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Executive Summary

In the deliverable at hand, we provide a detailed report on the progress of the Dissemination and Communication Activities of STAR during the whole project duration, M01-M36, reporting specifically on the activities undertaken on the period from M19 (July 1st, 2022) to M36 (December, 31st 2023). This document serves as an update of the previous deliverable D8.2 reporting on the activities implemented during the period from M01 (January 1st 2021) to M18 (June 30th 2022).

The major dissemination means, channels and procedures that are used by STAR have been thoroughly defined and described in the dissemination plan (see deliverable D8.1"Dissemination and Communication Plan") and include both "conventional" approaches, such as participation in events, publications and creation of printed material, and also web related activities.

In this report, we present how these means have been used by the STAR consortium to promote the concept and results of the project towards selected stakeholders and multipliers, as well as to outreach to the targeted audiences to engage them with the technology and business challenges of the project.

We therefore provide an overview of the tools and promotional material developed and used, the activities implemented by the project partners, the extensive use of the online means together with relevant analytics, as well as the evaluation of the project's dissemination and communication achievements in comparison to the targets set.

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Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
AI	Artificial Intelligence
CPS	Cyber Physical System
DIH	Digital Innovation Hub
DoA	Description of Action
EC	European Commission
EU	European Union
H2020	Horizon 2020
IIoT	Industrial Internet of Things
IoT	Internet of Things
KPIs	Key Performance Indicators
RIA	Research and Innovation Action
SDO	Standards Developing Organisation
SMART	Specific-measurable-achievable-realistic-timely & targeted
VDIH	Virtualised Digital Innovation Hub
WP	Work Package
WTP	Worker's Training Platform

1 Introduction

1.1 Purpose and Scope

The deliverable at hand has been prepared in the context of Work Package 8 "Dissemination, Exploitation and Standardisation" and is in particular associated with Task 8.1 "Dissemination and Communication Activities". Here it shall be stated that WP8 is a horizontal Work Package within the project work plan and as such is connected to all other activities.

The present deliverable is the final of three deliverable revisions within the Task 8.1 "Dissemination and Communication Activities", (namely D8.1/D8.2/D8.3) and is closely interrelated and developed in parallel with Task 8.2 "Contributions to Clusters and Associations" and Task 8.6 "Collaboration with other ICT-38-2020 projects".

The purpose of this manuscript, produced at the final month of the project, is to document the STAR dissemination and communication work implemented during the whole project duration, reporting specifically on the activities undertaken on the period from M19 (July 1st, 2022) to M36 (December 31st 2023). The outcomes and impacts, assessment metrics and tools are also presented. A detailed report of each activity is presented within each category.

1.2 Document Structure

The Sections of the present deliverable are organised in the following manner.

After the introductory Section 1, Section 2 provides an overview of the dissemination and communication strategy whereas Section 3 Provides a report on the dissemination and communication activities that took place in the course of the project, providing details for the those taken place during the last 18 months.

Section 4 presents the checklist of the indicators that are being used to measure success in the dissemination work together with the respective actual project achievements, and, finally, Section 5 concludes the document.

2 Dissemination and Communication Strategy

Dissemination and Communication in the context of STAR is designed as a forerunner activity to ensure knowledge diffusion and stakeholders' involvement and is regarded as a two-way dynamic and interactive process, which is continuous and progressive during the project.

To support the fulfilment of its overall vision and ambition of designing **new technologies**, to enable the implementation of standard-based, **secure, safe, reliable** and **trusted human-centric** AI systems in manufacturing environments. STAR has adopted a structured dissemination and communication strategy. The following key pillars, defined since the very beginning of the project and therefore included in the D8.1 "Dissemination and Communication Plan", lay on the basis of the project's **dissemination vision**:

- Integrating the project into the global (CPS/Industry4.0 enabled) manufacturing ecosystem,
- Federating communities of Manufacturers, AI innovators and experts in relevant digital technologies (e.g., AI, Big Data, IIoT, Blockchain),
- Engagement with relevant stakeholders in developing/integrating AI components and solutions,
- Ensuring a close and effective collaboration with AI4EU,
- Engaging key stakeholders in security, safety and ethics,
- Reaching to the future innovators in CPS manufacturing in general and AI solutions for manufacturing,

Supporting the project's commercialisation and market uptake strategy.

2.1 Objectives

The main objective of the Dissemination and Communication activities from their design is to articulate the project's key achievements and main messages, with the aim to create a strong awareness of the STAR project at the European level. The activities designed span communication to the public, as well as dissemination to professional, well-defined, targeted stakeholders.

The detailed aims of the STAR communication strategy have been listed in the deliverables D8.1 [REF-03] and D8.2 [REF-04].

2.2 Approach

STAR adopted a dynamic and flexible approach to be able to adjust the processes in accordance with the results of the feedback received from various information providers (consortium members, stakeholders involved, etc.) and to take into account various opportunities. The STAR dissemination and communication approach has been described in detail in the deliverables D8.1[REF-03] and D8.2[REF-04].

The first phase of the Dissemination and Communication activities (**Phase I – Awareness raising**) covered the first 12 months of the project duration. During the second phase (**Phase II – Engagement**) that started at M13, the focus gradually shifted more to further building up and further establishing a reputation, with emphasis on the first outcomes. Finally, in the third phase around M25-M36 (**Phase III – Encouraging results adoption and**

leveraging the exploitation of outcomes) we focused on implementing actions to encourage STAR results adoption.

2.3 Targeted audiences

As detailed described in Deliverable D8.1 "Dissemination and Communication Plan" the target stakeholders of STAR have been classified into the following major categories:

- **Core communities / stakeholders in the industrial and business world**
 - CPS/Industry4.0 manufacturers, innovators and developers/integrators of AI components and solutions
 - Manufacturers in relevant digital technologies (e.g., AI, Big Data, IIoT, Blockchain)
 - Future innovators in CPS manufacturing in general and AI solutions for manufacturing (enterprises (including SMEs) that have used the services of the DIHs)
- **Communities of users and experts**
 - Experts' in AI and relevant digital technologies
 - Experts in security, safety and ethics
 - Relevant SDOs, focusing on AI in Manufacturing, security and privacy
 - EU clusters and associations in AI and relevant digital technologies
 - EU and National Manufacturing Initiatives
 - Industry4.0 Initiatives
 - EU Initiatives in AI and digital technologies
 - Training Initiatives in manufacturing
- **Policy makers**
 - EC and other decision/policy makers
 - EU and national policy makers dealing with ethical issues
- **Research & academic community**
- **Relevant research projects and initiatives**
- **General public**

2.4 Targeted activities

STAR disseminated its results using a variety of means and activities, intended for transferring the project's achievements, information and news, but also for engaging the targeted audiences in the project activities. The goal was to maximise the involvement of the identified stakeholders in order to let them closely follow STAR's developments, provide their feedback and get engaged in the STAR activities.

The detailed list of the dissemination and communication means used in the project under each category of activities as well as matrix of the dissemination mechanisms/activities used in STAR, associated with the respective objectives and targeted groups have been included in the Dissemination and Communication plan D8.1 [REF-03].

3 Dissemination and Communication activities

3.1 Project identity (visual and branding)

For successful communication, it is important to have a clear project brand identity so as to achieve the highest possible impact on the perception of the target audience. The STAR visual identity has been created since the early stage of the project securing thus a strong and unique brand. The materials produced and adhering to the visual identity are: a leaflet, a PowerPoint template, a press release template, an infographic and an e-newsletter template. Since only recently physical meetings and events started to take place a poster template and a roll-up template will be prepared in the near future.

With respect to the STAR logo, this is characterised by a smart, simple and intuitive design. It provides an easily recognisable project trademark to be used in all dissemination material and activities to contribute to creating awareness and promotion.



Figure 1: STAR logo in different variations

3.2 Web-based communication

3.2.1 Project website

The STAR project website is the main communication tool for the dissemination and communication of information related to the project. The website is the gateway to access available results for people seeking information. The project website is accessible under: <https://star-ai.eu/>.

More detailed information about the website is available in the deliverable D8.2[REF-04].

3.2.1.1 Website analytics

In this section, we present the website analytics since the start of the project.

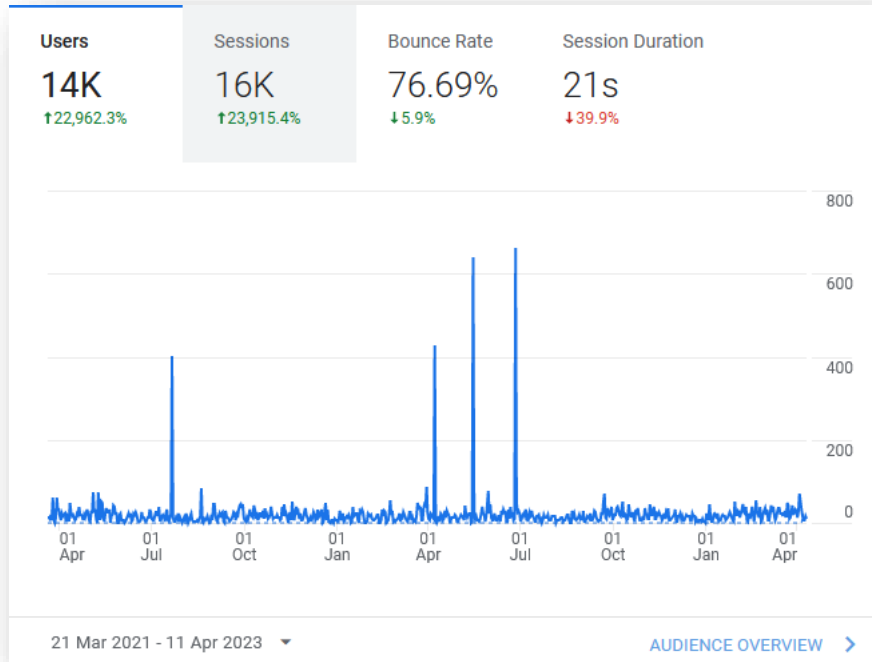


Figure 2: STAR website Audience Overview for the period 21 Mar.2021- 11 Apr.2023 (based on the Universal analytics report)

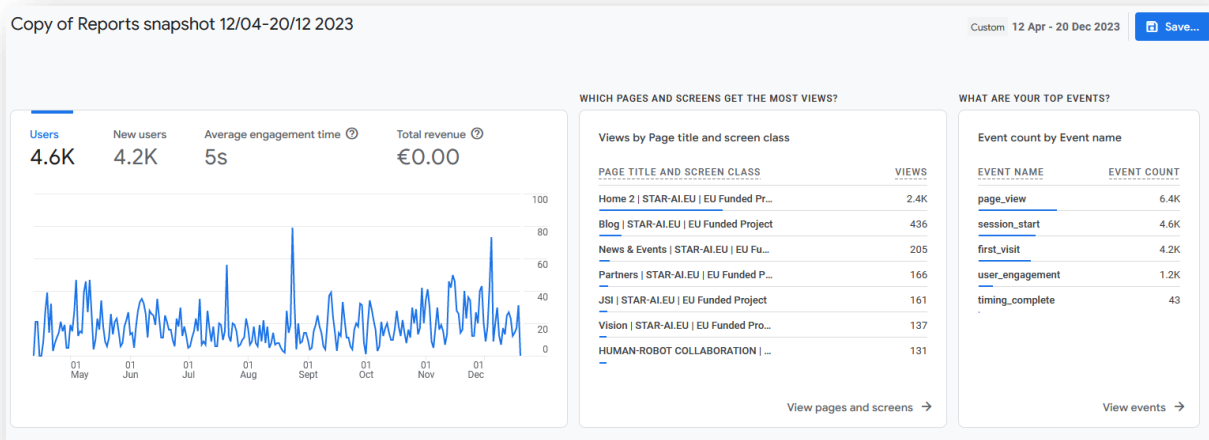


Figure 3: STAR website selected GA4 metrics for the period 12 Apr.2023- 20 Dec.2023 (based on the GA4 report)

Due to the migration from the Universal Analytics (UA) to Google Analytics 4 (GA4), the STAR website measurement is split into two periods:

- from the website launch – 11 April 2023: based on the (basic) metrics on the Universal Analytics
- 12 April 2023- today (20 December 2023): based on the metrics on the GA4

Based on the sum from the two periods, the total number of users is **18.6K**. As it can be observed, the fluctuations in both periods are quite significant. The peeks of users' activity

coincide with the publishing of interesting posts. To increase the interest of the public in the project outcomes and the visibility of the website, we push each interesting information published on the website via the project's social media channels.

From the GA4 for the period from 12 April 2023 until now, it springs that the Home page is the most visited one (36.68%), which is logical, since this is the main page of the website with a lot of information about the project and the events the partners participated in. The page presenting the Blogs is the second most popular pages (6.8%), the fact demonstrating the interest of the users to our latest Blogs fed also by relatively high frequency of publishing in the Blog and the social media strategy we followed for each new blog article published (see section 3.2.2).

The News & Events section is also among the most visited pages (3.2%), followed by the page with the presentation of the STAR partners (2.6%).

3.2.2 STAR Blog

The previous deliverables, D8.1 and D8.2, have already provided an overview of the STAR blogging process and structure and explained its importance in research dissemination and networking.

In total, 47 blog posts featuring various aspects relevant to the project developments in different Work Packages and directed to relevant target AI in manufacturing audiences have been published online starting from March, 2021. Project partners assigned were responsible for producing the content, while INTRA-LU coordinated the activity of planning, content collection and publishing.

