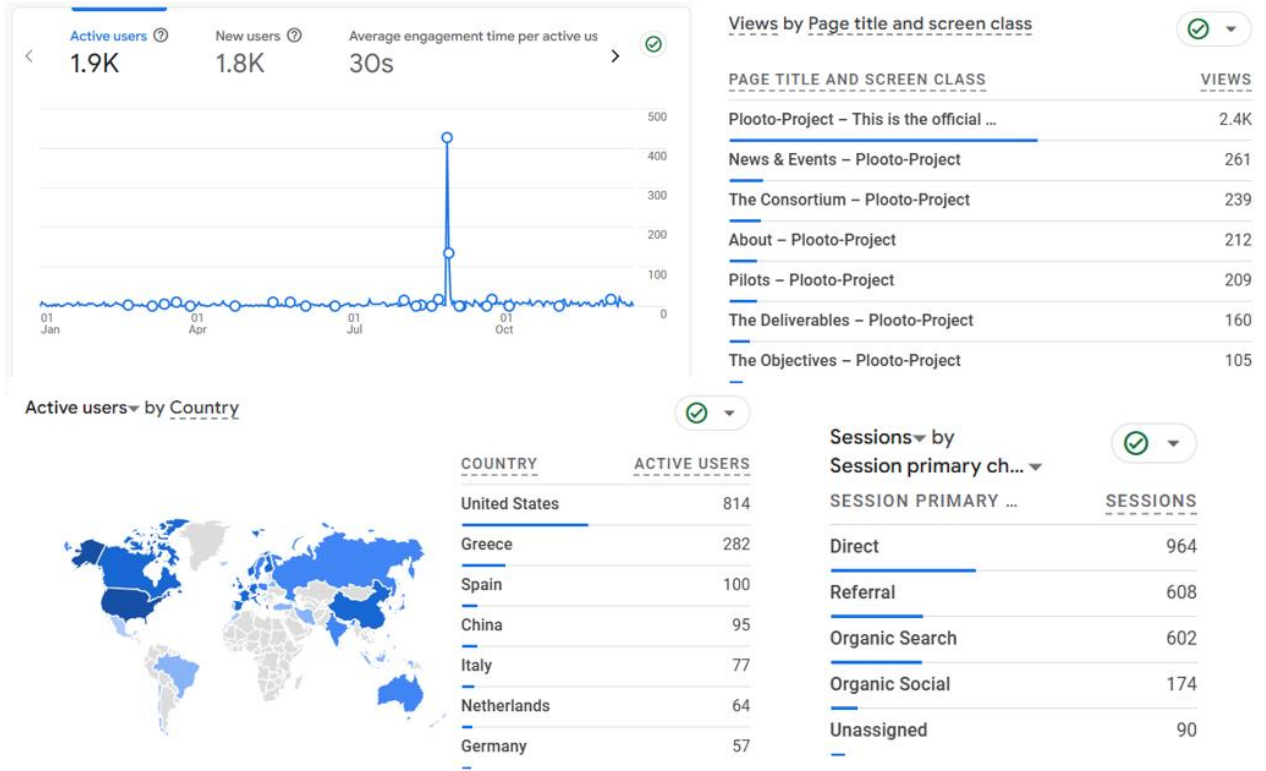
Figure 2: Plooto Website visits, geographical reach, views and traffic origin according to Google Analytics

2.2 Social Media

In parallel with the website, actions are being taken through the social media channel as well. As such this section presents all the social media outlets utilized by the Plooto project as well as the relevant activities that have taken place during the period M12-M24 as well as cumulatively up to the present time. In the following sections the updates on LinkedIn, Facebook and X are presented.

2.2.1 LinkedIn

The LinkedIn page has been operational from the starting months of the project and can be found at the following link: https://www.linkedin.com/company/plooto-project/. Its current view is presented in Figure 3.
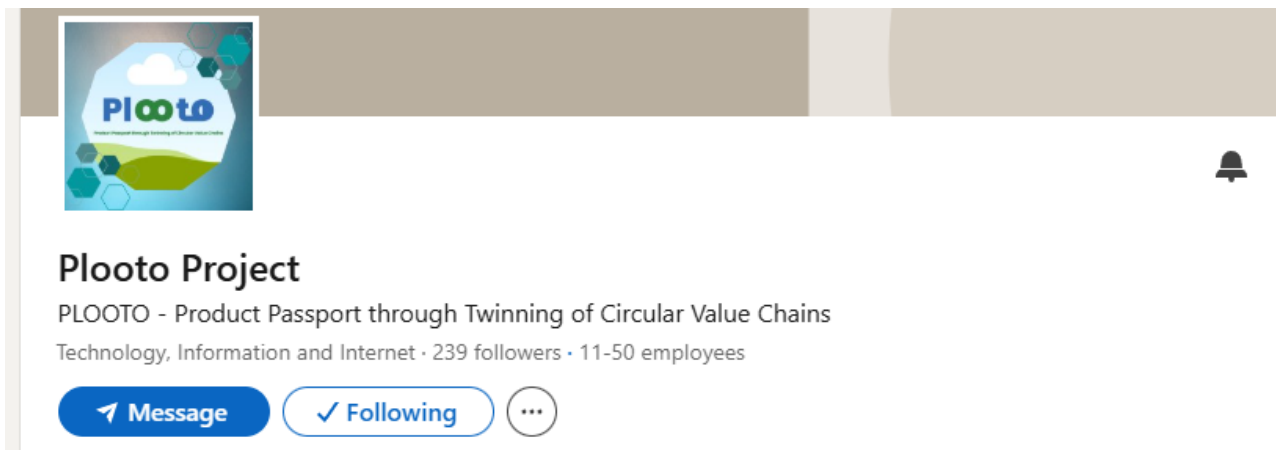
Figure 3: Plooto LinkedIn presence

LinkedIn has become a key social media outlet for Plooto, steadily gaining followers and interactions during the M12-M24 period. As shown in Figure 3, LinkedIn now has **239** followers (from 160 at M12), and Figure 4 presents the overall reach for M12-M24. The overall reach in the period of M12-M24 includes over **400** reactions and over **9500** impressions on its shared content. It merits here to present that all interactions are organic, showcasing their wide diffusion.
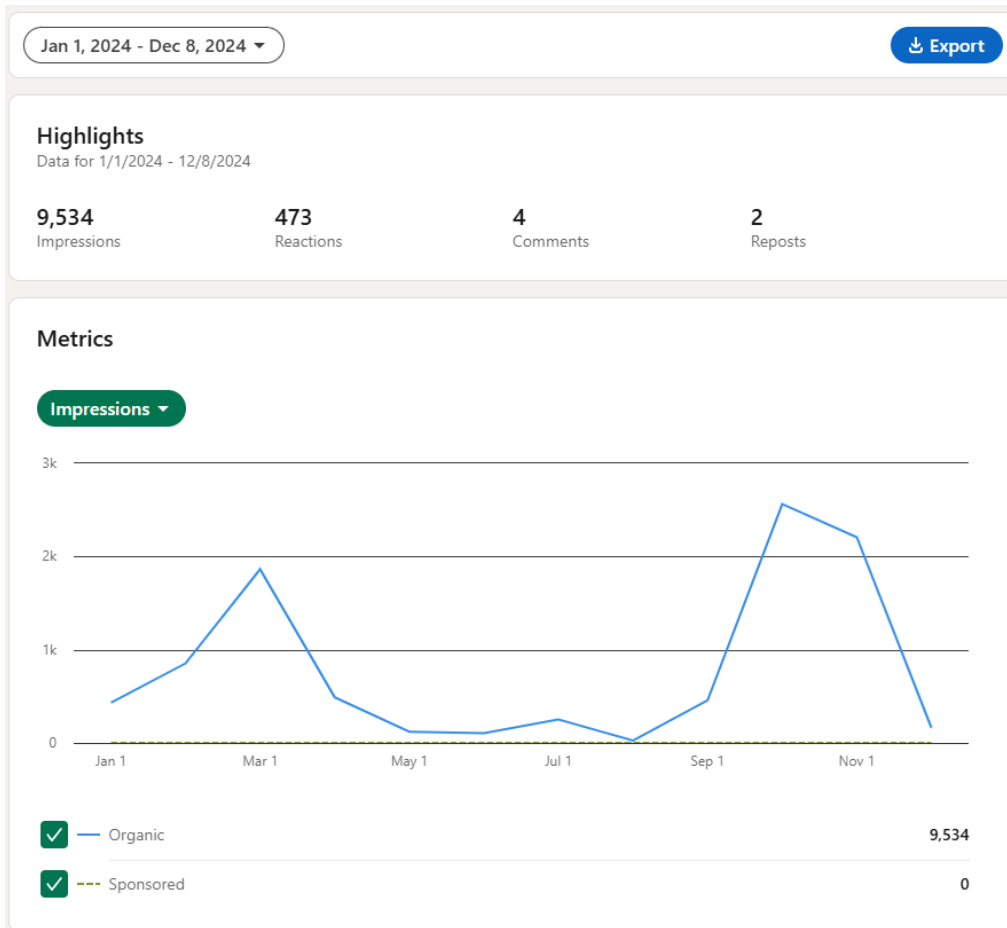
Figure 4: LinkedIn Outreach KPIs

In particular, **10** new posts have been published during the second year each of which have the following performances as presented in Table 1 (also including the M1-M12). In total, we can see that from M1-M24 the KPIs achieved include over **18000** Impressions of our content, over **700** clicks for extra information / content over **1100** reactions and over **90** reposts.

