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DELIVERABLE

D7.1 – Market Platform and VDIH Services Specification

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Executive Summary

This deliverable specifies how the Market Platform is going to look like, namely it presents the Market Platform objectives, the design look and feel, the how to navigate through the site, the how the pages are going to look like and the implementation plan presenting what type of technologies are going to be used as well as the steps to do it.

The consortium decided how the Market Platform should look like, the organisation in terms of sitemap, the content it should present and the functionalities and services that it should provide to users. Analysing the discussions inside the consortium, it was possible to identify the main objectives of the Market Platform and the technology that can be used for the implementation of the platform and meeting the objectives.

Liferay is going to be the baseline of the platform, providing the base functionalities and thanks to the plugin system it can provide advanced functionalities needed by the market platform. Another technology identified was the IoT-Catalogue that is going to provide the graphical interface for the assets and the success stories and the model to make them navigable and searchable in the Market Platform. There is also the IoT-Catalogue Liferay Plugin which allows to use IoT-Catalogue functionalities inside the Liferay CMS.

In order to support the implementation of a theme for Liferay, two look and feel designs were developed and then voted inside the consortium, electing which one would be used in the Market Platform implementation. Also the overall platform structure was defined, not only from the point of view of the content, but also from the perspective of the navigation through the Market Platform. For this, the consortium was once again consulted, which helped to build the sitemap of the Market Platform. At last, the implementation plan for the Market Platform was specified.

This Deliverable represents the initial work whereas the final work of the implementation of the Market Platform will be reported in deliverable D7.2.

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Table of Contents

EXECUTIVE SUMMARY	2
TABLE OF CONTENTS.....	4
LIST OF FIGURES	5
LIST OF TABLES.....	7
DEFINITIONS, ACRONYMS AND ABBREVIATIONS	8
1 INTRODUCTION.....	9
1.1 WORK PACKAGE 7 OVERVIEW	9
1.2 ROADMAP	11
1.3 STRUCTURE OF THE DOCUMENT.....	12
2 MARKET PLATFORM OBJECTIVES.....	14
2.1 REQUIREMENTS	14
2.2 RESULTS ANALYSIS.....	16
2.3 OBJECTIVES	18
3 BACKGROUND.....	19
3.1 CMS PLATFORM – LIFERAY	19
3.2 IOT-CATALOGUE.....	20
3.2.1 <i>Products</i>	21
3.2.2 <i>Use Case</i>	26
3.3 IOT-CATALOGUE LIFERAY PLUGIN	33
4 MARKET PLATFORM.....	35
4.1 MARKET PLATFORM LOOK & FEEL	35
4.1.1 <i>Design guidelines</i>	36
4.2 NAVIGATION.....	39
4.2.1 <i>Market Platform Layout</i>	40
4.2.2 <i>Homepage</i>	42
4.2.3 <i>Resources Listing</i>	42
4.2.4 <i>Assets</i>	43
4.2.5 <i>Success Stories</i>	43
4.2.6 <i>Training Resources</i>	44
4.3 IMPLEMENTATION PLAN.....	45
5 CONCLUSION.....	47
5.1 NEXT STEPS	48
ANNEX 1 PRODUCT TEMPLATE.....	49
ANNEX 2 USE CASE TEMPLATE.....	55
ANNEX 3 DESIGN ALTERNATIVE: PROJECT IMAGE	59