The blog posts are available online through: <https://star-ai.eu/blogs-grid>

It is worth mentioning that in order to increase the impact of each blog post, specific strategy for repurposing and reusing the content of each blog post across various channels have been adopted. Publishing of each blog post followed by the following numbers of the Social Media posts based on the content/main conclusions of each blog article:

- 1) 2-3 Tweets
- 2) 2-3 LinkedIn posts

The exact number of the Social Media posts created for each blog article depended on the size and the content of each blog post.

Moreover, some of the blog posts have been re-published by the authors' organisations websites and promoted through their mechanisms and channels, in this way multiplying the reach by the very relevant audiences. Below we present an [example of the post authored by Arthur's Legal and re-published on their website](#), including also the links to STAR social media channels.

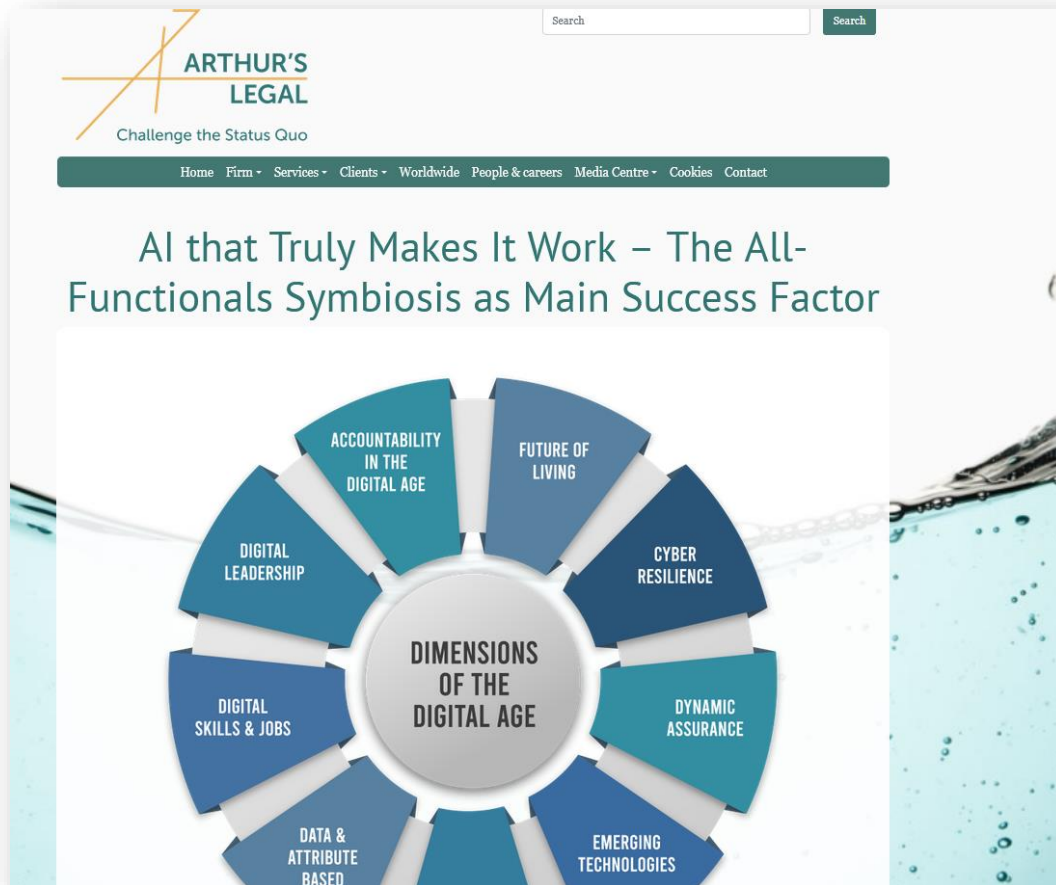


Figure 4: STAR blog post on AI that Truly Makes It Work – The All-Functionals Symbiosis as Main Success Factor, featured on the Arthur’s Legal website

With the aim to maximise the impact of the rich and targeted material provided in the form of blog articles, the STAR Booklet has been produced based on the selection of the blog posts. More details about the Booklet can be found in the section 3.4.3.

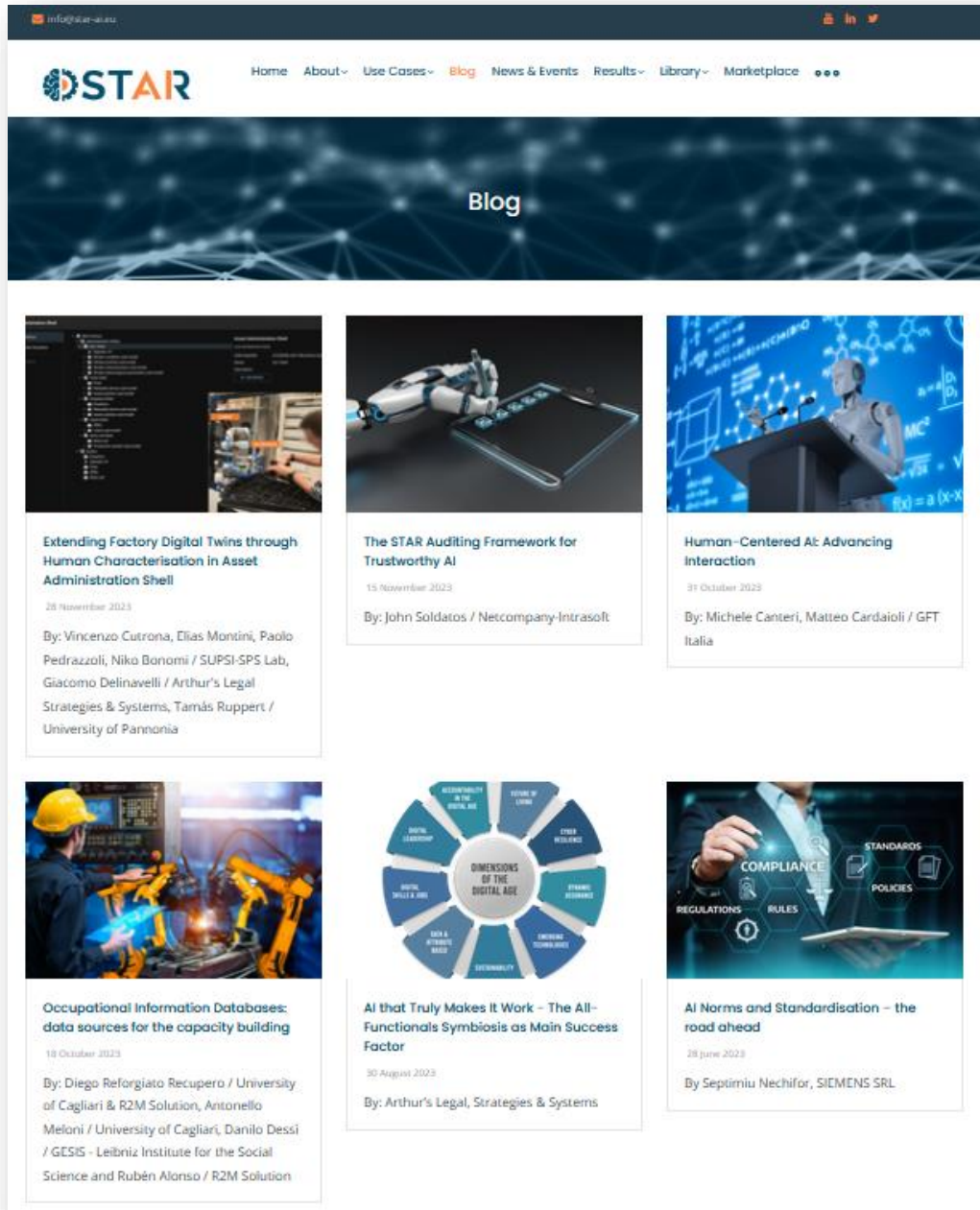


Figure 5: STAR Blog page

3.2.3 STAR Social Media package

Various social networks have been used as marketing tools to promote activities and results of the project on a regular basis. Furthermore, social media have been utilised also to encourage a wider discussion on the topics related to STAR work.

STAR has an active presence in popular social media, such as Twitter and LinkedIn. Links to these social media can be found also at the project's website. Whereas Twitter is utilised to present the project's news, key messages and announcements to a wider audience, the content in LinkedIn is more specific and can be shared to a network of professionals in the fields relevant to STAR.

X (ex-Twitter)

(https://twitter.com/starAI_eu)

STAR has an active X (ex-Twitter) account (@starAI_eu) and has chosen the hashtag #star_AI for its tweets. The Twitter account has been used for promoting and disseminating the STAR’s developments, news, events, blog posts, outcomes, etc. Moreover, re-tweets have been made of relevant and interesting content from disparate sources. Finally, through targeted following of other relevant users STAR not only has got access to more relevant content and updates, but also has acquired more followers.

Main hashtags used among other include: #H2020, #HorizonEU, #STAR_AI, #ArtificialIntelligence, #AI, #AISecurity, #Industry40, #ExplainableAI, #SimulatedReality, #DigitalTwins, #HumanRobotCollaboration #Manufacturing. STAR follows the official Twitter account for the Horizon 2020 programme @EU_H2020 thus becoming a part of the community of H2020 projects on social media. Moreover, closely to the end of the project, we tagged @CORDIS_EU account in the most critical posts informing about the projects major results and developments. This tagging allows the social media managers of the CORDIS channel to be automatically notified of our posts and potentially repost and/or like them accordingly.

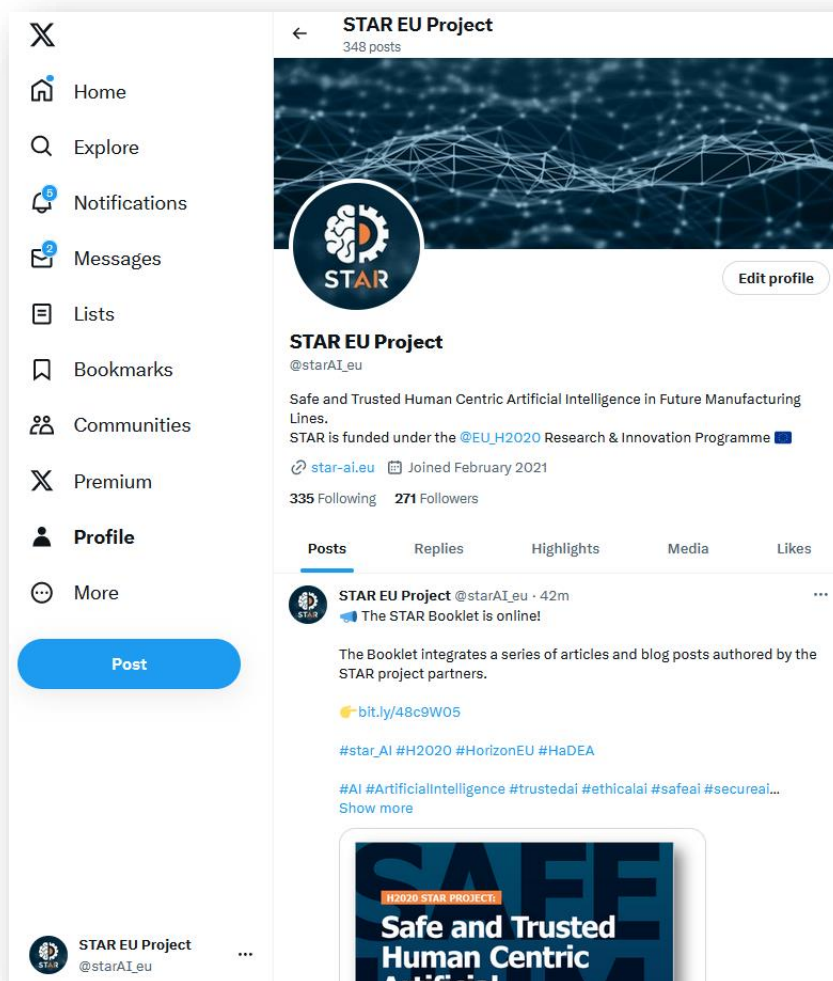


Figure 6: STAR X (ex-Twitter) account (stand 28 December 2023)

STAR’s presence in X (ex-Twitter) has a total number of tweets is 348 and has led to 271 followers and 335 followed accounts and more than 45.5K impressions. Many of the project’s tweets have been re-tweeted and reached by large audiences through the followers of the users that re-tweeted them.

3.2.3.1 LinkedIn

(<https://www.linkedin.com/in/star-ai/>)

LinkedIn is a business-oriented professional networking tool that is used by many as a source of information and inspiration, therefore a solid presence to amplify the news on the website is necessary. STAR maintains a LinkedIn profile page, making it possible to connect to very relevant professionals and diffuse to them the project’s main news and developments. On the other hand, it has given the possibility to subscribe and post to the major groups relevant to the fields relevant to AI in manufacturing and more general H2020 research groups.

STAR’s presence in LinkedIn has increased significantly since the previous period, leading to 201 connections and 504 followers. The total number of posts has reached 312 and of profile views in the last 90 days - 111.



Figure 7: STAR LinkedIn profile page

Many of the project’s posts have been shared and reached by large audiences through the followers of the users that shared them. Thus, in the last 365 days (28 December 2022 – 28 December 2023) the LinkedIn profile page had 30,636 impressions and 739 engagements.