Table 1: LinkedIn Posts KPIs / M1-M12 Cumulatively and M12-M24 Individually

Year	No	Post title	Type	Impressions	Clicks	CTR	Reactions	Comments	Reposts	Engagement rate
2023	*1-26*	*Posts reported in deliverable D5.2 Cumulative results in next columns*		*9762*	*343*		*692*	*2*	*57*	
2024	27	Plooto project has already been running…	Image	500	8	1.6%	28	0	1	7.4%
	28	According to IDC global sustainability	Text	316	4	1.27%	17	0	0	6.65%
	29	In Plooto the model of DPPs…	Text	306	2	0.65%	18	0	2	7.19%
	30	Last year was wrapped with…	Image	322	3	0.9%	20	0	1	7.23%
	31	Day #1 of the Technical Meeting…	Image	462	68	14.72%	31	1	0	21.65%
	32	Day #1 for the Plooto Consortium Meeting…	Image	1368	75	5.48%	47	1	6	9.43%
	33	The PLOOTO Project held its two-day…	Image	953	70	7.35%	37	0	5	11.75%
	34	♻ Have you checked the…	Text	545	27	4.95%	25	0	2	9.91%
	35	🌐 Want to know how data can	Image	511	21	4.11%	30	1	1	10.37%
	36	How is the Plooto Blockchain reshaping	Image	359	7	1.95%	26	0	0	9.19%
	37	🚀 PLOOTO Project Update: Halfway	Text	430	14	3.26%	29	0	1	10.23%
	38	🦺 TÜV AUSTRIA HELLAS and Plooto Project…	Text	417	8	1.92%	23	0	1	7.67%
	39	🌐 Advancing Process Simulation, Traceability…	Text	778	38	4.88%	38	0	4	10.28%
	40	🌐 IDC on DPPs for Circular Economy…	Text	265	3	1.13%	18	0	1	8.3%
	41	🏭🌐 Innovative Progress in Sustainable…	Text	450	12	2.67%	30	0	2	9.78%
	42	🌐 Ingeniería Magnética Aplicada and the…	Text	610	16	2.62%	35	0	5	9.18%
	43	Don't miss the chance to…	Repost	213	4	1.88%	15	0	0	8.92%
	44	Within Plooto project…	Text	163	2	1.23%	13	0	2	10.43%
	45	The 4th Pillar "Governance of AI models"…	Text	73	4	5.48%	17	1	1	17.81%
Totals M1-M24				**18803**	**729**		**1189**	**6**	**92**	

2.2.2   Twitter – X

The X (former Twitter) page has been operational from the first half of the project and can be found in the following link : @PlootoProject. Its current view is presented in Figure 5. The main role of X, as reflected in the posts, is to diffuse the project results to a wider audience as well as to cross-polinate with other projects and industrial partners.

Figure 5: X/Twitter of Plooto Project

As seen in Figure 6 and Figure 6 the focal point of the second year was to enhance the X page with more contents, including posts from key dissemination and communication activities. As such, the X account has currently **133** Followers (M12-M24). Similarly to all social media outlets, the content that has been served through X follows the communication and dissemination plan. The overall reach of the X page includes over **7000** impressions for this period (from 1500 impressions on M12) on its shared content similarly all with organic nature. Additional KPIs for dissemination include **1.6** engagements, **848** likes, and **177** reposts of our most prominent tweets.
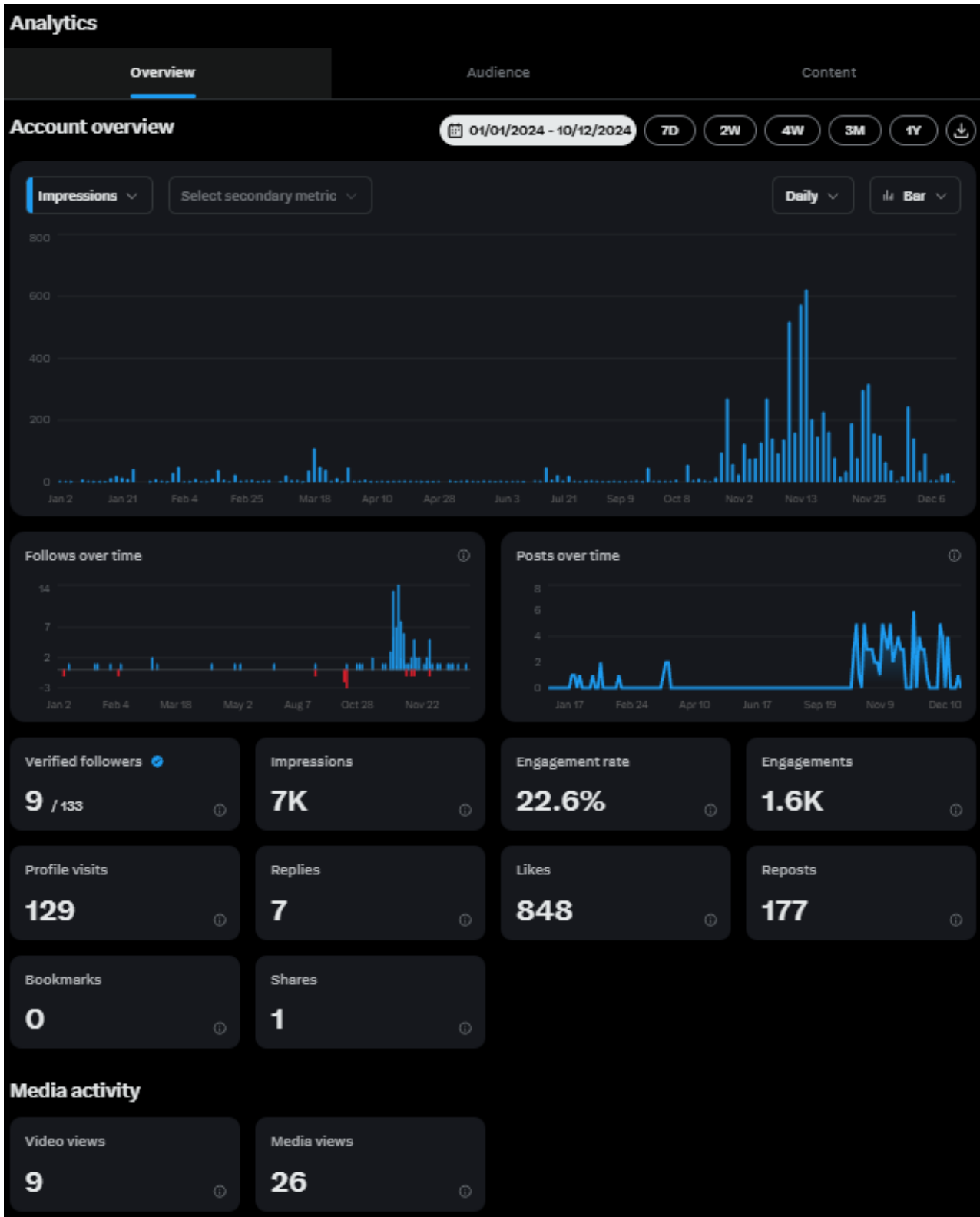
Figure 6: X / Twitter Outreach KPI

In particular, **78** posts have been done during second year of the project, each of which have the following performances as presented in Table 2.