List of Figures

- FIGURE 1 – WORK PACKAGE 7 TIMELINE10
- FIGURE 2 - RELATIONSHIP BETWEEN WP7 TASKS.....11
- FIGURE 3 – TASK 7.1 ROADMAP12
- FIGURE 4 - SURVEY.....15
- FIGURE 5 – RESULTS ABOUT THE MOST DESIRED WEBSITE SECTIONS16
- FIGURE 6 – RESULTS ABOUT THE TYPE OF RESOURCES THAT SHOULD BE SUPPORTED17
- FIGURE 7 – RESULTS ABOUT THE TARGET STAKEHOLDERS17
- FIGURE 8 - LIFERAY CMS19
- FIGURE 9 - IoT-CATALOGUE OVERVIEW21
- FIGURE 10 - PRODUCT PAGE OVERVIEW.....22
- FIGURE 11 - GENERAL INFORMATION23
- FIGURE 12 - REFERENCE23
- FIGURE 13 - MEDIA GALLERY24
- FIGURE 14 - LIVE DEMO BAR24
- FIGURE 15 - LIVE DEMO: DESCRIPTION25
- FIGURE 16 - LIVE DEMO: TECHNOLOGIES25
- FIGURE 17 - LIVE DEMO: GUIDES25
- FIGURE 18 - LIVE DEMO: INTERACTION26
- FIGURE 19 - METADATA26
- FIGURE 20 - USE CASE OVERVIEW28
- FIGURE 21 - GENERAL INFORMATION28
- FIGURE 22 - STATUS28
- FIGURE 23 - PLACE.....29
- FIGURE 24 - TEAM.....29
- FIGURE 25 - CHARACTERISATION30
- FIGURE 26 - SOLUTIONS30
- FIGURE 27 - PERFORMANCE & IMPACT: KPIS SUMMARY TAB31
- FIGURE 28 - PERFORMANCE & IMPACT: KPIS EVOLUTION TAB31
- FIGURE 29 - PERFORMANCE & IMPACT: KPIS NOTES TAB32
- FIGURE 30 - MEDIA GALLERY.....32
- FIGURE 31 - DOCUMENTATION32
- FIGURE 32 - PLUGIN ARCHITECTURE33
- FIGURE 33 - DESIGN VOTING OPTIONS36
- FIGURE 34 - DIGITAL VS REAL WORLD: MOOD BOARD.....37
- FIGURE 35 - DIGITAL VS REAL WORLD: MAIN IMAGE.....38
- FIGURE 36 - DIGITAL VS REAL WORLD: LOGO.....38
- FIGURE 37 - DIGITAL VS REAL WORLD: HOMEPAGE39
- FIGURE 38 - SITEMAP40
- FIGURE 39 - WIREFRAME STRUCTURE40
- FIGURE 40 - HEADER SECTION41
- FIGURE 41 - LOGIN SECTION41
- FIGURE 42 - SEARCH SECTION41
- FIGURE 43 - HOMEPAGE42
- FIGURE 44 - LISTING VIEW42
- FIGURE 45 - ASSETS PAGE43
- FIGURE 46 - SUCCESS STORIES PAGE43
- FIGURE 47 - TRAINING RESOURCES PAGE44
- FIGURE 48 - MARKET PLATFORM ARCHITECTURE45
- FIGURE 49 - STAR DESIGN BASED: MOODBOARD.....59
- FIGURE 50 - STAR DESIGN BASED: MAIN IMAGE.....60

FIGURE 51 - STAR DESIGN BASED: LOGO60
FIGURE 52 - STAR DESIGN BASED: HOMEPAGE MOCKUP61

List of Tables

TABLE 1 – PRODUCTS AVAILABLE TYPES OF PRODUCTS.....	53
TABLE 2 – PRODUCTS AVAILABLE TECHNICAL CATEGORIES.....	53
TABLE 3 – PRODUCT AVAILABLE RESEARCH AREAS	54
TABLE 4 – PRODUCTS AVAILABLE BUSINESS CATEGORIES	54

Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
AI	Artificial Intelligence
AI4EU	European AI On-Demand Platform
AIOTI	Alliance for the IoT Innovation
BDVA	Big Data Value Association
CMS	Content Management System
ICT	Information and Communications Technology
KPI	Key Performance Indicator
LDAP	Lightweight Directory Access Protocol
Liferay DXP	Liferay Digital Experience Platform
OpenSSO	Open Single Sign-On
SAML	Security Assertion Markup Language
VDIH	Virtualised Digital Innovation Hub
WP	Work Package

1 Introduction

This deliverable presents the work carried out by Task 7.1, which is the first task of Work Package 7 in STAR. This introductory chapter provides the necessary information to give context to the reader to understand the scope of the activities and the objectives defined, which can be identified in the following sections:

- **Work Package 7 overview:** provides an overview of the whole WP7, its timeline, and its objectives. This section also describes each of the inner tasks of the WP, including the relationships between them.
- **Roadmap:** this section provides the envisioned roadmap for Task 7.1, including the results that shall be provided in each of the 2 deliverables directly related to Task 7.1.
- **Structure of the document:** this section is self-explanatory, as it provides an overview of the information that is provided in the current deliverable.