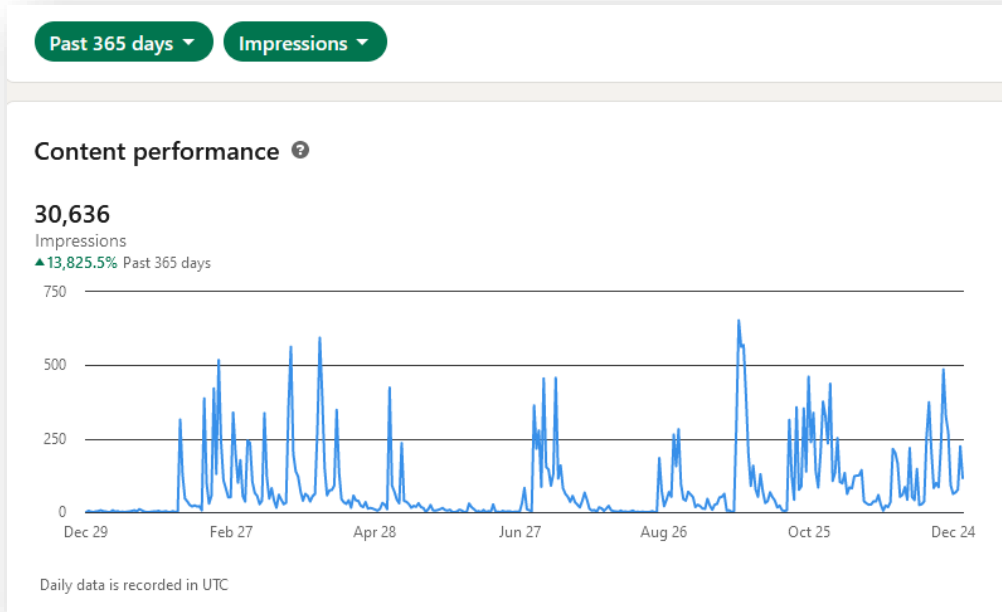


Figure 8: STAR LinkedIn account impression in the last 365 days (28 December 2022 - 28 December 2023)

Here it shall be stated that these numbers are only about the projects profile. Partners and individuals also share posts about STAR on their own networks and thus the numbers are multiplied.

John Soldatos • 1st
Internet of Things and Artificial Intelligence Exp...
1w • Edited

STAR EU Project: AI Trustworthiness Auditing Framework

How can one audit an #artificialintelligence system for industrial use in terms of its trustworthiness? As part of the #h2020 #star project at Netcompany-Intrasoft we have introduced a framework for auditing AI systems in terms of their trustworthiness considering many different dimensions! You can read about our approach in my recent blog post for the STAR Website(https://lnkd.in/dV_gECbN) and we will soon publish a whitepaper with practical information on how to use it!

Important: The framework ends up giving A ...see more

You and 32 others 2 comments • 3 reposts

Like Comment Repost Send

Add a comment...

Most relevant

Gabriela Bar • 2nd
CEO at Szostek_Bar i Partnerzy, PhD in Ia...
1w ***

Thank you for sharing, **John Soldatos** ! Very interesting. As a part of .MAS4AI . we developed a self-assessment tool for Ethical #AI.

Like 1 | Reply 1 Reply

John Soldatos Author 1w ***

Figure 9: Post about STAR published on the STAR’s Technical Coordinator’s account and commented

3.2.3.2 YouTube

(https://www.youtube.com/channel/UCdjvLERunC_yAI2eNvxXRKA)

Apart from the videos from the AI-MAN (ICT-38) projects Cluster online workshops and the presentations delivered in various online events, in the second half of the project, the STAR YouTube channel has been populated with the own audio-visual content. Currently in our YouTube channel we host three short training tutorials, prepared by INTRA (more information available in the section 3.2.5.2)

In addition, the project’s YouTube channel includes videos presenting some of the STAR technologies and services, including the STAR Worker’s Training Platform, the STAR HDT and Quality Inspection as well as a quick overview of the project’s work in relation to the Security for AI Systems in Manufacturing. Finally, a video from the Manufacturing Partnership Day 2023 is also presented.

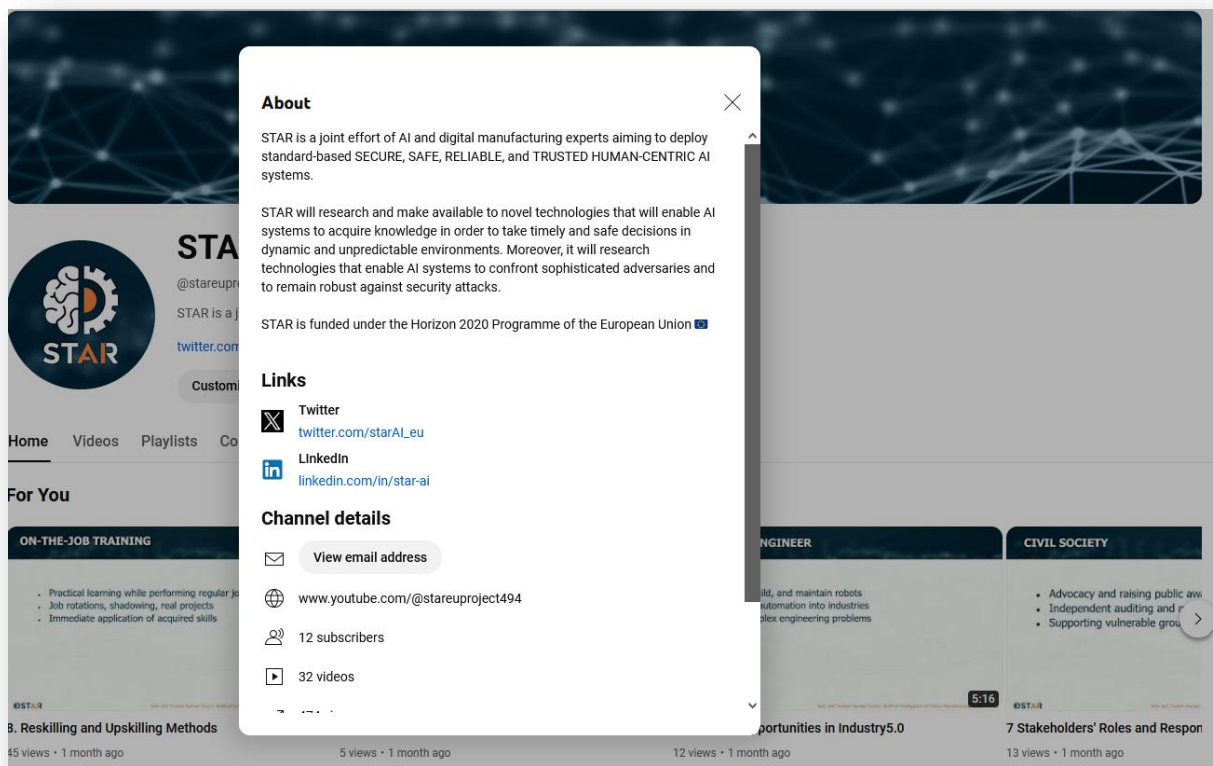


Figure 10: STAR YouTube channel

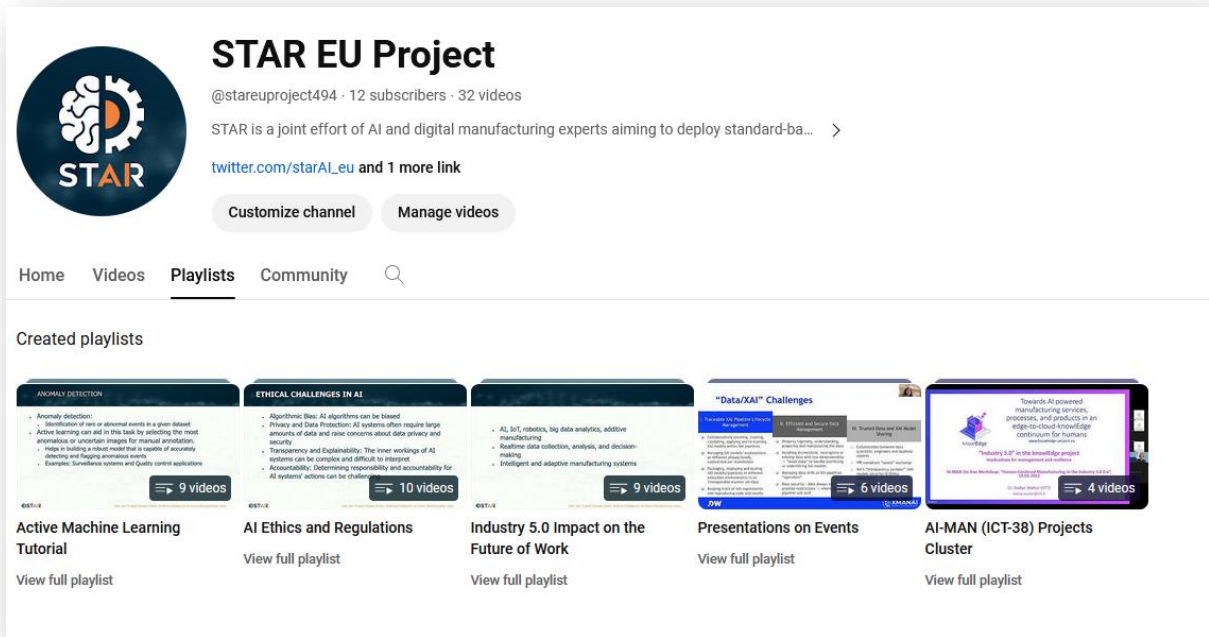


Figure 11: STAR YouTube channel - Playlists

In order to benefit from the visibility of the channels on the CORDIS project page, our website and social media accounts have been shared with the CORDIS team and featured on the [STAR CORDIS page](#).



Figure 12: Reference to STAR website and social media channels on CORDIS

3.2.4 e-Newsletter

E-newsletters provide regular updates on what is happening on the project, highlighting its major news and developments. Netcompany-Intrasoft as the WP8 leader has been responsible for structuring, collecting/writing content, placing into layout and issuing the e-newsletter. The project partners have been providing information when requested ensuring that the content is accurate.

In parallel with the newsletter template, a mailing list has been created, using the [Moosend](#) e-mail marketing platform, giving the possibility to share the e-Newsletter via mass mailing as well as to inform interested users about project news, achievements and planning of events. A registration functionality allowing the interested visitors to subscribe to the newsletter has been embedded on the website.¹ Each newsletter issue was also promoted on the project's social media.

12 issues of the e-newsletter are online (<https://star-ai.eu/newsletters>) to communicate and update the readers on the project activities. Links to both the project website and the social media channels are provided (all are clickable leading directly to the requested page) in order to make it easier for the interested reader to look for more information on our website and follow our social media accounts.

3.2.5 Visuals and multimedia

A rich set of multimedia content have been produced for presenting the STAR project context and solutions, including infographics, images and video material.

Images and, when possible and relevant, videos will be produced. These can be produced during project events and meetings, as well as during other activities (e.g. pilots deployment activities or co-creation workshops). Images and videos can be used for both internal and external communication materials such as website articles, reports, presentations, etc. All partners can contribute with pictures and have the right to use these images as well.

In order to present complex information in a visual representation that guides the readers, infographics are created when possible. Up to now, STAR has prepared one infographic depicting the project's context during the first year of the project.

3.2.5.1 STAR infographic

The [STAR infographic](#) depicting the project's context was prepared during the first year of the project and included in the project's website and dissemination material (leaflet, brochure, poster, roll-up). More information about the STAR infographic is included in the deliverable D8.2[REF-04].

More infographics have been produced by several project partners and used with their relevant blog posts. For example, INTRA-LU created two infographics for their blog post titled "[The STAR Auditing Framework for Trustworthy AI](#)" (see one of them in the figure below), while ALEGAL presented the Digital Age dimensions in the form of infographic used in their blog post "[AI that Truly Makes It Work - The All-Functionals Symbiosis as Main Success Factor](#)".

3.2.5.2 Videos

As already mentioned in the section 3.2.3.2, in our YouTube channel we host three videos presenting some specific services & technologies of the STAR project, including:

- [STAR project work in relation to the Security and Data Governance for AI Systems in Manufacturing](#)
- [STAR HDT and Quality Inspection](#)
- [STAR Workers' Training Platform](#)

¹ Moosend form, aligned with the General Data Protection Regulation (GDPR) (<https://gdpr-info.eu/>)

Moreover, the video created for and showed during the Manufacturing Partnership Day is also featured in our YouTube channel: [STAR video- The Manufacturing Partnership Day](#).

Videos have also been created depicting the workshops of the AI-MAN (ICT-38) Projects Cluster. These videos are included under the [AI-MAN \(ICT-38\) Projects Cluster playlist](#). STAR played a key role in organising these workshops. Furthermore, in our channel we also link to presentations that were delivered on various (mainly, online) events: [Presentation on Events playlist](#).