Table 2: X Posts KPIs M1–M12 Cumulatively and M12–M24 Individually

No.	Tweet	Impressions	Engagements	Engagement Rate
1–29 (2023)	2023 Tweets reported in deliverable D5.2 Cumulative results in next columns	2224	267	
30	According to @IDC global…	53	6	11.32%
31	Indeed, circular economy	41	4	9.76%
32	After 1 year of @PlootoProject…	46	9	19.57%
33	Plooto Project promotes…	40	4	10.00%
34	Data exchange protocols…	47	8	17.02%
35	These practices involve…	41	4	9.76%
36	In Plooto Project, Cetma..	49	6	12.24%
37	#CircularEconomy…	45	4	8.89%
38	In Plooto Project, with Frontier..	50	5	10.00%
39	Our focus is on supporting…	47	5	10.64%
40	Day #1 of the Technical …	134	20	14.93%
41	Exploring the edges of innovation..	63	7	11.11%
42	Eurecat Robotics is…	71	10	14.08%
43	With the start of the new…	145	12	8.28%
44	Day #1 of the Plooto Consortium…	130	16	12.31%
45	The #PlootoProject is advancing…	51	14	27.45%
46	Transforming waste into resources…	52	14	26.92%
47	Big strides in #SustainableLogistics…	79	16	20.25%
48	Clear roles mean clear results!…	54	13	24.07%
49	Disseminating knowledge is core…	41	9	21.95%
50	Meet our trusted partner, @Gruppo_Maggioli…	52	19	36.54%
51	Digital Product Passports: the future…	49	13	26.53%
52	Circular value chains are key for a…	44	16	36.36%
53	Circularity means no resource is wasted…	45	18	40.00%
54	Thrilled to collaborate with Indigo…	51	20	39.22%
55	IMA and the #PlootoProject are revolutionizing…	40	15	37.50%
56	What is the Sustainability Balanced…	45	12	26.67%
57	Innovating in IT and cybersecurity, @AegisITResearch…	72	22	30.56%
58	A green economy is possible!…	49	12	24.49%
59	Circular supply chains are key to…	46	14	30.43%
60	@ENTERSOFT_SA empowers businesses…	47	14	29.79%
61	Meet the KPIs that matter! #Plooto tracks…	43	12	27.91%
62	Progress reports every six…	43	11	25.58%
63	@Eurecat_news drives business…	52	16	30.77%
64	KPIs for a resilient future: With…	36	15	41.67%
65	@IDC is a global leader in market…	41	11	26.83%
66	Climate change challenges us…	62	10	16.13%
67	The University of Oslo is Norway's…	83	11	13.25%
68	@Frontier_Innov drives innovation in…	55	15	27.27%
69	#PlootoProject's CRIS provides real-time…	61	30	49.18%

No.	Tweet	Impressions	Engagements	Engagement Rate
70	Data is key. #PlootoProject's CRIS uses big…	53	10	18.87%
71	Turning digital into sustainable…	57	11	19.30%
72	Europe's rare-earth supply just got a boost…	68	13	19.12%
73	@Consorzio_CETMA excels in materials…	59	9	15.25%
74	Pioneering Circular Solutions…	81	17	20.99%
75	The future of circular supply chains? Digital…	70	18	25.71%
76	Italian pilot project spotlights CFRP's…	62	14	22.58%
77	Jožef Stefan Institute is a leader…	49	10	20.41%
78	Pioneering Circular Solutions: The #PlootoProject Pilots…	70	12	17.14%
79	LCA reveals the environmental impact…	52	14	26.92%
80	Meet ASPIS—champions of Greek produce…	60	14	23.33%
81	Citrus Processing Waste: Citrus peels…	97	19	19.59%
82	#EUHaveYourSay on the future Digital Product Passport…	526	9	1.71%
83	Did you know: Starting in 2024…	129	6	4.65%
84	Data alone isn't enough…	78	9	11.54%
85	Why a #DataManagementPlan? It keeps…	83	11	13.25%
86	@CelsaGroup is a leader in circular and low…	112	15	13.39%
87	From data collection to reuse…	74	22	29.73%
88	Introducing IMDEA Networks, a leading…	58	23	39.66%
89	Excited to announce…	51	11	21.57%
90	#Collaboration is key! At #PlootoProject…	37	19	51.35%
91	Presenting CETMA Composites—Italian…	42	14	33.33%
92	Introducing HP Composites—leaders…	38	10	26.32%
93	Exciting updates! The Plooto project…	49	17	34.69%
94	Our website is live! Visit us at…	37	12	32.43%
95	Meet Acceligence—a leader in UAV solutions…	63	11	17.46%
96	KPI update: With 5,000 unique…	41	16	39.02%
97	Calling all researchers!…	49	12	24.49%
98	Introducing KPAD Ltd.—leaders in sustainable…	52	11	21.15%
99	Plooto involves clusters, associations…	30	9	30.00%
100	By engaging with the public and industry…	43	19	44.19%
101	Proud to collaborate with @TUVAUTHellas…	23	9	39.13%
102	As part of Plooto, @TUVAUTHellas will develop…	29	15	51.72%
103	#PlootoProject will deliver guidelines…	32	11	34.38%
104	The #PlootoProject, funded…	35	13	37.14%
105	#PlootoProject platform will follow…	41	14	34.15%
106	In the #PlootoProject, TUVAustriaHellas…	38	14	36.84%
107	How can digitalization drive a more sustainable…	481	26	5.41%
	Totals	**7568**	**1278**	

2.2.3 Facebook

Similarly to LinkedIn and Twitter, Facebook has been utilized to diffuse the news of the Plooto project to a wider audience and can be found at https://www.facebook.com/plootoproject. The current look of the Facebook page of Plooto is presented in Figure 7.
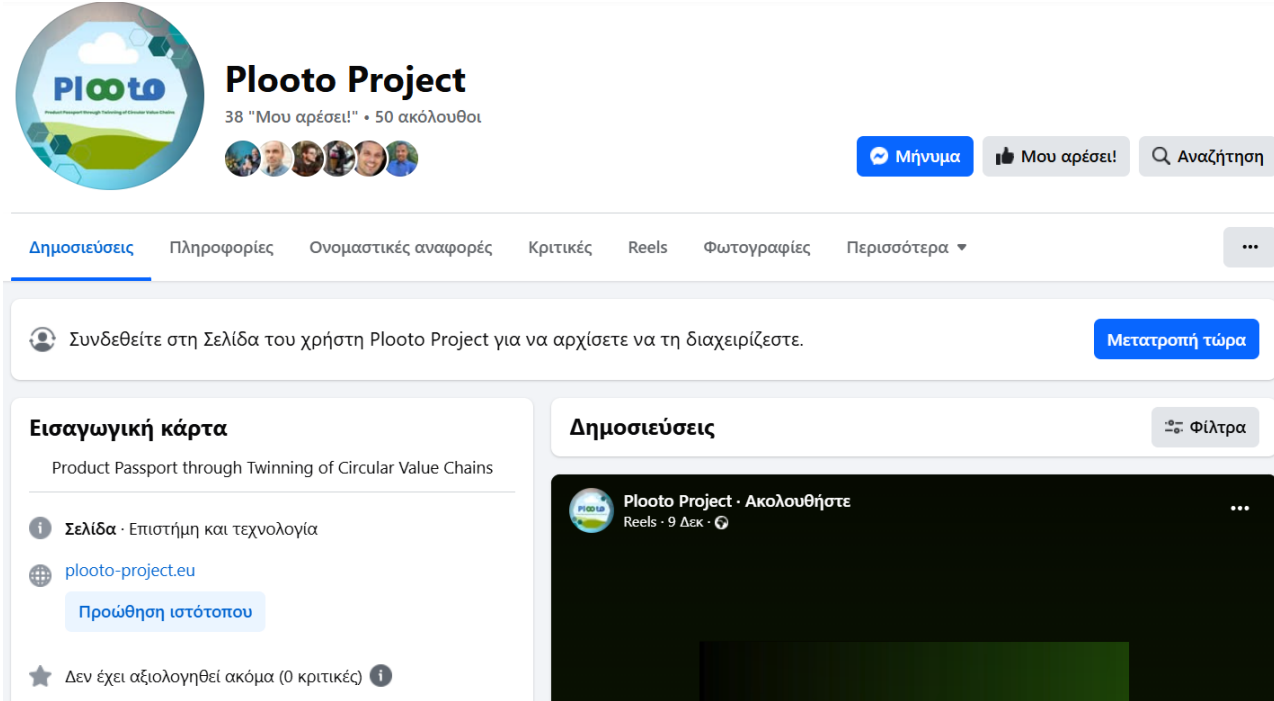
Figure 7: Facebook of Plooto project

As can be seen in Figure 8, the overall reach of the Plooto Facebook page currently includes **50** followers, having received **38** Likes as well as over **3600** total number of reach and as well as **400+** interactions (e.g. comments and shares) on its shared content. It merits here to present that also, in this medium, all interactions are organic.
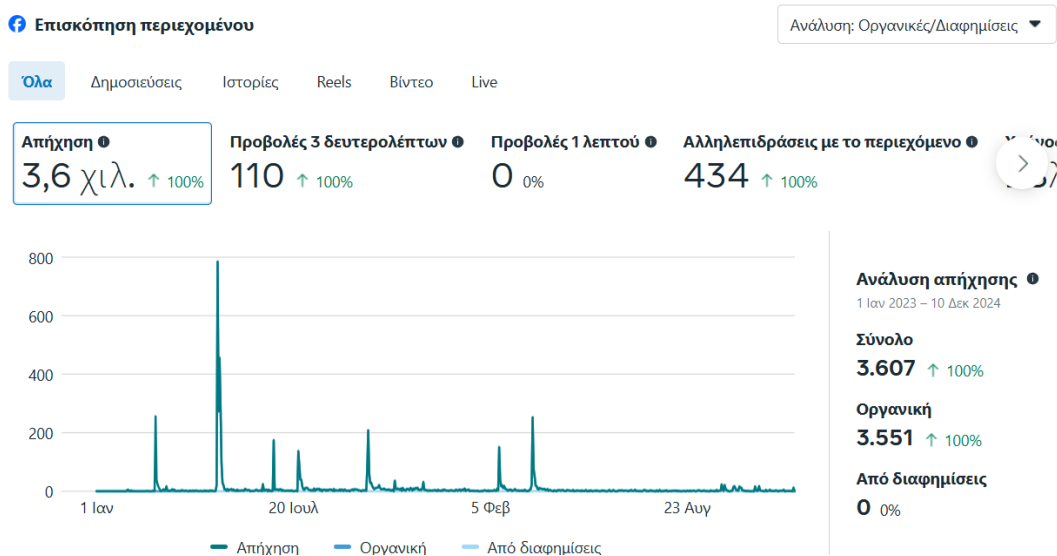
Figure 8: Facebook Outreach KPIs M12-M24 and Overall M1-M24

In particular, **17** posts have been done in the second year of the project, each of which has the following performance, as presented inTable 3.