1.1 Work Package 7 overview

STAR's Work Package 7 is responsible for the Virtualized Digital Innovation Hub for Secure and Safe AI in Manufacturing. It is active during the execution of the project (from M01 to M36) and is dedicated to the *development and establishment of a virtualised digital innovation hub that will integrate resources for secure and safe AI in manufacturing. The hub will be empowered by a market platform that will integrate the project's results. WP7 sets the following main objectives:*

- To design and implement an on-line market platform as a hosting environment for the project's results.*
- To integrate STAR's solutions for safe and secure AI in the market platform.*
- To develop and integrate in the market platform innovation management and training resources, which will be offered through the VDIHs.*
- To develop a certification programme for AI systems in manufacturing and to make it available through the VDIH.*
- To ensure close collaboration and linking to the AI4EU project for the purpose of creating critical mass and integrating the project's market platform and VDIH to the AI4EU ecosystem.*

These 5 objectives are directly related to the 5 tasks of the WP7, which also span across the Work Package duration.

Figure 1 depicts the WP7 timeline, providing a view of the start and end date of each task.



Figure 1 – Work Package 7 Timeline

This deliverable D7.1 "Market Platform and VDIH Services Specification" is meant to present the work done during the first twelve months of T7.1, whose objective is to *"design and implement a platform for promoting and demonstrating the project's solutions for secure, safe, trustworthy and ethical Artificial Intelligence (AI) in manufacturing, including software/middleware solutions, algorithms, legal recommendations, architectural blueprints and more. The heart of the platform will be a portal containing multimedia information about the above-listed assets, along with links to sandboxes and cloud services for demonstrating the operation of the various solutions and services. Moreover, the portal will also provide a standard set of market platform services, including users' registration, products reviews and stakeholders' collaboration functionalities. The work of the task will entail the detailed design of the structure of the portal and the specification of its contents. Following the design and specification of the platform, the task will implement the above-listed functionalities (e.g., user management, product reviews, solutions presentation/demonstration), leveraging existing frameworks for building on-line marketplaces"*.

With respect to the relationships between the tasks within the Work Package, it is a fairly straightforward process, as T7.1 is responsible for the Market Platform infrastructure and the other tasks are responsible for gathering content to share in the Market Platform, as depicted in Figure 2.