3.2.5.2.1 Training material

Three tutorials consisted of 9-10 short videos have been created by INTRA-LU and placed on our YouTube channel to be available for the interested stakeholders free of charge. They include:

1. [Active Machine Learning Tutorial](#) (incl.9 videos)
2. [AI Ethics and Regulations](#) (incl. 10 videos)
3. [Industry 5.0 Impact on the Future of Work](#) (incl. 9 videos)

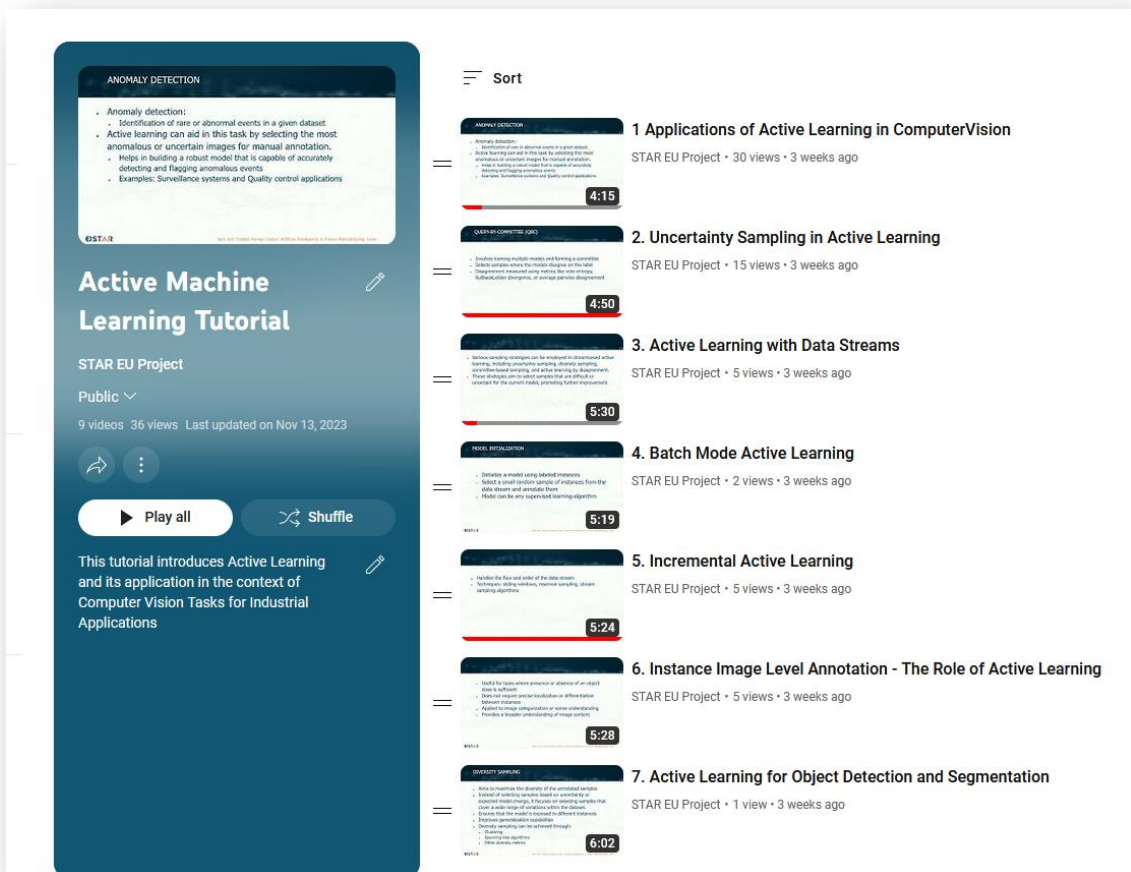


Figure 13: Example of STAR training tutorial – Active Machine learning Tutorial

More information about these Training Tutorials is available on the deliverable D7.5 “Training and Innovation Management Services”

3.3 Events

In order to significantly increase the visibility of the project, but also disseminate the aims and the results of the work to the very targeted audiences, STAR paid specific attention to participation of its partners in or, in some cases, (co-)organisation of the targeted events/sessions. Participation in events is also an opportunity to increase and strengthen the network of relevant parties interested in becoming target audiences and intermediaries becoming multipliers of STAR.

The dissemination events that the STAR consortium participated in or (co-)organised are reported below.

Table 1: List of events STAR participated/co-organised in (period M19-M36)²

Date	Event name	Type	Location
23-26/08/2022	17th International Conference on Availability, Reliability and Security (ARES 2022)	Conference	Vienna, Austria
01/09/2022	Sustainable Places 2022: AI and Ethics Workshop	Workshop	Nice, France
5-7/10/ 2022	16th World Congress on Engineering Asset Management	Conference	Seville, Spain
23-27/10/2022	The Semantic Web - ISWC	Conference	Online
17/11/2022	ICT-38 cluster - Data & Models Interoperability for AI Systems in Manufacturing	Workshop	Online
5/4/2023	Enabling and evaluating Safe, Secure and Ethical AI in manufacturing	Workshop	Drachten, Netherlands
14-16/06/2023	Sustainable Places 2023	Conference	Madrid, Spain
26-27/06/2023	5th Summit of Gender Equality in Computing	Summit	Athens, Greece
9-14/07/2023	22nd IFAC World Congress	Conference	Yokohama, Japan
17-21/9/2023	IFIP APMS 2023: Advances in Production Management Systems Conference	Conference	Trondheim, Norway
20-22/09/2023	Central European Conference on Information and Intelligent Systems	Conference	Dubrovnik, Croatia
26/09/2023	The Manufacturing Partnership Day	Partnership day	Brussels, Belgium
18/10/2023	Pavia Museum Event + CoderDojo	Training	Pavia, Italy
16-17/11/2023	International Conference on Electrical, Computer and Energy Technologies	Conference	Online

² The events in which the project partners participated or (co-)organised during M01-M18 is included in the deliverable D8.2 Dissemination and Communication Activities-Initial version

22-24/11/2023	International Conference on Industry 4.0 and Smart Manufacturing	Conference	Lisbon, Portugal
20/12/2023	ICT-38 cluster - Standardisation for AI in Manufacturing: AI4Manufacturing Cluster Projects Initiatives and Experiences	Workshop	Online

3.3.1 Workshops & sessions (co-)organised

3.3.1.1 Co-creation workshops

Specific attention has been paid to the Co-creation workshops. The 1st Phase Co-creation Workshops for the design of human-centric AI for the STAR three Pilots took place during April-July 2021 (PCL Pilot: 29th April 2021, DFKI Pilot: 11th May 2021, IBER-OLEFF Pilot: 5th July 2021). Within these first phase workshops, the project partners brought in the needed different stakeholder viewpoints for the design perspective of the STAR approach for trusted and human-centric AI.

The second phase workshops took place in parallel with the project General Assembly on the 6th of July 2022 (full day) in Athens, Greece. All partners participated in these workshops. Pilot partners specified the importance of discussing their individual updated use cases and related requirements with the technical partners as to make sure that it is well understood how the 'system' should work (be implemented) in the factory to achieve defined success criteria (i.e., socio-technical performance outcomes).

On April 5th 2023, STAR organised the on-site interactive AI co-creation workshop "Enabling and evaluating Safe, Secure and Ethical AI in manufacturing" that took place at Philips premises in Drachten, the Netherlands.

The workshop gathered more than 40 experts and interested in the field attendees. The event was co-organised by the STAR partners, Philips and the University of Groningen, as well as the Innovation Cluster Drachten and the AI Hub North Netherlands.

This workshop provided insights on the development, deployment and evaluation of AI-based human-centred production systems. Specifically, after a brief project presentation, the discussion was focused on two topics:

- How to involve the Human in the Loop: practical tips, interactive use and demonstration of STAR AI tools in manufacturing uses cases
- How to approach the assessment of human-centric AI systems in manufacturing.

A great interest of the participants to the topics presented and discussed and to the project's achievements in general has been noticed.

During the workshop an exhibition was held with 5 stands presenting tools developed in STAR (Quality inspection and Active Learning, STAR Risk Assessment Engine and Security Manager, Video Analytics and Reinforcement Learning for AMR's, Workers Training Platform for continuous training and Human Digital Twins in Collaborative Robotics Applications) where interested participants could see demos and discuss with the STAR partners about the specific functionalities.

Table 2: Agenda of the STAR interactive co-creation workshop on April 5th 2023 in Drachten, the Netherlands

Time	Activity
13.45 – 14:00	Arrival
14:00 - 14:40	Trusted and Human-Centric AI in Manufacturing with Industrial Cases
14:40 – 15:40	How to involve the Human in the Loop: practical tips, interactive use and demonstration of STAR AI tools in manufacturing uses cases
15:45-16:30	How to approach the assessment of human-centric AI systems in manufacturing: active discussion and evaluation
16:30-17:00	Participants mix-up and drinks



Figure 14: Snapshots from the STAR interactive co-creation workshop on April 5th 2023 in Drachten, the Netherlands

Three internal workshops took place on the 4th and the 5th April 2023 in the same site. Each workshop was dedicated to each of the three STAR Pilots and concentrated on the presentation and discussion of the Use Cases and the respective Techno-Economic and Socio-Economic evaluation criteria.

The sessions and workshops co-organised in cooperation with the AI-MAN Cluster of projects are described in the section 3.8.

3.4 Promotional and light-weight exhibition material

3.4.1 Digital leaflet

The [project leaflet](#) (online version), aiming to introduce the project and present its scope and objectives, was prepared in July 2021 and is available in the project website. The leaflet has already been presented in the deliverable D8.2[REF-04].

3.4.2 Printed material

The printed materials have been prepared in order to be used during conferences, workshops, exhibitions and other relevant events.

3.4.2.1 Brochure

The 8-page STAR brochure has been produced by the WP8 leader Netcompany-Intrasoft, with its layout and content agreed upon by all the partners. Apart from presenting STAR scope and objectives, it concentrates on the technologies developed in the project, but also makes specific focus on the STAR Market Platform. It is available in English, with a clean, modern and attractive design and was produced. The STAR leaflet was prepared in September 2023 and is available in the project website (https://star-ai.eu/sites/default/files/star_brochure_b5_20230914v02.pdf) and in print (distributed to the relevant stakeholders).

Safe and Trusted Human Centric Artificial Intelligence in Future Manufacturing Lines

www.star-ai.eu

Enabling SAFE, SECURE and ETHICAL AI in Manufacturing

STAR researches, develops, validates, and makes available to the community leading edge AI technologies with wide applicability in manufacturing environments:

Explainable AI

Why did you do this?

- Explain to Factory Workers and Quality Engineers the rules and principles of the AI systems operation
- Increasing Transparency and Trust on AI Systems

Active Learning

Robot-to-Human: Is this piece defective?

- Query human where not sure what to do next!
- Accelerate Knowledge Acquisition for AI

(Cyber) Security for AI Systems

Protection of AI Systems against Adversarial Attacks

Safe and Trusted Human-Centric Artificial Intelligence in Future Manufacturing Lines

Human-Centric Digital Twins

What-if-Analysis with the Human-in-Loop?

- Simulation & Detection of Safety Zones
- Optimal Deployment of Automated Mobile Robots
- Detection of Safety Zones

Simulated Reality

- Shorten Reinforcement Learning Cycle
- Simulate the next actions of Reinforcement Learning from expecting convergence

These technologies are validated in challenging scenarios in manufacturing lines, in the areas of quality management, human robot collaboration and AI-based agile manufacturing

Safe and Trusted Human-Centric Artificial Intelligence in Future Manufacturing Lines

The challenge

Artificial intelligence (AI) systems in the manufacturing sector are increasingly replacing human tasks improving the automation of production. These systems need to be safe, trusted and secure, even when operating in dynamic, unstructured and unpredictable environments to be able to react to different situations and security threats. Ensuring the safety and reliability of these systems is a key prerequisite for deploying them at scale and for fully leveraging the benefits of AI in manufacturing.

Challenges for AI in Industrial Systems:

- Transparency and Explainability
- Slow and Hazardous Interactions between AI Systems and Manufacturing Environment
- Human-Centric AI Systems i.e. AI, Humans, Robots must co-exist in Industrial Plants
- New Opportunities for AI (Cyber)Security Attacks
- Inaccuracy and Unreliability of Industrial Data

Discover STAR

STAR, a joint effort of AI and digital manufacturing experts, deploys standard-based secure, safe, reliable and trusted human-centric AI systems.

STAR researches, develops, validates and makes available to the AI and Industry 4.0 communities novel technologies that enable AI systems to acquire knowledge in order to take timely and safe decisions in dynamic and unpredictable environments, including Explainable AI, Active Learning and Simulated Reality for fast, safe and efficient online learning and knowledge acquisition, Human-Centric Digital Twins, and Security for AI systems.

These technologies are validated in challenging scenarios in manufacturing lines, in the areas of quality management, human-robot collaboration and AI-based agile manufacturing.

The project's results are fully integrated into existing EU-wide Industry 4.0 and AI initiatives (notably ETTRA and ARES), as a means of enabling researchers and the European industry to deploy and fully leverage advanced AI solutions in manufacturing lines.

Safe and Trusted Human-Centric Artificial Intelligence in Future Manufacturing Lines



Figure 15: STAR brochure

3.4.2.2 Poster/Roll-up

STAR roll-up and poster have been produced by the Netcompany-Intrasoft team to raise the awareness of the stakeholders and a variety of audiences about the project with succinct textual and graphical information. Their design is matching the look and feel of the website and the overall project design concept. The roll-up and posters have been prepared in English language.