Table 3: Facebook Posts KPIs

No	Title	Views	Reach	Engagement, Comments, Shares	Total Clicks
1-19 (2023)	**2023 Facebook posts reported in deliverable D5.2 Cumulative results in next columns**	**3610**	**2918**	**273**	**1970**
20	The group of Permanent Magnets and Applications at …	53	38	9	3
21	Two days of Plooto Project to Technical Meeting…	56	36	12	11
22	Day #1 of the Technical Meeting …	238	174	16	28
23	🌐 Eurecat Robotics is fully immersed …	73	51	14	1
24	Excited to share our latest research…	42	29	5	0
25	📈 Unlock the Power of PLOOTO Analytics …	49	41	11	1
26	🚁 Sustainable Drone Production Innovation! …	30	23	9	5
27	🚀 PLOOTO Project Update…	39	33	7	4
28	🚀How is AEGIS Revolutionizing…	26	23	7	1
29	How can the #PlootoProject reshape…	10	10	3	0
30	🌍 IMA and the Plooto Project are…	38	31	9	3
31	🏭🌍 Innovative Progress in Sustainable Logistics …	20	16	8	2
32	🌍 IDC on DPPs for Circular Economy and Market Readiness! …	25	23	5	0
33	🌍 Elevating Process Simulation, Traceability, and …	46	40	8	0
34	🚀 Want to know how TÜV AUSTRIA Hellas …	27	24	6	1
	Totals	**4382**	**3510**	**402**	**2030**

2.2.4 YouTube

The Plooto's YouTube channel (https://www.youtube.com/@plootoproject) has been created to share any video content from the project. Currently, work is being conducted to develop the first video for the Plooto project, which will be available on the YouTube channel soon. This is in the status of reviewing and post-production, which is available in the unlisted playlist: https://youtu.be/6YCEtscrGzA

Figure 9: Plooto YouTube Channel

Additionally, Plooto project partners' featured videos are planned for M24-M36. This series of videos are currently being recorded and processed.

2.3 Newsletters

In the second year of the project, two newsletters were created, the first one at the beginning of 2024 and the second at the mid year. The newsletters were circulated through the partner's networks, which served as hosts of the project's newsletter in parallel with the registered users in the Plooto mailing list. The first newsletters are presented in the following figure and are available under the News&Events section as blogposts as well as directly in the Materials and Downloads section of the website as follows:

- [Plooto First Newsletter](#)
- [Plooto Second Newsletter](#)
- [Plooto Third Newsletter](#)

Figure 10: Plooto Second and Third Newsletter

The upcoming newsletter is scheduled to be sent out in the same manner as the previous one with the support of the partners on 15th Jan 2025 to take advantage of the new year and not to have reduced diffusion due to different holidays.

2.4 Partners' Efforts in Communication

In parallel to all the communication activities done through the official Plooto's media outlets (Website, Social Media), the consortium partners utilized their own channels (Website and Social Media) to communicate and disseminate the project results and ongoing progress. The following table highlights sample activities that took place during the first and second year of the Plooto project by each partner.

Table 4: Partners' Communication and Dissemination actions through own Outlets

No	Partner	Activity	Target audience	Channel	KPI Achieved
1 – 21	**2023 activities were conducted by consortium partners as presented in Deliverable D5.2 each with respective KPIs.**				
22	IMA	LinkedIn IMDEA and IMA advancing tasks of the Spanish Pilot.	Industry business partners	Social media	30 reactions and 9 responses
23	IMA	LinkedIn Post – Plooto Project consortium in Chania.	Industry business partners	Social media	52 reactions, 1 comment and 17 reposts
24	IMA	LinkedIn Post – Plooto Project consortium in Barcelona	Industry business partners	Social media	22 reactions, 6 reposts
25	IMA	LinkedIn pre-consortium meeting in Barcelona	Industry business partners	Social media	41 reactions, 10 reposts
26	CETMA	Brief description of Plooto project on Cetma website	Industry business partners	Website	367 Views
27	KPAD	LinkedIn Repost project dissemination announcement	Research communities	Social media	
28	AEGIS	Social Media Post on own channels	Industry, Innovators, Research, Citizens	Social Media	<100 Facebook reactions, <200 LinkedIn
29	TUC	LinkedIn post about the Conference ISAG2024 co-organisation by TUC	Industry business partners, Innovators, Investors, EU Institutions,	Social media	16 Reactions and 1 repost

No	Partner	Activity	Target audience	Channel	KPI Achieved
			Research communities		
30	TUC	LinkedIn post about the presentation of the PSM Service and Sustainability Balanced Scorecards in Consortium Meeting in Ljubljana	Industry business partners, Innovators, Investors, EU Institutions, Research communities, Academia	Social media	30 Reactions and 2 reposts
31	TUC	LinkedIn post regarding the presentation of Plooto project in the International Symposium of Applied Geoinformatics in Wroclaw, Poland - ISAG2024	Research communities, Academia	Social media	64 Reactions and 2 reposts
32	FRONT	LinkedIn post for our GA meeting in Brindisi	Innovators	Social media	31 likes, 3 reposts
33	FRONT	Blog post regarding analytics is uploaded to our company's website link	Industry business partners	Website	18 Views
34	CETMA	LinkedIn posts about JEC Composite Magazine article	Industry business partners	Social Media	23 likes, 2 comments and 8 reposts
35	TUC	LinkedIn post regarding the Plooto Blog Publication	Industry business partners	Social media	10 reactions and 2 reposts
36	TUC	LinkedIn post regarding the participation in the Consortium Meeting in CETMA premises in Brindisi	Research communities	Social media	14 reactions and 1 repost

No	Partner	Activity	Target audience	Channel	KPI Achieved
37	IDC	Blog post about Plooto and DPP	Industry business partners	Blog post own Website	14 interactions
38	CC	Facebook brief description of Plooto project and meeting	Industry business partners	Social Media	20 Interactions
39	CC	Instagram brief description of Plooto project and meeting	Industry business partners	Social Media	80 Interactions
40	CETMA	LinkedIn posts about ECOMODO exhibition 2024	Industry business partners	Social Media	22 Likes, 1 Comment, 1 Repost

3   Dissemination Activities M12-M24

In the following sections, the Plooto-related dissemination activities are presented, starting from the achieved academic publications that the partners have successfully submitted and have been accepted and/or presented as well as the different events and activities conducted in relation to conferences / workshops and clustering activities.

3.1   Scientific Publications

During the first and second year, the Plooto partners produced several scientific publications. In particular, the research output that has been successfully published includes **nine (9)** publications in conference proceedings, **six (6)** articles in journals and **two (2)** chapters in books leading to a total of **17** publications. The following table presents the scientific publications conducted during the first and second year of the Plooto project, starting from the newest.