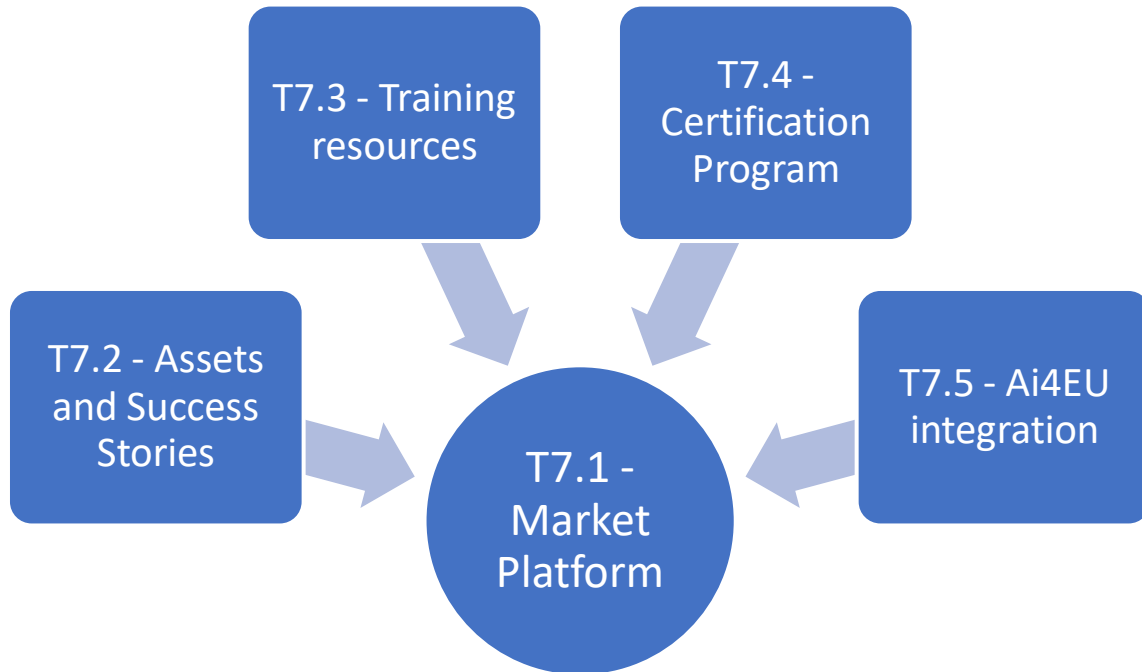


Figure 2 - Relationship between WP7 tasks

Each WP7 task, apart from T7.1, is responsible to gather content to be made available through the Market Platform to the STAR’s stakeholders. Each task shall provide:

- T7.2 – Information related to the assets developed within the scope of the project, as part of Technical Work Packages. This task will also provide details on the success stories resulting from the project activities so as to showcase where and how the assets are being successfully deployed and used.
- T7.3 – This task will be responsible for providing all sorts of training resources. This should include documentation, videos, presentations, white papers, etc. These resources should be fed into the Market Platform and made available to our stakeholders.
- T7.4 – The certification program is the responsibility of Task 7.4. This certification program shall be used by the Market Platform so as to provide information to the stakeholders related to STAR certified resources.
- T7.5 – This task shall provide details on how to collaborate with the AI4EU platform, which is a well-established platform in the AI domain, offering several resources that could be of interest to STAR Market Platform stakeholders.

1.2 Roadmap

As part of the activities of Task 7.1 - Specification, Detailed Design and Implementation of Market Platform, there are two deliverables scheduled:

- D7.1 - Market Platform and VDIH Services Specification – Due on M12
- D7.2 - Market Implementation and VDIH Establishment – Due on M24

To provide a better understanding of what should be reported in each of them, a roadmap was created so that the content of each document is clear. Figure 3 provides an overview of the Task 7.1 roadmap.

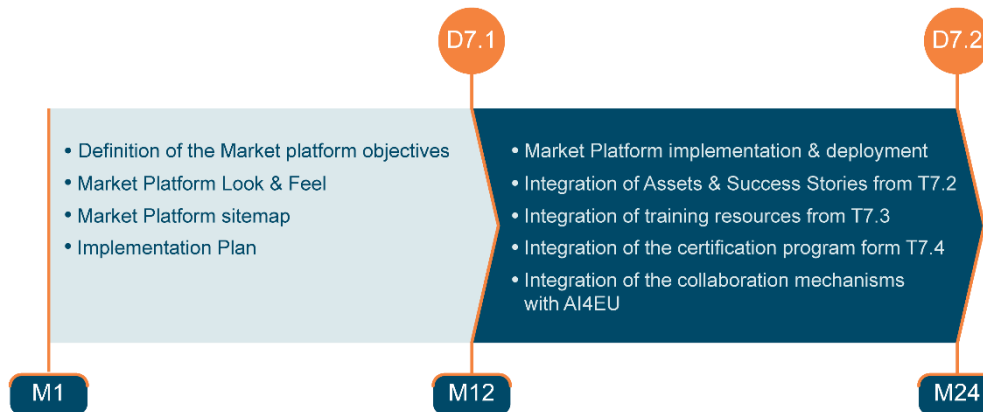


Figure 3 – Task 7.1 Roadmap

The current document, D7.1, addresses:

- The Market Platform identified objectives based on the collected requirements.
- The Market Platform look & feel, including a preview of the Market Platform homepage and a set of design guidelines.
- The structure of the Market Platform, with some details related to the type of information made available through the Market Platform.
- An implementation plan which details the next steps to be taken in order to fully implement and deploy the STAR Market Platform.