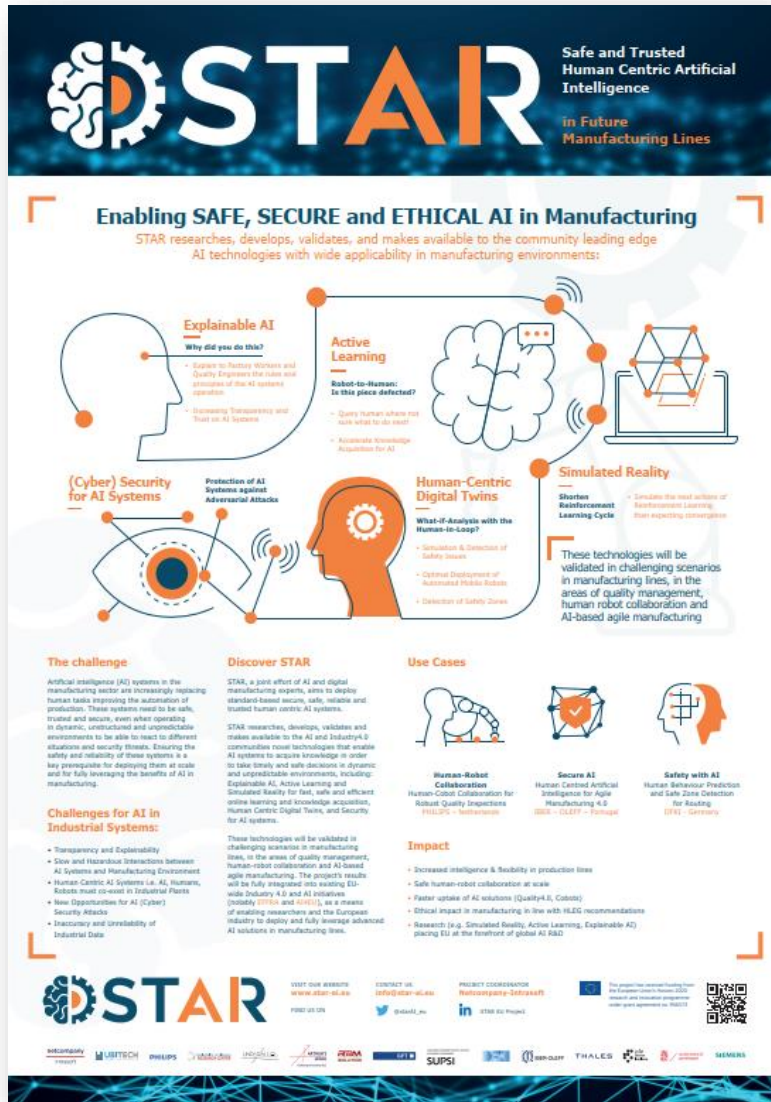


Figure 17: STAR poster

More event-specific posters have been produced and featured during the events, where STAR partners participated. In the figure below we present the example of the poster presented at the 5th Summit on Gender Equality in Computing on 27th June 2023 in Athens, Greece.

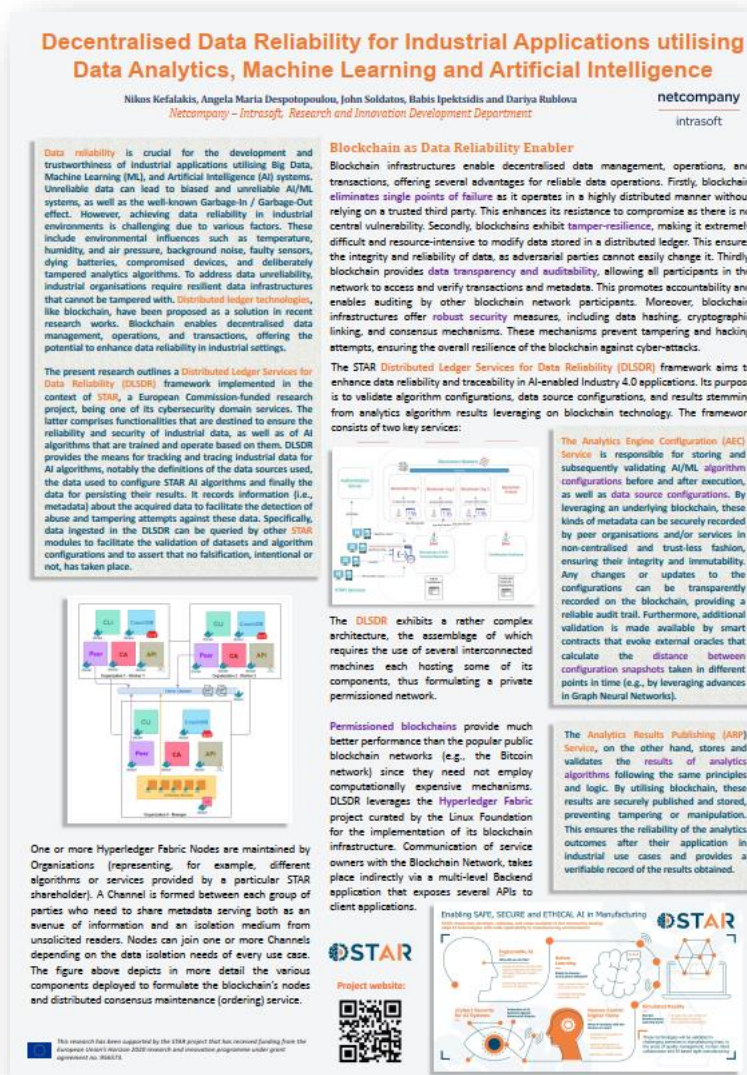


Figure 18: Poster presented by STAR at the 5th Summit on Gender Equality in Computing (GEC23) on 27th June 2023 in Athens, Greece

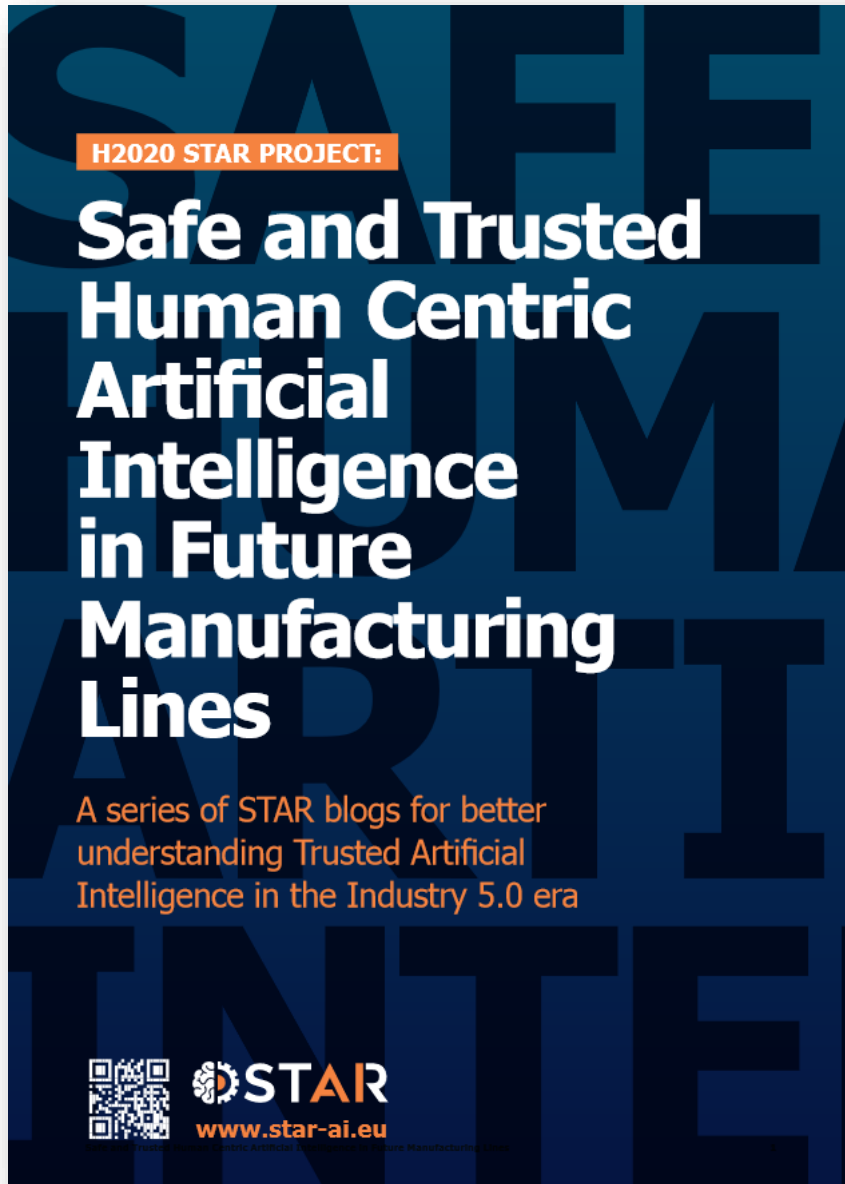
3.4.3 STAR Booklet

Provided that we have collected rich material in the form of the blog post articles touching different aspects related to trustworthy AI in manufacturing and the relevant work implemented in STAR, the consortium decided to include the collection of the blog articles under a single Booklet. The STAR Booklet titled "A series of STAR blogs for better understanding Trusted Artificial Intelligence in the Industry 5.0 era" separates the articles into the six sections (Parts), namely:

- Part I: H2020 STAR Project Overview
- Part II: Human-AI Systems Collaboration and Human-Centred Manufacturing
- Part III: Industrial Systems Safety
- Part IV: Explainable and Trustworthy AI
- Part V: AI Cybersecurity

- Part VI: AI Ethics and Regulations

The Booklet has become available digitally on the [STAR website](#) and has been widely promoted on the project's and partners' social media. The file for professional printing is also available for the project partners.



Library of Reference AI Scenarios and Use Cases

By: **Tiago Teixeira** / UNPARALLEL INNOVATION LDA

In the context of STAR, a Library of Reference AI Scenarios and Use Cases was created. The AI Scenarios and Use Cases identified are related to manufacturing with an emphasis on scenarios directly related to STAR. To elaborate this library of scenarios the elicitation was performed in two groups. The first one related to the STAR scenarios and use cases and the second, to external and public know scenarios and use cases. The figure below depicts the first steps made for the identification of the scenarios.

The research for external scenarios and use cases, was mainly performed with the help of platforms, as the IoT-Catalogue.com and the EFFRA portal. The IoT-Catalogue.com was utilised to elicit a list of use cases that are known to use AI in manufacturing together with EFFRA which is a portal that promotes the development of new and innovative production technologies provides quite good information. At the same time also the AI4EU project was analysed to elicit the relevant use cases and scenarios targeted by it. Additionally, an analysis was performed on a study conducted by the Centre for Strategy and Evaluation Services (CSES). The name of the study is Opportunities of Artificial Intelligence and provides an assessment of the state of AI adoption in the European industry. STAR has collected a total of 58 AI Scenarios and Use Cases, distributed in the following way:

- STAR: 10;
- IoT-Catalogue.com: 14;
- EFFRA portal: 18;
- AI4EU: 8;
- Opportunities of Artificial Intelligence Study: 8.

Figure 1

Figure 2

The second figure represents the organogram of how the work progressed after the identification of the scenarios.

The work performed to understand the similarities between the STAR project scenarios and the external scenarios, had the following steps:

- Identify and extract the parameters such as country, project, and year from the elicited scenarios.
- Analyse and classify the collected information and obtain the domain and category of the AI scenario.
- Relate the STAR project scenarios with the external scenarios.

This enabled the identification of which external scenarios related to the STAR scenarios, and the possible relevance in how the external scenarios can be of use for the implementation and deployment of STAR technologies within the STAR pilots.

Safe and Trusted Human Centric Artificial Intelligence in Future Manufacturing Lines

The "little" challenges within the CHALLENGE

By: **Mihail Fontul & Gil Oliveira** / IBER-Oleff

Iber-Oleffs (IBER) main challenge within the STAR project is to become agile by good use of AI in the production process. This article is all about the little challenges they face in this journey.

IBER was born 25 years ago, with a small team of 25 people. During IBER's lifetime new projects arrived and thus IBER evolved to what it is today, a 500+ people company acting across several industries always with a special focus on technical plastic parts with kinematics. Although there were improvements in the workflows and processes over the years, the general philosophy and organisation remained the same. Those were the days of mass production where customisation was still a buzz word. Nowadays, the world has followed the mass of mass customisation instead and organisations like IBER must quickly adapt to this trend or they run the risk of getting out of the business. In the STAR project, IBER saw the opportunity to run a first pilot of the new production cells with higher degrees of agility and situations.

The first of these "littles" challenges were related to creating an island of customisation within an organisation that used to work towards mass production. It is like a piece of sand in a huge gear box. The IBER STAR team had to start from scratch a work with company colleagues to start this mind shift without jeopardising the running production. This first challenge brought a good set of lessons learned that proved later to be very useful in other situations.

The second "little" challenge was the technological state of the art of the production lines that was in line with the philosophy of mass production. Lack of sensorisation, no real-time monitoring in each workstation and so many other examples, are symbols of the history of the company. To be able to prepare the pilot, changes and adaptation of the work environment were needed far beyond what was forecasted.

The STAR Auditing Framework for Trustworthy AI

By: **John Soldatos** / Netcompany-Introsoft

The team was able to understand this little challenge and in a reasonable amount of time span, to adapt the pilot areas to be ready and have the necessary technological upskill to give the mandatory output to enable the project to succeed.