Table 5: List of Scientific Publications

No	Type	PID / URI	Title of Publication	Authors	Academic Outlet	Month/ Year of publication
1	C	Link	WEEE Flow for Magnets	Kyriakos Bitsis, Alexandros Spanos, Konstantinos Kaparis, Georgios Zois	APMS 2024	9.2024
2	C	Link	Developing a Circular and Resilient Information System: A Design Science Approach	Timoleon Farmakis , Anastasios Koukopoulos , Georgios Zois , Ioannis Mourtos , Stavros Lounis , and Kostas Kalaboukas	APMS 2024	9.2024
3	C	Link	Circular product design for allowing re-using and re-purposing of products and components: a conceptual framework for circularity	Foivos Psarommatis Victor Azamfiere John David Lindström	IFAC PapersOnline	8.2024
4	C	Link	Advancing Circular Economy: The Product Circularity Index as a Tool for Sustainable Design	Foivos Psarommatis, Fotios K. Konstantinidis,	Advances in Design, Simulation and Manufacturing VII	7.2024

No	Type	PID / URI	Title of Publication	Authors	Academic Outlet	Month/ Year of publication
				Victor Azamfirei & Gökan May		
5	J	Link	Extending Product Lifecycles—An Initial Model with New and Emerging Existential Design Aspects Required for Long and Extendable Lifecycles	J Lindström, P Kyösti, F Psarommatis, K Andersson, K Starck Enman	Applied Sciences	7.2024
6	J	Link	The role and benefits of Digital Product Passport in the remanufacturing process in the era of Zero Defect Re-manufacturing	Foivos Psarommatis Gokan May	Procedia CIRP	5.2024
7	C	Link	Enhancing Manufacturing Sustainability through Integrated Digital Product Passports and the Sustainability Balanced Scorecard	Aryblia Maria, Sifakis Nikolaos, Tsinarakis George, Arampatzis George	ISAG2024	5.2024
8	J	Link	Digital Product Passport: A Pathway to Circularity and Sustainability in Modern Manufacturing	Foivos Psarommatis, Gökan May	Sustainability journal	1.2024
2023						
9	J	Link	Optimization of Zero Defect Manufacturing Strategies: A Comparative Study on Simplified Modeling Approaches for Enhanced Efficiency and Accuracy	Foivos Psarommatis , Gokan May	Computers & Industrial Engineering, Elsevier	30.11.2023
10	C	Link	Advancing sustainability in industrial supply chains by embracing circular approaches & digital transformation	Aryblia M., Sarantinoudis N., Tsinarakis G., Arampatzis G.	IEES 2023, International Ecological Engineering Society (IEES)	10.2023
11	C	Link	Enabling sustainability and resilience in industries through the value chains' circularity and digitalisation	Aryblia M., Sarantinoudis N., Tsinarakis G., Arampatzis G.	International Conference on Environmental Science and Technology (CEST)	09.2023

No	Type	PID / URI	Title of Publication	Authors	Academic Outlet	Month/ Year of publication
12	J	Link	A Systematic Analysis for Mapping Product-Oriented and Process-Oriented Zero-Defect Manufacturing (ZDM) in the Industry 4.0 Era	Foivos Psarommatis , Gokan May	Sustainability journal, MDPI	08.23
13	BC	Link	A Readiness Level Assessment Framework for Zero Defect Manufacturing (ZDM)	Foivos Psarommatis, Gokan May, Victor Azamfirei, Maria Chiara Magnanini & Daryl Powell	Lecture Notes in Mechanical Engineering, Springer	08.23
14	BC	Link	Human Factors in the Design of Advanced Quality Inspection Systems in the Era of Zero-Defect Manufacturing	Victor Azamfirei, Foivos Psarommatis & Yvonne Lagrosen	Lecture Notes in Mechanical Engineering, Springer	08.23
15	C	Link	D&C for EU Funded Projects: Towards an Integrated Omnichannel Dissemination and Communication Framework	Koukopoulos, Anastasios & Adam, Vrechopoulos & Georgios, Doukidis & Lounis, Stavros & Timoleon, Farmakis.	11th International Conference on Contemporary Marketing Issues	7.2023
16	C		A Rula-based Assessment Framework based on Machine Vision and Zero-Defect Manufacturing 4.0 Initiative	Foivos Psarommatis, Victor Azamfirei, Fotios K Konstantinidis	3rd IFSA Winter Conference on Automation, Robotics & Communications for Industry 4.0 / 5.0 (ARCI' 2023)	2.2023
17	J	Link	Envisioning maintenance 5.0: Insights from a systematic literature review of Industry 4.0 and a proposed framework	Foivos Psarommatis, Gökan May , Victor Azamfirei	Journal of Manufacturing Systems, Elsevier	26.01.2023

Legend: C = Conference, J = Journal, BC = Book Chapter

The abstracts for Plooto publications 9-17 can be found in the Deliverable D5.2 Annual dissemination, standardization and marketing report v1 and the following sections, presents the newly published papers of Plooto through their abstracts.

3.1.1   WEEE Flow for Magnets

Abstract: The recovery of Waste from Electrical and Electronic Equipment (WEEE) poses a significant challenge in the realm of solid waste management. With the global urgency to develop innovative disposal methods for WEEE, the creation of value chains that facilitate the recovery of valuable secondary raw materials is crucial. This paper explores a value network formulated specifically for the recovery and reuse of magnets from WEEE. To this direction, we introduce a holistic Mixed Integer Linear Programming (MILP) model, capable to optimise the material flows and the total cost incurred within the value network. Interestingly, our model integrates the proposed policies and directives of the European Commission (EC), aiming to devise a strategy that efficiently blends secondary and virgin magnetic materials to minimize total energy costs. We validate our modeling approach through a set of computational results, applying sensitivity analysis to assess the robustness of the proposed solutions under specific fluctuations in the energy cost. We conclude with the introduction of a two-stage stochastic model that extends the deterministic framework of the MILP, offering broader applicability and resilience in planning.

3.1.2   Developing a Circular and Resilient Information System: A Design Science Approach

Abstract: Nowadays, circularity and resiliency are crucial for manufacturing. There is a need for collaboration across the value chain, deployment of critical enablers, and connection of traceability to sustainability and business objectives to accelerate the shift towards circular and resilient production processes. This study reviews circular economy and resilient manufacturing by further analyzing the literature on circular and resilient information systems (IS). We identify key performance indicators for circularity and resiliency and utilize a design science research approach to design the circular and resilient information system (CRIS) conceptual architecture. We further propose leveraging cutting-edge technologies and tools to enable real-time decision-making, monitoring, and certification of materials and products, facilitating sustainable and resilient manufacturing practices. The deployment of CRIS as part of digital transformation efforts represents a strategic move to meet the growing demands for sustainability and resilience.

3.1.3   Circular product design for allowing re-using and re-purposing of products and components: a conceptual framework for circularity

Abstract: We live in a fast-consuming era, where manufacturers producing products faster than ever and with only one lifecyle in mind. This phenomenon has resulted in products being designed and manufactured with attention to the company profit and insufficient attention to the implementation of circular approached and by extent sustainability. Currently, the implementation of circularity is only considered at the end of the life of a product and not from the beginning during the design of the product. To achieve circularity there is the need to add

more requirements to the product design that are coming from the concept of circular economy. Therefore, in the current paper we have defined additional design steps that are adding more requirement. Those steps include the incorporation of the product re-use, repurpose, re-manufacture and recycling. We provide a structural approach to quantifying circularity in design to close the gap between conventional design methods and sustainability.

3.1.4 Advancing Circular Economy: The Product Circularity Index as a Tool for Sustainable Design

Abstract: The rise of the fast-consuming era, marked by manufacturers continuously increasing production rates, has led to the design and manufacturing of products without due consideration for sustainability aspects. Despite the overall reduction in production costs, this approach harms the environment and circumvents circularity methodologies. To bridge the gap between traditional design practices and sustainability, we propose a structural method for measuring circularity in design. The introduced Product Circularity Index (ProdCircIn) serves as a quantifiable measure to assess a product's alignment with circular economy principles and functions as a key performance indicator (KPI) for evaluating and comparing products based on their circularity attributes. Specifically, ProdCircIn evaluates products in six pillars: design philosophy, usage of materials, design for manufacturing, design for quality, design for warranty, and design for the future. These pillars are quantified through relevant questionnaires, as analytical solutions and formulas could be more practical due to the distinct characteristics of each product.

3.1.5 Extending Product Lifecycles—An Initial Model with New and Emerging Existential Design Aspects Required for Long and Extendable Lifecycles

Abstract: This paper introduces an evaluated initial model for how product lifecycles can be extended considering new and emerging existential design aspects concerning both general as well as digital/connected products. The initial model, which is cyclic, includes reverse logistics of components and raw materials, as well as information on how to manage data at the end of lifecycles. The aim is to improve long-term sustainability with a high degree of circularity while also achieving increased profitability and competitiveness. Further, we highlighted that product providers must start to evaluate and prepare for how to improve product durability, manage long and extendable lifespans, and achieve circularity with reverse logistics to close the loops. Additionally, updatability and upgradability are also required to stay current with time and create value while being cybersecure. Otherwise, customers' expectations, various legal and regulatory aspects, as well as other existential design aspects can halt or even terminate a product's lifecycle.

3.1.6 The role and benefits of Digital Product Passport in the remanufacturing process in the era of Zero Defect Re-manufacturing

Abstract: The implementation of Digital Product Passports (DPPs) has become a game-changing strategy in the pursuit of sustainable manufacturing methods, especially in the remanufacturing industry. The goal of this research is to achieve Zero Defect Manufacturing (ZDM) in the circular

economy by examining the functions and advantages of DPPs in remanufacturing processes. Through a comprehensive study, including a detailed case analysis in the automotive industry, we elucidate the significant efficiency gains and cost savings facilitated by DPPs. Our findings reveal a substantial reduction in remanufacturing time by 39.07 percent, and a corresponding decrease in costs, highlighting the DPP's potential to enhance operational efficiency and sustainability across various sectors. Even with the potential advantages, there are still obstacles to overcome when implementing DPPs, such as the initial setup costs, the requirement for digital infrastructure, and worries about data security. But these difficulties also present chances for creativity and teamwork, highlighting how crucial it is to create standardized data procedures and security safeguards. This paper adds to the conversation on sustainable manufacturing by outlining the DPP's critical role in advancing the circular economy, outlining potential directions for further study, and arguing in favor of the creation of international standards to encourage broad adoption.

3.1.7 Enhancing Manufacturing Sustainability through Integrated Digital Product Passports and the Sustainability Balanced Scorecard

Abstract: This study investigates the implementation and impact of the Process Simulation and Modelling (PSM) tool within the Plooto project, emphasizing its role in enhancing the integration of Secondary Raw Materials (SRMs) into manufacturing processes. The research focuses on the PSM tool's ability to comprehensively map material flows throughout various production stages, aligning with circular economy principles. The findings reveal that the PSM tool, through its dynamic and interactive models, significantly improves resource optimization and waste reduction and can be effective on calculating the relevant Key Performance Indicators (KPIs). This development is attributed to the tool's comprehensive approach to modelling material, data, and energy flows. The PSM tool's multifaceted features, including graphical model design, detailed flow specifications, and comprehensive KPI generation, facilitate strategic decision-making for sustainable manufacturing practices. The research underscores the PSM tool's crucial contribution to the Plooto project as a driver of sustainable & circular manufacturing innovation. It highlights the tool's effectiveness in implementing and integrating circular economy practices within industrial operations, demonstrating a shift towards more sustainable manufacturing concepts. The study promises for broader application and exploration of the PSM tool's capabilities across diverse manufacturing settings to fully exploit its potential in promoting sustainable manufacturing solutions

3.1.8 Digital Product Passport: A Pathway to Circularity and Sustainability in Modern Manufacturing

Abstract: The primary aim of this study is to explore and understand the potential benefits and applications of the Digital Product Passport (DPP) system within the modern manufacturing industry. To achieve this, we developed a unique methodology, model, and a template for creating a DPP, identifying the key characteristics essential for effective implementation. Our approach involved an analysis of the literature and the formulation of a unified DPP framework,

tailored to enhance supply chain transparency and support sustainable manufacturing practices. The empirical findings from our research demonstrate the DPP's impact on supply chain transparency, providing crucial product lifecycle information that bolsters decision-making and facilitates optimal resource management. Additionally, our study suggests that the DPP model, when applied to sectors such as electronics manufacturing, promises transformative results. This research underpins the pivotal role of DPPs in the future of manufacturing, highlighting their potential to catalyze a shift towards greater transparency and sustainability. Actionable guidelines are provided for manufacturers considering the adoption of this innovative system.

3.1.9 Article in JEC Magazine

Additionally, to the scientific publications Cetma has published an article on JEC Composite Magazine (Composites Sustainability Report 2024) which talks about upcycling and reuse of carbon fiber prepreg waste and presents solutions developed on two important projects in which CETMA is involved: Plooto Project and Ricreare. "Regarding the out-of-spec prepreg, CETMA is working on developing a procedure to extend the useful life of prepregs. Research activities are performed within the project Plooto –Product Passport Through Twinning of Circular Value Chains, a European project that aims to develop a circular and resilient information system (CRIS) that enables waste reduction and end-to-end traceability of SRMs through interconnected digital services" Read more at this link.

Figure 11: Plooto in JEC Magazine (Sustainability Report 2024)

3.2 Events (conferences, workshops, etc) and Clustering activities

Additionally to the presented communication activities all Plooto partners also presented the Plooto project in several events and clustering activities as presented in the following paragraphs.

3.2.1   World Remanufacturing Summit

During the World Remanufacturing Summit, University of Oslo had the opportunity to discuss the Plooto project and get inspired from other activies in the remanufacturing domain and the Digital Product Passport. The particular event gathered the attention of industry business partners, innovators, and research communities on the respective topics of Plooto.

3.2.2   JEC World 2024 Fair

CETMA participated in the JEC World 2024 Fair, where they informed relevant stakeholders of the composites value chain about Plooto, its offering and the benefits for their organizations. The particular event gathered the attention of Industry business partners, Innovators, Research communities and Specific end-user communities in the field.

3.2.3   The Future of Advanced Polymers and Composites: Strategies for Improved Sustainability

On 24th Sept 2024, CETMA had a poster presentation in the context of the conference entitled: The Future of Advanced Polymers and Composites: Strategies for Improved Sustainability. In the conference CETMA had the opportunity to present Plooto and their work to Industry business partners, Innovators and relevant Research communities.

Figure 12: Plooto at the Future of Advanced Polymers and Composites

3.2.4 Ecomondo Fair 2024

As in Ecomondo Fair 2023, during this years event, CETMA participated in Ecomondo 2024 fair with their own booth. In the event CETMA had the opportunity to inform relevant stakeholders involved in waste management of Plooto solutions. This event gathered the attention of a wide audience including Industry business partners, Innovators, Local authorities and Citizens as well as Specific end-user communities.

Figure 13: CETMA and Plooto at EcoMondo 2024

3.2.5 Digital Transformation Week 2024

On 25th Jun 2024, during the Madeira Digital Transformation Summit, our partners Maggioli, IDC and AUEB, participated in an insightful panel discussion titled "**Digital Approaches to Achieve Circular, Resilient, and Sustainable Supply Chains**." This event was part of the esteemed Madeira Digital Transformation Week, which brought together five major events: the 30th ICE/IEEE

ITMC Conference, the 2nd edition of the Madeira Digital Transformation Summit, the EIT Health Transformation Talks, the CyberSecPro Summer School, and the NITIM Graduate School. (Read more at this link).

Figure 14: Plooto at Digital Transformation Week 2024

3.2.6   IDC Manufacturing eXchange

On the 22nd Oct 2024, Kostas Kalaboukas (MAG), as the Plooto Project Coordinator, presented the Plooto approach on the Digital Product Passport and the main considerations for further deployment. The Workshop (21-22 Oct 2024, Frankfurt), organized by IDC brought together high-level IT professionals from manufacturing industries where future trends have been discussed, such as Digital Twins, the role of AI, Digital Product Passport, etc. (Read more at this link)

3.2.7   Festival of the New European Bauhaus

Aegis represented Plooto in the Festival of the New European Bauhaus, networking with the participants including EU officials and industry representatives regarding the EU strategy for sustainable and circular textiles and the role of Digital Product Passports. The event attracted the attention of citizens and the industry.

3.2.8   ESTEP Digital 4 Environment workshop

BARNA presented the Plooto project at the ESTEP Digital 4 environment workshop where stakeholders from specific user communities were invited to learn more about Plooto and the

ongoing works of the project. Special focus was put on how the DPP will revolutionise not only the EII, as it was the target of the workshop, but all sectors.

Figure 15: CELSA and Plooto at ESTEP Digital 4 Envirment

3.2.9   Digital Product Passport & Tracing (DPP) Event Series

On 15th Nov 2024, Kostas Kalaboukas (MAG), the Plooto Project Coordinator, presented the Plooto project as a tool for supply chain traceability and DPP sharing. The presentation was given during the 1ˢᵗ event of ICCS Digital Product Passport entitled "Digital Product Passport and Tracing: Projects joining forces". Among the participants were the projects DigInTraCE, CIRPASS-2, Reconstruct, MobelPass, MaDiTraCE, Theros and DPP4Food (Agenda can be found here)

3.2.10 AI Procurement event in Slovenia

Kostas Kalaboukas (MAG), on 21st Nov 2024 as the Plooto Project Coordinator presented the Plooto project in an online event relevant to AI Procurement organized in Slovenia. The event had over 100 attendees who were interested in the Plooto project.

3.2.11 Plooto at the CEMAG Workshop

IMA participated in a round table in the context of the CEMAG Workshop about the Current Research in Magneitsm and Magnetic Materials presenting Plooto. Thanks to European projects, especially PLOOTO, IMA has improved its production processes by injecting bonded materials.

Scrap is being reduced, injection moulds are being optimized and recycling bonded material homologations are being carried out and these benefits were discussed during the Round Table.

Figure 16: Plooto at CEMAG Workshop

3.2.12 Plooto in various Conferences

During M12-M24, the project has been presented (besides the aforementioned events) in conferences as the University of Oslo presented Plooto in CIRP CMS conference 2024, IFAC AMEST conference 2024 and DSMIE Conference 2024. Similarly, TUC presented Plooto in ISAG 2024, and AUEB presented Plooto in APMS 2024.

3.2.13 Plooto and CE-Rise

Lastly, MAG and Kostas Kalaboukas presented Plooto in the CE-RISE project on a dedicated workshop organized for Plooto and CE-RISE collaboration and introduction.