The third and last little challenge is about DATA! IBER never had to share production data with third parties. First because of the severe NDA with clients; secondly because it was never needed! Besides these two main reasons, IBER is a manufacturing site with not so many IT experts and IT expertise, meaning that training for technical teams and awareness for production teams were much appreciated and had quite an impact. Nevertheless, this is still an ongoing "little" challenge as the anonymisation of the data is still something IBER is working hard on. The generation of Giga bites of information on real time are being stored in an internal database and must be transformed into valid information to be shared with the STAR partners to be further processed in the AI machine.

In summary, STAR has given IBER the chance to create not only a great pilot project for the use of AI in manufacturing processes, but also to begin a digital transformation journey. The IBER team is excited with what the upcoming months will bring, but also to see the impact of the pilot project in the full extent of the company.

The STAR Auditing Framework for Trustworthy AI

By: **John Soldatos** / Netcompany-Introsoft

Figure 1: STAR Trustworthiness Auditing Framework Overview

Considering the above listed components, the AI trustworthiness auditing process involves the following steps:

- An AI Trustworthiness Evaluation Guide, which provides the means for processing the information of the self-evaluation form. It comprises rules for scoring the trustworthiness of an AI system, based on the information of the self-evaluation form about the system.
- Two main outputs of the AI auditing process, which are produced based on the processing of the self-evaluation questions in-line with the rules and instructions of the evaluation guide.

Supply of Information about the AI System: The business owner of the AI system (e.g., manufacturing worker, production manager) or the developer/integrator of the AI system provides information about the system. The information is provided in the form of answers to a specific set of multiple-choice questions based on a proper self-evaluation form/questionnaire.

The auditing framework consists of the following components:

- A Self-Assessment / Self-Evaluation Form for the trustworthiness of AI systems. It consists of a set of questions that relate to different aspects of the trustworthiness of an AI system.

Figure 19: Screenshots from the STAR Booklet's pages – front page, example of the articles in the inner pages

3.5 Press-based communication/dissemination

3.5.1 Press Releases and publishing on the own and third-party portals

STAR has produced 6 press releases, during important moments (milestones, events) of the project. Two Press Releases have been intended to be shared not only with the specialised stakeholders, but also with the general public in order to raise wider interest in the project, including the first Press Release announcing the project and providing its general overview, but also the one introducing the STAR Booklet. Four other Press Releases have been targeting mostly the major stakeholders (including the communities of users and AI experts, the core communities and stakeholders in the industrial and business world, research and academia and the relevant research projects and initiatives.

Press Releases have been created by INTRA and shared with all the partners in order to be circulated to their business networks and media contacts, through the databases that they maintain, published on the partners’ websites and newsletters.

In this way, Press Releases have been sent for publication to / published in various (local and European) more generic or specialised information providers identified by the consortium, including, for example, the [BDVA news and newsletters](#), [CORDIS news](#), [EFFRA Innovation Portal](#), [AIoD news](#), [ENGINE newsletter](#).

All the Press Releases can be found in the dedicated page of the project’s website: <https://star-ai.eu/press-releases>

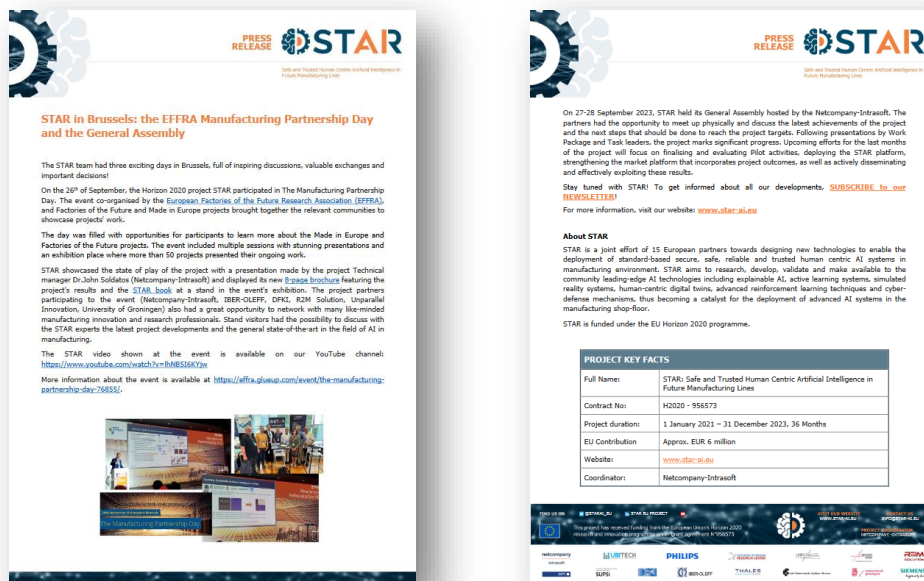


Figure 20: Example of the STAR Press Release

It should be mentioned here that apart from the Press Releases, the project partners shared with their relevant networks and published on their websites other relevant to them project’s developments and news.

3.5.2 Publishing on third-party means

Significant project developments, news and announcements, press releases, but also articles introducing STAR have been shared with the relevant networks, associations, initiatives, clusters project partners collaborate with. Subsequently, articles about STAR and its latest developments have been included in the third-party websites, portals, newsletters, etc. Some examples include the news items on the AI4EU (and [AI4Europe](#)) website, articles on the [BDV](#) website and newsletters, news on the [AI4Manufacturing](#) website and [LinkedIn page](#), news in the [EFFRA Innovation Portal](#).



Figure 21: Article about STAR mini-courses and a new blog post at the [BDVA website](#)

3.5.2.1 STAR Results in Brief

STAR Results in Brief article has been published under the Results Pack on human-centric manufacturing on the [CORDIS website](#).

The article, titled "People-first approach helps build trust in manufacturing AI" is provided in six languages (DE, EN, ES, FR, IT, PL). It explains how the STAR project uses human-centric

design to build safe and reliable technologies. It explains the risks and challenges in enhancing the intelligence of manufacturing processes and the benefits of trust-building AI systems. The article focuses on the novel AI technologies evaluated and validated in three pilots for both technical and social performance – in particular, their trustworthiness.

In order to produce the article, STAR Technical Coordinator has been interviewed by the assigned journalist.

3.6 Scientific papers and publications

3.6.1 Scientific publications

Publications in specialised journals and conferences are a conventional but effective way to disseminate project outcomes and attract the attention of the scientific, business and public stakeholders. Our initial target included at least 20 publications in the Open Access international referred journals and magazines. Up to now, 40 scientific publications have been prepared and one Open access Book has been published.

Table 3: STAR – List scientific publications (during the whole project duration)

Title	Authors	Title of the Journal/ Proceedings	Year
An Abstraction Layer Exploiting Voice Assistant Technologies for Effective Human—Robot Interaction	Ruben Alonso (R2M), Emanuele Concas (UNICA), Diego Reforgiato Recupero (R2M, UNICA)	Applied Sciences (ISSN 2076-3417). Special issue belonging to the section "Robotics and Automation".	2021
Help me learn! Architecture and strategies to combine recommendations and active learning in manufacturing.	Patrik Zajec, Jože M. Rožanec, Elena Trajkova, Inna Novalija, Klemen Kenda, Blaž Fortuna, Dunja Mladenčić	MDPI Information 2021	2021
Knowledge graph-based rich and confidentiality preserving Explainable Artificial Intelligence (XAI)	Jože M. Rožanec, Blaž Fortuna, Dunja Mladenčić	Information Fusion	2022
Enriching Artificial Intelligence Explanations with Knowledge Fragments	Jože M. Rožanec, Elena Trajkova, Inna Novalija, Patrik Zajec, Klemen Kenda, Blaž Fortuna, Dunja Mladenčić	MDPI Future Internet	2022
An IIoT Platform For Human-Aware Factory Digital Twins	Montini, E., Cutrona, V., Bonomi, N. Bettoni, A., Landolfi, G., Rocco, P. Carpanzano, E.	Procedia CIRP	
Extending factory digital Twins through human characterisation in Asset Administration Shell	Vincenzo Cutrona, Niko Bonomi, Elias Montini, Tamas Ruppert, Giacomo Delinavelli, Paolo Pedrazzoli	International Journal of Computer Integrated Manufacturing	2023
Identifying Novel Defects During AI-Driven Visual Quality Inspection	S.Theodoropoulos, P.Zajec, J.M.Rozanec, D. Dardanis, G. Makridis, D.Kyriazis, P.Tsanakas	IFAC WC 2023	2023
XAI enhancing cyber defence against adversarial attacks in industrial applications	Georgios Makridis, Spyros Theodoropoulos, Dimitrios Dardanis, Ioannis Makridis, Maria Margarita Separdani, Georgios	2022 IEEE 5th International Conference on Image	2022

	Fatouros, Dimosthenis Kyriazis, Panagiotis Koulouris	Processing Applications and Systems (IPAS)	
XAI for time-series classification leveraging image highlight methods	Georgios Makridis, Georgios Fatouros, Vasileios Koukos, Dimitrios Kotios, Dimosthenis Kyriazis and Ioannis Soldatos	MEDES 2023	2023
Synthetic Data Augmentation Using GAN For Improved Automated Visual Inspection	Rožanec, Jože M.; Zajec, Patrik; Theodoropoulos, Spyros; Koehorst, Erik; Fortuna, Blaž; Mladenić, Dunja	IFAC WC 2023	2023
Robust Anomaly Map Assisted Multiple Defect Detection with Supervised Classification Techniques	Jože M. Rožanec, Patrik Zajec, Spyros Theodoropoulos, Erik Koehorst, Blaž Fortunat, Dunja Mladenić	IFAC WC 2023	2023
Worker Activity Recognition in Manufacturing Line Using Near-body Electric Field	Suh, Sungho, Vitor Fortes Rey, Sizhen Bian, Yu-Chi Huang, Jože M. Rožanec, Hooman Tavakoli Ghinani, Bo Zhou, and Paul Lukowicz.	IEEE Internet of Things	2023
CaptAinGlove: Capacitive and inertial fusion-based glove for real-time on edge hand gesture recognition for drone control	Bello, Hymalai, Sungho Suh, Daniel Geißler, Lala Shakti Swarup Ray, Bo Zhou, and Paul Lukowicz	In Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing & the 2023 ACM International Symposium on Wearable Computing	2023
Object Detection for Human-Robot Interaction and Worker Assistance Systems	Hooman Tavakoli Ghinani, Snehal Walunj, Parsha Pahlevannejad, Christiane Plociennik, Martin Ruskowski	Artificial Intelligence in Manufacturing ICT-38	2023
STARdom: an architecture for trusted and secure human-centered manufacturing systems	Jože M. Rožanec, Patrik Zajec, Klemen Kenda, Inna Novalija, Blaž Fortuna, Dunja Mladenić, Entso Veliou, Dimitrios Papamartzivanos, Thanassis Giannetsos, Sofia Anna Menesidou, Rubén Alonso, Nino Cauli, Diego Reforgiato Recupero, Dimosthenis Kyriazis, Georgios Sofianidis, Spyros Theodoropoulos, John Soldatos	APMS	2021
A General and NLP-based Architecture to perform Recommendation: A Use Case for Online Job Search and Skills Acquisition	Rubén Alonso, Danilo Dessí, Antonello Meloni , and Diego Reforgiato Recuero	In Proceedings of the 38th ACM/SIGAPP Symposium On Applied Computing	2023
Human-centric artificial intelligence architecture for industry 5.0 applications	Jože M. Rožanec, Inna Novalija, Patrik Zajec, Klemen Kenda, Hooman Tavakoli Ghinani, Sungho Suh, Entso Veliou, Dimitrios Papamartzivanos, Thanassis Giannetsos, Sofia Anna Menesidou, Ruben Alonso, Nino	International Journal of Production Research	2022