4 Standardisation Activities

The standardisation activities of Plooto will be around the Digital Product Passport and the digital twins implementation. The first step in the standardization of Plooto activities is to identify what are the needs of the Plooto pilots for standardization. Therefore, a questionnaire has been developed and disseminated to the pilot partners. The questionnaire can be found below. It is a questionnaire in order to extract the needs of the pilots and also to understand the different standards already using. Initiatives like Plooto are using targeted questionnaires to capture the standardization needs of stakeholders. These surveys provide valuable insights into:

- **Existing Practices**: By identifying the standards already in use, organizations can understand current capabilities and limitations.
- **Barriers to Adoption**: Questions about challenges reveal the technical, financial, and organizational obstacles to implementing standardized solutions.
- **Future Requirements**: Stakeholders can articulate their specific needs, enabling the development of relevant and practical standards.

Table 6: Preliminary questionnaire for the standardization needs for Digital twins (DT)

Question	Answer
1. Do you have DTs implemented in your company ?	
2. Are you planning to implement them DTs?	
3. What standards are you using in your organization that are close to the DT concept?	
4. What are the standardization needs of your organization for these topics to adopt and implement the DT?	
5. What is the current status in your company concerning the implementation of DT solutions?	
6. Is standardization a barrier for the adoption and implementation of DT?	
7. What would trigger your company to implement a standardized DT solution?	

Table 7: Preliminary questionnaire for the standardization needs for Digital product passport (DPP)

Question	Answer
1. Do you have DPP implemented in your company ?	
2. Are you planning to implement them DPP?	
3. What standards are you using in your organization that are close to the DPP concept?	
4. What are the standardization needs of your organization for these topics in order to adopt and implement the DPP?	

5. What is the current status in your company concerning the implementation of DPP solutions?	
6. Is standardization a barrier for the adoption and implementation of DPP?	
7. What would trigger your company to implement a standardized DPP DT solution?	

Table 8: Answers for DT questionnaire

	ASPIS	CC	FERIMET	HPC	IMA
Do you have DTs implemented in your company?	No	Not yet	Not yet, still developing DTs for specific processes.	No but we have implemented a SCADA, a MES and an ERP system.	No
Are you planning to implement the DTs? If yes, in which part of your production stages are you going to use DT?	Yes, in the wastes valorization process line	Yes. We would like to use this tool to reduce the generation of scraps during production	Yes, we are developing DTs in some of our key processes. One of the most representative processes is the reheating operation of the steel, in the Reheating Furnace, which works with Natural Gas. An implementation of a DT would optimize the process and assist the transition towards Hydrogen combustions.	No	Not sure but Plooto could help to introduce DT in some sections (for example: injection area), we need to study the possibilities.
What standards are you using in your organization that are close to the DT concept?	Some sensors in key processes that provide us with real time data for decision making	Actually we have internally procedures that refer to ASTM standard and best practice for the production of composite components	he Digital Twin methodology. Fast replication of the Digital Models is mandatory to scale-up the solutions we implement in our facilities. To develop a standard	No one	Only some data is introduced about self-control by staff, using OSPROG software in three computers in production area.

	ASPIS	CC	FERIMET	HPC	IMA
			methodology for the development of the DTs of our processes is needed in order to optimize the timeframe.		
What are the standardization needs of your organization for these topics in order to adopt and implement the DT?	N/A	The DT should be easy to use and compatible with our processes.	First stage; still trying to understand the possible applications, data requirements, etc.	It's quite difficult answering this question since, at the moment, we are not considering implementing a DT. Generally speaking, since we are a third-parties supplier and producing components in batch, standardizing families of componets and method to allocate resources could be a need.	ISO 9001, ISO 14001, IATF 16494, production requirements and standards.
What is the current status in your company concerning the implementation of DT solutions?	No progress	We don't have experience in the use of DT	Standardization is a milestone to transfer the implementations of DTs to all our business units. It should make it easier to transfer all the knowledge and the know-how to the other industrial plants and processes.	No implementation.	5%, only some self-control
Is standardization a barrier for the adoption and implementation of DT?	No	No	Standardization is a milestone to transfer the implementations of DTs to all our business units. It should make it	Could be.	

	ASPIS	CC	FERIMET	HPC	IMA
			easier to transfer all the knowledge and the know-how to the other industrial plants and processes.		
What would trigger your company to implement a standardized DT solution?	The need for virtual optimization of the process line in terms of energy consumption	The costs related with the implementation of DT should be recovered with the reduction of scraps	Proven efficiency, high ROI, low time to implement.	Being able to make production more efficient, reducing scraps and OPEX and unexpected failure.	

Table 9: DPP questionnaire answers

	ASPIS	CC	FERIMET	HPC	IMA
Do you have DPPs implemented in your company?	No	Not yet	We have a pilot project developed during last year	No	No
Are you planning to implement the DPPs? If yes, in which part of your production stages are you going to use DPPs?	If yes, in which part of your production stages are you going to use DPP? Yes, for the molasses	we don't have specific needs for the materials used in production, because they are certified. We probably need DPPs if we want to re-use the requalified material coming from HP composites	Yes, from scrap collection to final product delivered to construction projects.	No	We are thinking of introducing the barcode systems for our references. This barcode could help with the DPPs
What standards are you using in your organization that are close to the DPPs concept?	Some sensors in key processes that provide us with real time data for decision making	None	ISO22095 – Chain of custody ISO 14021 - Environmental labels and declarations	No one	Not really DPPs, we need some training in this matter to know the real concept of DPP.
What are the standardization needs of your organization for these topics in order to adopt and implement the DPPs?	N/A	No specific needs	Data collection and traceability	Define the necessary data and information related to the materials and products	
What is the current status in your company concerning the implementation of DPPs solutions?	No progress	Actually we have track of the characteristics of the materials that we use during production	Initial pilot done, next steps are to collect homogeneous data and create a first MVP with a customer.	No implementation	
Is standardization a barrier for the adoption and	No	no	Yes, the lack of standards in construction sector is the barrier.	Yes	

	ASPIS	CC	FERIMET	HPC	IMA
implementation of DPPs?					
What would trigger your company to implement a standardized DPPs solution?	The need to promote the quality of our molasses	The DPP should allow the re-use of re-qualified material coming from HP	Legal requirements.	A clear and shared definition of DPP.	

Once the Plooto pilots will answer the questionnaire and the standardization needs are clarified the following procedure will be followed for the standardization process.

1. Check Official Websites: Look for official websites of standardization bodies, industry associations, or organizations involved in the relevant field. These websites often provide reports, publications, and updates related to standardization initiatives.

2. Industry Publications: Explore industry-specific publications, journals, or magazines that cover standardization and industry commons topics. These sources may highlight key reports or initiatives.

3. Government Agencies: Check with relevant government agencies that oversee or promote standardization efforts in your region or industry.

4. Professional Networks: Engage with professional networks, forums, or conferences related to the industry in question. Attendees or members may share information about the latest reports or initiatives.

5. Online Databases: Utilize online databases, repositories, or libraries that host reports and publications. These could include academic databases, industry databases, or government repositories.

6. Contact Relevant Organizations: If you have specific organizations or bodies in mind, consider reaching out to them directly to inquire about the report or initiative you're interested in.

7. Search for similar standards and for active standardization activities.

4.1 Importance of Standardization in Digital Twin and Digital Product Passport

Digital Twins: DTs replicate physical assets, processes, or systems in a virtual environment, providing capabilities such as real-time monitoring, predictive analytics, and decision-making. As DTs are deployed across industries—ranging from manufacturing and energy to healthcare and urban planning—standardization plays a crucial role. A lack of standardized frameworks often leads to fragmented implementations, limiting their utility and scalability. Standardization ensures:

- **Interoperability Across Systems**: DT systems typically integrate data from diverse sources, including sensors, enterprise systems, and external platforms. Standardized data exchange protocols and interfaces allow these components to work seamlessly, reducing integration costs and time.
- **Scalability** and Flexibility: A well-structured standard allows organizations to scale their DT applications across multiple sites or processes without significant re-engineering, fostering wider adoption.
- **Security and Trustworthiness**: DTs handle sensitive operational and business data. Standardized security measures ensure consistent application of best practices, thereby reducing risks of breaches and enhancing stakeholder confidence.

Digital Product Passports: DPPs provide a digital record of a product's lifecycle, encapsulating data such as its origin, composition, maintenance history, and end-of-life options. As industries prioritize sustainability, DPPs emerge as a vital tool for promoting circular economy practices. Standardization in DPPs is critical to:

- **Fostering Transparency and Accountability**: Uniform standards ensure that all stakeholders, including manufacturers, consumers, and regulators, have access to reliable and consistent product information.
- **Simplifying Compliance with Regulations**: Internationally aligned standards help organizations meet diverse regulatory requirements, such as the EU's Circular Economy directives, reducing complexity and costs.
- **Enhancing Collaboration Across Supply Chains**: By creating a shared framework for data exchange, standards enable seamless collaboration between partners, reducing inefficiencies and errors.

Significant progress is being made in the standardization of DT and DPP, driven by global standardization bodies, industry groups, and regional initiatives. These efforts aim to provide a unified framework to address technical, operational, and regulatory challenges.