	Cauli, Antonello Meloni, Diego Reforgiato Recupero, Dimosthenis Kyriazis, Georgios Sofianidis, Spyros Theodoropoulos, Blaž Fortuna, Dunja Mladenčić & John Soldatos		
Human in the AI Loop in Production Environments	Emmanouilidis, C., Waschull, S., Bokhorst, J.A.C., and Wortmann, J.C.	In: Dolgui, A., Bernard, A., Lemoine, D., von Cieminski, G., Romero, D. (eds) Advances in Production Management Systems. Artificial Intelligence for Sustainable and Resilient Production Systems. APMS 2021. IFIP Advances in Information and Communication Technology	2021
Development and application of a human-centric co-creation design method for AI-enabled systems in manufacturing	Emmanouilidis, C., and Waschull, S.	14th IFAC Workshop on Intelligent Manufacturing Systems IMS 2022	2022
Human-Centric Industrial Augmented Reality: Requirements and Design Guidelines for Usability	Florescu, T., Waschull, S., and Emmanouilidis, C.	In: Alfnes, E., Romsdal, A., Strandhagen, J.O., von Cieminski, G., Romero, D. (eds) Advances in Production Management Systems. Production Management Systems for Responsible Manufacturing, Service, and Logistics Futures. APMS 2023. IFIP Advances in Information and Communication Technology.	2023
Visual Quality Control via eXplainable AI and the Case of Human in the AI Loop	Emmanouilidis, Christos; Rica-Alarcón, Elena	In: Crespo Márquez, A., Gómez Fernández, J.F., González-Prida Díaz, V., Amadi-Echendu, J. (eds) 16th WCEAM Proceedings. WCEAM 2022. Lecture Notes in Mechanical Engineering.	2022
Data-Driven Wheel Slip Diagnostics for Improved Railway Operations	Bernadin Namoano; Christos Emmanouilidis; Cristobal Ruiz-Carcel; Andrew Starr	5th IFAC Workshop on Advanced Maintenance Engineering, Services and Technologies AMEST 2022 Bogotá, Colombia, July 26 – 29, 2022	2022
Predicting Operators' Fatigue in a Human in the Artificial Intelligence Loop for Defect Detection in Manufacturing	Jože M. Rožanec, Karel Križnar, Elias Montini, Vincenzo Cutrona, Erik Koehorst, Blaž Fortuna, Dunja Mladenčić, Christos Emmanouilidis	22nd IFAC World Congress Yokohama, Japan, July 9-14, 2023	2023
Assessing human-centricity in AI enabled manufacturing systems: a	Waschull, S., Emmanouilidis, C.	22nd IFAC World Congress Yokohama, Japan, July 9-14, 2023	2023

socio-technical evaluation methodology			
Anticipating human presence for safer worker - robot shared workspaces	Emmanouilidis, C., Rica, E., and Duqueroie, B.	22nd IFAC World Congress Yokohama, Japan, July 9-14, 2023	2023
A Perfect Match: Deep Learning Towards Enhanced Data Trustworthiness in Crowd-Sensing Systems	Afzal-Houshmand, Sam, Sajad Homayoun, and Thanassis Giannetsos	2021 IEEE International Mediterranean Conference on Communications and Networking (MeditCom)	2021
Explainable Artificial Intelligence to Enhance Data Trustworthiness in Crowd-Sensing Systems	Sam Afzal-Houshmand; Dimitrios Papamartzivanos; Sajad Homayoun; Entso Veliou; Christian D. Jensen; Athanasios Voulodimos; Thanassis Giannetsos,	2023 19th International Conference on Distributed Computing in Smart Systems and the Internet of Things (DCOSS-IoT)	2023
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Explainable Artificial Intelligence Meets Active Learning: A Novel GradCAM-based Active Learning Strategy	Križnar, K., Fortuna, B., Rožanec, J. M., & Mladenić, D.	Central European Conference on Information and Intelligent Systems, Faculty of Organization and Informatics Varazdin	2023
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On-the-fly Image-level Oversampling for Imbalanced Datasets of Manufacturing Defects	Spyros Theodoropoulos, Patrik Zajek, Joze M. Rozanec, Dimosthenis Kyriazis, Panayiotis Tsanakas	Springer, Machine Learning, Special Issue on Imbalanced Learning	pending
Enhancing Robustness to Novel Visual Defects through StyleGAN Latent Space Navigation: A Manufacturing Use Case.	S.Theodoropoulos, D. Dardanis, G. Makridis, P.Zajec, J.M.Rozanec, D.Kyriazis, P.Tsanakas	Journal of Intelligent Manufacturing, Springer	pending

3.6.2 STAR Open Access Book

The book written by the STAR partners titled "Trusted Artificial Intelligence in Manufacturing: A Review of the Emerging Wave of Ethical and Human Centric AI Technologies for Smart Production" has been published on 22 November 2021. It includes the Frontmatter and 11 chapters authored by STAR partners. Each chapter relates to a different topic and can be also downloaded separately. The book has been downloaded up to now more than 48,000 times (stand 23 December 2023).

The book is available in Open access here: <https://nowpublishers.com/article/BookDetails/9781680838763>.



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Trusted Artificial Intelligence in Manufacturing: A Review of the Emerging Wave of Ethical and Human Centric AI Technologies for Smart Production
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Edited by John Soldatos, INTRASOFT International | Dimosthenis Kyriazis, University of Piraeus

Publication Date: 22 Nov 2021

Suggested Citation: John Soldatos (ed.), Dimosthenis Kyriazis (ed.) (2021), "Trusted Artificial Intelligence in Manufacturing: A Review of the Emerging Wave of Ethical and Human Centric AI Technologies for Smart Production", Boston-Delft: now publishers, <http://dx.doi.org/10.1561/9781680838770>

Downloaded: 48057 times

Description

This book is co-authored by the STAR consortium members and provides a review of technologies, techniques and systems for trusted, ethical, and secure AI in manufacturing. The different chapters of the book cover systems and technologies for industrial data reliability, responsible and transparent artificial intelligence systems, human centered manufacturing systems such as human-centred digital twins, cyber-defence in AI systems, simulated reality systems, human robot collaboration systems, as well as automated mobile robots for manufacturing environments. A variety of cutting-edge AI technologies are employed by these systems including deep neural networks, reinforcement learning systems, and explainable artificial intelligence systems. Furthermore, relevant standards and applicable regulations are discussed. Beyond reviewing state of the art standards and technologies, the book illustrates how the STAR research goes beyond the state of the art, towards enabling and showcasing human-centred technologies in production lines. Emphasis is put on dynamic human in the loop scenarios, where ethical, transparent, and trusted AI systems co-exist with human workers. The book is made available as an open access publication, which could make it broadly and freely available to the AI and smart manufacturing communities.

Table of Contents

Frontmatter John Soldatos Dimosthenis Kyriazis	Pages i-xxiii	<input type="checkbox"/>
1. Blockchain Based Data Provenance for Trusted Artificial Intelligence John Soldatos Angela-Maria Despotopoulou Nikos Kefalakis Babis Ipektsidis	Pages 1-29	<input type="checkbox"/>
2. Artificial Intelligence and Secure Manufacturing: Filling Gaps in Making Industrial Environments Safer Entso Vellou Dimitrios Papamartzivanos Sofia Anna Menesidou Panagiotis Gouvas Thanassis Giannetsos	Pages 30-51	<input type="checkbox"/>

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Figure 22: STAR Open Access Book

Another book on **“Artificial Intelligence in Manufacturing - Enabling Intelligent, Flexible and Cost-Effective Production Through AI”**, prepared in cooperation with the AI-MAN Cluster projects, is now under production. More details are available in the deliverable D8.5 [REF-07].

3.6.3 Engagement with students and researchers

The research partners have engaged students and researchers with STAR-related work, in such a way diffusing the scientific and technological knowledge generated in the project to this category of target audiences, but also receiving invaluable feedback. Examples of such engagement are presented below:

- 2 Bachelor Thesis on the topics related to STAR WP5: human-digital twins and fatigue

monitoring system (implemented by SUPSI),

- 1 Master project on the fatigue monitoring system (implemented by SUPSI),
- 14 experiments involving STAR technologies conducted involving students and researchers at SUPSI,
- Smart Industry Operations course provided by the University of Groningen (RUG) – this course provides introductory coverage of Industry 4.0 technologies and their interrelations with humans, with a specific focus on IoT and machine learning/artificial intelligence. This course uses, among other, findings and knowledge generated in STAR. The course has been published on the AIO Platform: <https://www.ai4europe.eu/education/education-catalog/smart-industry-operations>
- On 22 June 2022, STAR was presented by RUG at the [Jantina Tammes School of Digital Society, Technology and AI](#)
- [DASH webinar](#) (DASH - Data Science Centre in Health of the University Medical Centre Groningen (UMCG)) by Christos Emmanouilidis, RUG.
- On 18th November 2023, STAR Training Platform has been presented during the 10th anniversary celebration of CoderDojo, the free programming school for youth aged 7 to 17 in Pavia, teaching them to have fun creating codes, using 3D printers, drones, and laser technology.

3.7 STAR Marketplace

The STAR Marketplace is the platform that comprises all the info related with the project results along with additional content and media directly related with the project's scope.

In the marketplace, users can find the following content:

- Assets – Tools/components developed in the scope of the project. The user will find a list of all the assets and a page with details for each of them.
- Success Stories – Use cases provided by the three STAR pilots with a description and characteristics.
- Services – Content/platforms developed directly in the scope of the project, including:
 - STAR Courses – the four courses developed in STAR, described in the deliverable D7.5 Training and Innovation Management Services.
 - Workshops – the workshops organised during the whole execution of the STAR project.
 - STAR Book – the open access book described in Section 3.6.2.
 - Worker's Training Platform – The platform oriented to skill assessment and enhancement developed in STAR, described in detail in D5.10.
 - AI Trustworthiness Framework – A self-assessment form for the trustworthiness of AI systems. It consists of a set of questions that relate to different aspects AI systems. This relates directly with the content made available from D7.6.
- External Resources – Online content/sources not developed in the scope of the project but directly related and of high relevance to the project scope and goals:
 - External Courses – List of courses from external sources, linked with the topics of STAR, such as AI, Cybersecurity, Privacy, IoT, etc.
 - Relevant Communities – List of relevant communities to the STAR stakeholders,

such as EFFRA, AI4EU, DFA and IoT-Catalogue.com

STAR Marketplace is available on <https://www.market.star-ai.eu>. A screenshot of the homepage of the marketplace can be seen on the figure below. More details on its structure and content can be found in the deliverable D7.4 Integrated Secure and Safe AI Solutions-Final version.

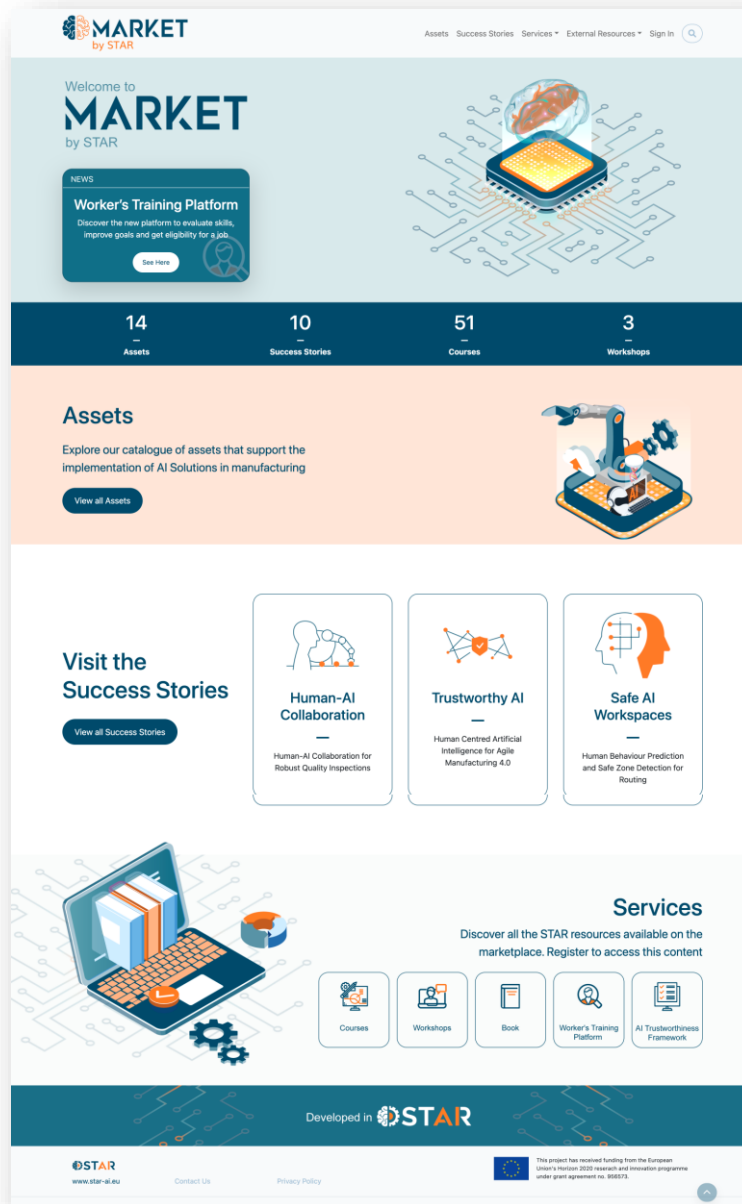


Figure 23: STAR Marketplace homepage

3.8 Collaboration activities with other ICT-38 projects

Collaboration with other EU-funded projects and activities often leads to new insights and exchanges of knowledge in research but also dissemination. Hence, liaising with other projects and initiatives in relevant fields are actively followed and closely monitored with the main purpose of exchanging information, ideas and promoting innovation in the field.

STAR is a member of the AI-MAN (ICT-38) Projects Cluster that were funded under this call. This cluster is comprised of STAR and eight more projects, namely:

- [AI-PROFICIENT](#) (Artificial Intelligence for improved PROduction effICIency, quality and maintenance – 957391)
- [ASSISTANT](#) (leArning and robuSt deciSIon SupporT systems for agile mANufacTuring environments – 101000165)
- [COALA](#) (COgnitive Assisted agile manufacturing for a Labor force supported by trustworthy Artificial Intelligence – 957296)
- [EU-Japan.AI](#) (Advancing Collaboration and Exchange of Knowledge Between the EU and Japan for AI-Driven Innovation in Manufacturing – 957339)
- [knowlEdge](#) (Towards AI powered manufacturing services, processes, and products in an edge-to-cloud-knowlEdge continuum for humans [in-the-loop] – 957331)
- [STAR](#) (Safe and Trusted Human Centric Artificial Intelligence in Future Manufacturing Lines – 956573)
- [MAS4AI](#) (Multi-Agent Systems for Pervasive Artificial Intelligence for assisting Humans in Modular Production Environments – 957204)
- [TEAMING.AI](#) (Human-AI Teaming Platform for Maintaining and Evolving AI Systems in Manufacturing – 957402)
- [XMANAI](#) (Explainable Manufacturing Artificial Intelligence - 957362)

Specific deliverables D8.4 "STAR's Contributions to Clusters and Associations-Initial version" and D8.5 "STAR's Contributions to Clusters and Associations-Final version" touch on the topic of collaborations of STAR with other projects, initiatives and associations, including its close collaboration with the AI-MAN Cluster. Therefore, here we briefly list the joint activities implemented during the project duration, with more details included in the parallel deliverable D8.5, but also for the period M01-M18, in the deliverable D8.4.

Major joint activities:

- Meetings
- Five ICT-38 Projects Cluster (AI-MAN) online workshops focusing on Explainable Artificial Intelligence in Manufacturing, Ethical and Legal issues, and Human Centred Manufacturing in the Industry 5.0 Era, Data & Models Interoperability for AI Systems, and Standardisation
- Co-organised sessions with COALA, XAMANAI, Teaming AI projects during the Data Week Conference organised by the BDVA/DAIRO on 25th-27th May 2021
- An online workshop co-organised by STAR and the ICT-38 projects in collaboration with AI4EU/AI4Europe in order to discuss the collaboration activities on May 17th, 2022
- AI-MAN Book

4 Monitoring and evaluation

The communication and dissemination activities planned and implemented by the project have been closely monitored and evaluated by the WP8 leader in order to keep track of all relevant ongoing activities. The deliverables D8.2 and the present, D8.3, document all the related conducted activities. At the same time, the deliverables D8.4 "STAR's Contributions to Clusters and Associations-Initial version" in Month 18 and D8.5 "STAR's Contributions to Clusters and Associations-Final version" in Month 36, report on the project's contributions to clusters and associations.

The evaluation of the Dissemination and Communication strategy concerns both qualitative and quantitative indicators. In D8.1 "Dissemination and Communication Plan" we defined measurable objectives, that we have evaluated and have checked the degree to which the project has achieved its objectives. Process evaluation involves examining the progress of the strategy's implementation and will refer to an outreach activity that is quantifiable through the attendance of persons present from the audiences, quantity of material distributed, number of events participated, stakeholders and general public engagement, the development and dissemination of messages and materials, visibility of STAR, media presence and traffic created in social media.

There are various key issues associated with measuring and controlling the Dissemination and Communication strategy and plan. Achievements are often more difficult to measure and compare, and thus need to be carefully quantified and measured according to the specific type of the action involved. The objectives chosen must be realistic, clearly defined, relevant, and coherent; the means of measurement must be objective, clearly defined and quantified. Finally, the evaluation needs to be continuous or incremental as much as possible.

In full accordance with the STAR needs, we implement a five-step measurement cycle model, spanning from objective identification to data driven optimisation:

1. Identification of the core objectives (e.g. raise awareness, increase engagement – i.e. acquire more participants to our events).
2. Setting goals for the promotional tactics and concentrating on how to accomplish the objectives (e.g. inform visitors through the content of our website, intensify events promotion, etc.).
3. Identification of the dissemination and communication Key Performance Indicators (KPIs) – the metrics that play a crucial role to the success of the aforementioned utilised tactics and set the expected achievable qualitative and quantitative targets.
4. Measuring the progress and impact of the conducted activities based on these metrics on a regular basis. Such metrics will allow having a constant view of the amount and the effectiveness of the dissemination and communication activities conducted.
5. Optimisation and adjustment of the dissemination and communication strategy towards achieving the expected outcomes and maximising visibility.

4.1 Monitoring templates

A special process has been applied to effectively monitor and assess the communication and dissemination activities implemented in the project. This is based on a set of KPIs that covers all the aspects of the dissemination and communication. In order to collect and monitor information related to the communication and dissemination activities implemented by the

partners, a common online plan and reporting Excel document consisting of seven (7) sheets was created in the first month of the project and was made available to all partners:

- Events - List: A sheet collecting the 3rd party events that the partners will participate throughout the project
- Events – Report: A sheet collecting the reports from each event that partners participated
- Scientific publications: This sheet collects the papers submitted by the partners to conferences and scientific journals.
- Media, 3rd party websites: This sheet collects the list of the articles or other pieces of information about STAR in the media or other third-party websites/blogs/intranets.
- Partners’ websites: Mentioning the STAR project on partners’ websites
- Liaising activities: This sheet collects the liaising activities of the project and project partners
- Other Dissemination and Communication Activities: This sheet collects information on the complementary individual activities of the partners within the scope and framework of the communication/dissemination plan of the project.

All partners recognised that dissemination and communication activities are an essential and pervasive activity throughout the project’s life and integrate within all its work packages.

The Table 4 below presents the main Key Performance Indicators (KPIs) defined for each action/means as well as the actual achievement for each KPI on month 36 (December 2023).

Table 4: STAR KPIs to monitor the progress

Measure	Driver	Action	KPI	Target	M36 value
DISSEMINATION					
e-Publications (online magazines, blogs, etc.)	Policy making Social Awareness Knowledge diffusion	Online publishing in blogs, online magazines and other third-party means (portals, intranets, etc.)	No of online publications (including re-publishing)	> 15 publications and four blog post per month	> 15 publications, 2-4 posts (blog, news, other items, social media posts,..) per month
			No of views	> 500 views / publications / year	Not easy to measure as related to third-party means. Nonetheless, we believe that the KPI has been reached e.g. the STAR Book has been downloaded approx. 48,000 times
Customisable marketing packages (videos, how-to demos, press kit etc.), suitable also for trade fairs	Raise awareness Attract users (supply or demand)	Production of professional material tailored to specific audiences	No of produced	> 10	>10: 1 Roll-up + 1 leaflet + 1 brochure + 1 booklet + 1 poster + 1 video for EFFRA + 3 separate videos + multiple videos with training material
			No of distributions	> 50	>50 in the major physical events on the last year - Due to a long quarantine period distributed mainly digitally

Measure	Driver	Action	KPI	Target	M36 value
Organisation and/or attendance at conferences, workshops and exhibitions	Attendance, contributions and exchange of ideas with other stakeholders	Partners organising and/or attending conferences, workshops, exhibitions, and other events	No of events	10 Conferences 3 exhibitions*	52 (conferences, congresses, other major events, workshops) Exhibitions: 3 (2 EFFRA + Sustainable Places)
			Reach	100 visitors	>100 (in events and beyond)
			No of speakers	10 speakers	>25 speaking opportunities in various events
Demonstrations and presentations	Attract customers Raise awareness	Organisation of online and on-site presentations and demonstrations	No of demonstrations	6 demonstrations /2 on-site demos*	5 demos on-site in Drachten
			No of presentations	6 presentations	>10
			No of responders	3 responders	2 (Sustainable Places (R2M), APMS (SUPSI))
Open Access publications	Scientific dissemination	Publication to journals and magazines or/and book/book chapter publication	No of publications	> 20	40 (+2 pending) publications and 1 book with 11 chapters + 1 ICT-38 Cluster book under production (6 chapters authored by STAR partners)
Synergies established at local, national or international level for uptake of the VDIH	Raise awareness Attract users (supply or demand)	Conference Calls Events (any type) for F2F discussions	No of synergies established	6	4 (Drachten - Innovation Cluster Drachten, AI Hub, North Netherlands (and NLAIC - Dutch AI coalition), and the

Measure	Driver	Action	KPI	Target	M36 value
					CompVter association in Pavia)
Synergies at national or international levels for sharing knowledge and standardisation	Strengthen impact via joint efforts	Meeting attendance and common publications	No of projects	> 5	>5
COMMUNICATION					
STAR website and content	Regular information updates	Website maintenance and publishing new content on a regular basis	New content published	YR1: min. 2/month YR2: min: 3/month YR3: min 4/month	>2-4 /month (news, blogs, deliverables, publications) depending on the available content
			No of unique visitors	3.000	>18.000
Social media content - Twitter	Grow community Regular stakeholder engagement	Diffusing project news, keeping up-to-date and retweeting other news of interest & monitor outcomes	No of posts-re-posts/months	YR1: min 8 YR2: min 24 YR3: min 48	>8 per month as STAR, more on individual level
			No of followers	500	262
Social media content - LinkedIn	Grow community Regular stakeholder engagement gives important insights into interests/concerns	Publish posts, also in relevant groups, make relevant and interesting re-posts, engage with various stakeholders & monitor outcomes	No of posts/month	YR1: min 1 YR2: min 4 YR3: min 8	>8 per month as STAR, more on individual level
			No of connections	500	502 followers (200 connections)

Measure	Driver	Action	KPI	Target	M36 value
Stakeholder database	Early identification of prospective marketplace and service stakeholders	Develop a database of contacts for community development and stakeholder engagement	No of profiled and engaged stakeholders	YR1: 1500 YR2: 2500 YR3: 4000	Partners have identified stakeholders to be engaged. A concrete number is difficult to be provided. However, based on the other indicators we believe that this KPI has been achieved.
e-Newsletter	Different stakeholders are properly informed in a timely manner	Produce and circulate project news, achievements and events in the form of an e-newsletter	No of e-newsletter issues	YR1: min 6 YR2: min 8 YR3: min 10	12 newsletters
Visibility of STAR in channels used by different stakeholder categories	Ensure back-links/branding recognition to website through synergies and social media; General brand recognition is demonstrated	Liaise/engage initiatives with journalists /LinkedIn groups; Do a survey to verify brand recognition	Back-links across major stakeholders	≥ 20	>20
			Responders identified STAR (from a questionnaire)	≥ 50	Not implemented since scientific publications and the book show high visibility towards STAR
Press releases targeting major stakeholders on supply/demand sides	Raise interest and recruit demand actors (e.g., developers, end-users of AI) & supply side actors (e.g., AI solution providers)	Produce press releases targeting different media channels and audiences	No of specialised Press Releases after important STAR deliverables or Milestones	YR1: min 2 for IT audiences; YR2: min 1/ stakeholder category; YR3: min 2/major categories	4 press releases
Press releases for general public	Raise interest amongst non-specialised audiences	Lightweight blog for non-specialised channels	Press clippings	≥ 2	2 press releases

Measure	Driver	Action	KPI	Target	M36 value
Promotional material, including video content	Specific audiences receive tailored and timely messages	Design and produce focused material (for stakeholders / events)	No of materials produced	YR1: min 3 YR2: min. 6 YR3: min 12	>10 (printed and digital material), presentations webinars ITC-38, training material are available on the YouTube channel
Marketing events, e.g. trade fairs / exhibitions*	Ensure direct engagement with major stakeholders	Host a stand decked with demos, videos, informative material	No of events	YR2: min 1 YR3: min 2	4: 1 EFFRA +2 Sustain. Places + 1 organised (Drachten)
Exhibitions / workshops with free access*	Ensure outreach to non-specialised audiences	Show STAR use cases to visitors in a lively, lightweight environment	No of exhibitions/workshops	≥ 1	4: 1 EFFRA +2 Sustain. Places + 1 organised (Drachten)
			No of non-specialised attendees	≥ 50	This KPI has been difficult to measure, yet based on the number of activities undertaken we believe that this number has been achieved.
Online and/or F2F training sessions	Ensure general public is “educated” about the need for advanced research to address their needs	Provide a service for non-IT savvy to show what the new service means for them	No of online sessions	≥ 1	5 AI-MAN cluster (online) workshops + 3 courses on YouTube channel + STAR course on Marketplace
			No of attendees	≥ 50	688 (236 AI-MAN workshops attendees + 452 views from the YouTube channel)
			No of local events	≥ 1	1 (Drachten)

Measure	Driver	Action	KPI	Target	M36 value
F2F interactions with local people*	Ensure engagement with “real people” at the local level	Work with use case partners to co-host an open day, including media presence			
			No of appearance in local media	≥ 3	Not measured.
Free trials for general public*	Facilitate and drive uptake through early trial testing	Organise trials after reaching predefined maturity	No of “testers”	≥ 5	20. WTP’s was validated with 20 users for a scientific article in order to evaluate the SUS score

* Dependent on the COVID-19 pandemic situation and the respective restrictions

5 Conclusions

In the deliverable at hand, we provide a detailed report on the progress of the Dissemination and Communication Activities of STAR in the course of the project, detailing on the period of the last 18 months (1st July 2022 - 31st December 2023).

The STAR consortium recognises that dissemination, communication and engagement activities are an essential and all-encompassing activity throughout the project's duration. This deliverable presents the dissemination means, channels and procedures that have been used by STAR and that have been thoroughly defined and described in the dissemination plan.

In the report we also present the dissemination material produced by the STAR consortium. The extensive use of online dissemination means is summarised together with the respective analytics, showing the use of both the website and the Social Media channels employed by the project. Moreover, this deliverable entails information about the participation in events (virtual or physical), the co-organisation of sessions, workshops and webinars, while it also presents the scientific publications in journals and conferences, and book / book chapters authored by the project partners. STAR Marketplace is briefly presented, while more details on its structure and content can be found in the deliverable D7.4 Integrated Secure and Safe AI Solutions-Final version. Collaboration activities linked to clusters and associations are described in more detail in the deliverable D8.5 "Contributions to Clusters and Associations-Final version".

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[REF-06]	STAR Deliverable D7.8" Report on Integration and Collaboration with AI4EU-Initial version"
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