4.2 Current Standardization Activities

Digital Twin Standardization:

1. **ISO/IEC 30173 and ISO 23247**: ISO/IEC 30173 focuses on the architecture and interoperability of digital twin systems across various industries. Meanwhile, ISO 23247 defines a framework specifically tailored to smart manufacturing. These standards provide foundational guidelines for designing, deploying, and managing DT systems, emphasizing scalability and efficiency.
2. **Industrial Internet Consortium (IIC)**: The IIC publishes comprehensive frameworks for digital twin design and lifecycle management, promoting best practices and ensuring alignment with industry needs. Their work includes integrating DT with Industrial Internet of Things (IIoT) systems to maximize data utilization.

3. **Asset Administration Shell (AAS)**: AAS, part of the Industrie 4.0 initiative, provides a standardized format for describing and managing digital representations of assets. By serving as a "digital twin framework," AAS facilitates interoperability between systems and organizations, making it easier to integrate DTs into industrial ecosystems.

4. **IEEE Standards**: The IEEE focuses on standardizing DT applications in specific sectors such as energy and transportation. For example, standards for smart grids include guidelines for integrating DTs to enhance monitoring and optimization.

5. **Sector-Specific Standards**: Industries are creating their own DT standards tailored to their unique requirements. For example, healthcare DTs follow standards that prioritize patient data privacy, while urban planning uses frameworks aligned with smart city objectives.

Digital Product Passport Standardization:

1. **European Union (EU) Initiatives**: The EU leads global efforts in DPP standardization through policies like the Circular Economy Action Plan. This initiative emphasizes the use of DPPs in sectors such as electronics, textiles, and automotive. The EU's Sustainable Product Policy Initiative also underscores the need for DPPs to document and optimize the environmental impact of products throughout their lifecycle.

2. **GS1 Standards**: Originally developed for supply chain management, GS1 standards provide a robust foundation for DPP implementation. These standards include globally accepted identifiers, such as barcodes and RFID tags, which can be adapted to store and share DPP data.

3. **ISO 14040 Series**: This series of standards on lifecycle assessment aligns closely with the goals of DPPs. It provides methodologies for analyzing the environmental impact of products, which can be integrated into DPP frameworks to enhance sustainability reporting.

4. **Pilot Projects and Industry Consortia**: Collaborative projects like PLOOTO are crucial in identifying standardization needs by engaging with pilot partners. These projects aim to align existing practices with global standards and propose new frameworks where gaps are identified.

4.3   Challenges in Standardization

Despite the progress in standardization, several challenges hinder its widespread implementation:

1. **Diverse Industry Needs**: Industries vary significantly in their requirements for DT and DPP. For instance, manufacturing focuses on operational efficiency and predictive maintenance, while the retail sector prioritizes product traceability and customer engagement. Balancing these diverse needs in a single standard is a complex task.

2. **Rapid Technological Evolution**: The fast-paced development of technologies such as artificial intelligence (AI), blockchain, and IIoT often outpaces the standardization process. This mismatch can lead to standards becoming obsolete shortly after their release.

3. **Data Security and Privacy Concerns**: DTs and DPPs rely heavily on the exchange of sensitive data. Developing standards that ensure robust security while complying with regional data privacy laws, such as GDPR, remains a significant challenge.

4. **High Costs of Adoption**: Implementing standardized systems often requires substantial investment in technology, training, and process reengineering. This poses a barrier for small and medium-sized enterprises (SMEs), especially in developing regions.

5. **Regional Regulatory Differences**: Standardization efforts must navigate varying regulations across regions. For example, product safety and environmental compliance standards differ significantly between Europe, North America, and Asia.

5 Dissemination and Communication aggregate KPIs

During the period M1-M24 of the Plooto project, several dissemination and communication actions took place highlighting the overall results of the project. Each action on each outlet is presented in the respective chapter however, in the present chapter, an aggregation of all KPIs is presented for better comprehension.

Table 10: Aggregate presentation of Plooto KPIs for D&C

Community	Marketing strategy	Horizontal Activities	KPIs	Achieved as of M24	
Public: Web site, social media	Public awareness	Website	No of unique visitors: > 5.000	2900	
		Twitter account	a) No. of followers: > 700; b) No. of reactions > 1.000; c) > 2000 tweets	a) 133 Followers b) 1600 Engagements / 7000 Impressions c) 107 Tweets	Through Partners' Social Media own Plooto related Posts Impressions / Views: Views: 5267 Reactions: 693 Likes: 195 Reposts: 73 Clicks: 210
		Facebook account	a) no. of followers: > 200; b) > 100 posts; c) no. of reactions > 5.000;	a) 50 Followers b) 34 Posts c) 38 Likes / 4995 Impressions	
		LinkedIn account	a) No. of followers: > 250; b) No. of reactions > 1.000; c) > 100 posts	a) 239 Followers b) 1189 Reactions / 92 Reposts c) 45 Posts	
		Open learning	IRCAI: 4 open learning courses through Open Education for a better world OE4BW.org (See Task 5.4)		
ICT	• Create awareness • Do project	Website/Intranet	2 Workshops organized per Software vendor	Participation in EcoMondo 2023, EBDVF2023, JEC World 2024 Fair, Ecomondo Fair	

Community	Marketing strategy	Horizontal Activities	KPIs	Achieved as of M24
	offerings scalable and easy to integrate • Validate requirements and business models	Newsletters (1 per six months) Training material & specific demos (~ 1-2 for each of the Plooto results, per stakeholder category: ICT, Manufacturing) Social Media	(inside their existing networks of collaborative partners) > 10 workshops/stands in ICT-related events focusing on Industrial automation and supply chain (CEBIT, other) > 4 hackathons to experiment with Plooto tools Establish liaisons with other core EU Digital Platform projects (eFactory, ZMDP, KYKLOS 4.0)	2024, The Future of Advanced polymers and Composites 2024, AI Procurement event in Slovenia. Liasion with AI4Gov, DataSpace 4.0, DigInTraCE, CE-Rise, Participation at Digital Product Passport & Tracing (DPP) Event Series
Process Industries Industrial Consultants			> 10 workshops/stands in industry4.0 events (World Manufacturing Forum, IMS, CEBIT, etc.) > 3 dedicated workshops organized by the ICT industrial players (1 for each of MAG, Entersoft, IDC), utilizing their existing customer base and commercial marketing channels > 1 workshop for each of the pilot supply chains with selected supply chain collaboratives TUV: Promoting Plooto in 15 training	Participation in World Remanufacturing Summit 2024, Dedicated panel at Digital Transformation Week 2024, Festival of the New European Bauhaus, IDC Manufacturing eXchange 2024, Barna Steel – ESTEP Digital 4 Environment workshop, Plooto at the CEMAG Workshop,

Community	Marketing strategy	Horizontal Activities	KPIs	Achieved as of M24
			sessions (organized by TUV) with relevant course	
Associations/ Clusters			• Targeted visits and demos to clusters to incorporate them into the Plooto community • Approaching Clusters/Associations through Horizon projects (clustering and networking events)	
Academic / Research	Diffuse scientifically and technological results	Web site/Intranet Newsletters (1 per six months) Training material & specific demos (~ 1-2 for each of the Plooto results, per stakeholder category: ICT, Manufacturing) Social Media	20 papers/poster sessions at International conferences and stands > 10 papers in Scientific Journals (open access)	6 Journal Papers 9 Conference Papers 2 Book Chapters
Horizon2020/ HorizonEurope projects	Dissemination and look for synergies with Plooto)		Participation in all relevant EU Horizon cluster meetings and workshops > 10 Demos and talks in cluster events organized with	3 Newsletter Sent 1 Newsletter developed/Planed for Mid January 2025 Participation at HaDEA Clustering event Participation at P4Planet forum
National and EU initiatives	Promote Plooto as a decentralized platform for circular waste supply chains		• > 1 local workshop co-organized with the national authorities (for the countries represented by the Plooto consortium).	

Community	Marketing strategy	Horizontal Activities	KPIs	Achieved as of M24
			• > 5 workshops in relevant EU initiatives	

Conclusions and Next Steps

This deliverable presented the conducted dissemination, standardization and marketing activities of the Plooto project during the second year of the project. It showcased the activities carried out through all the project's online and offline outlets. It presented both the elaboration of the actions done between M12-M24 and the cumulative actions since the start of the project. As evident from the results of the different actions, Plooto continues its course as designed in the communication and dissemination strategy presented in Deliverable 5.1 Dissemination, Standardization and Marketing Plan and D5.2 Annual Dissemination, Standardization and Marketing Report v1

During the third year of the Plooto project the actions presented in this deliverable will continue and intensify following the direction of the overall strategy for communication and dissemination of the Plooto project as well as the newly produced results as the project has matured. Indicative actions are as follows

- Creation of YouTube videos
- Continuation of collaborative posts on all outlets
- Continuation of cross-polination actions relevant to the progress of the project
- Participation in additional events
- Continuation of academic publications of the new knowledge that will be created during the project.
- New blogposts
- Additional newsletters
- Participation in various conferences