D7.2, which is due in M24, is the last deliverable reporting the activities from Task 7.1. This means that the work on the implementation and deployment of the Market Platform will be concluded, however, the integration work related to the content made available by the other WP7 tasks will continue throughout the project duration. Consequently, D7.2 shall report the following:

- The final version of the Market Platform implementation, including information on its deployment and already some statistics related to visitors and accesses.
- The current version (at the time of the deliverable submission) of the Assets and success stories integration within the Market Platform
- The current version (at the time of the deliverable submission) of the Training resources made available through the Market Platform.
- Details on the defined certification programme designed by Task 7.4
- An initial version of the collaboration between the STAR Market Platform and the AI4EU platform.

1.3 Structure of the Document

The document is divided in:

- **Introduction:** This contains an overview of the WP7 presenting all the tasks with their objectives and showing how they are related. There is also a Roadmap showing what kind of work was done in the D7.1 and what work will be done in D7.2.
- **Market Platform Objectives:** This chapter presents the survey whose analysis led to the Market Platform requirements. With those requirements, it was defined what kind of objectives was needed to have in order to accomplish the consortium needs.

- **Background:** In this chapter the kind of information that is already available to be used is presented. It discusses characteristics of the Liferay CMS and IoT-Catalogue highlighting the ability to present products and use cases along with their plugin for Liferay.
- **Market Platform:** In this chapter, the two proposals for the design look and feel are presented (along with their creative process). These proposals were then proposed to the consortium with the aim of choosing by voting the design to be used in the Market Platform. This chapter also has a sitemap showing how the pages and the navigation is going to be, along with the implementation plan showing the technologies, plugins and functionalities that will be needed.
- **Conclusion:** In this chapter, the description of the results obtained, and the relevance of the results achieved for the success of the next step are presented.

2 Market Platform Objectives

Before starting the development of the Star Market Platform there was the need to define within the consortium a common understanding of how such platform should look like, the content it should present and the functionalities and services that it should provide to users. This common view was achieved by collecting the inputs from every member of the consortium regardless of their role on the project, resulting in a view from the perspective of both AI technologies and solutions developers, and from the perspective of adopters of such technologies.

This section provides details about how the inputs were collected and analysed to build a common understanding. For that, it is organised as follows.

- **Requirements:** Describes the survey used to collect the inputs from the consortium.
- **Results Analysis:** Presents and analyses the results from the survey.
- **Objectives:** Compiles the survey results and identifies the main objectives of the Star Market Platform, while identifying the tools that can be used for its implementation and also meeting the objectives.

2.1 Requirements

A survey was created to identify the main requirements for the Market Platform based on the inputs from the STAR consortium. This survey, presented in Figure 4, focused on the identification of the main sections and structure that the consortium believes to make sense for the STAR Market Platform, which kind of resources will be listed on the market, and who will be the main audience using the platform.

These questions allowed us to better identify which types of assets and resources the Market Platform should support and the answers had implications on the definition of the Market data model to ensure that all the information can be represented and categorised. Moreover, the answers allowed to identify the required visualisation capabilities that the Market Platform needs to support in order to ensure a correct display of the information to its targeted users.

STAR Marketplace

*** Required**

1. Please choose the sections that you would like to see available in STAR Marketplace website. *****

- Home
- Resources
- Pilots
- Media
- Blog
- Sign In
- Other

2. Please add some comments about the website structure.

3. What kind of resources do you expect to see in the website? *****

- Datasets
- Jupiter Notebooks
- Docker Containers
- AI Libraries
- AI as a Service
- AI Platform
- AI as a Model
- Other

4. Who would be the target stakeholders of the STAR Marketplace? *****

- AI Solutions Manufacturers
- AI Solutions Developers/Integrators
- AI Security and Safety Experts
- AI Scientific Community
- Established Communities (e.g. AIOTI, BDVA, AI4EU)
- Other

5. Do you have additional comments related to STAR Marketplace?

Figure 4 - Survey

2.2 Results Analysis

The following results were obtained from the answers of the consortium to each of the survey’s questions. The results are grouped by question.

1. Please choose the sections that you would like to see available in the STAR Market Platform website.

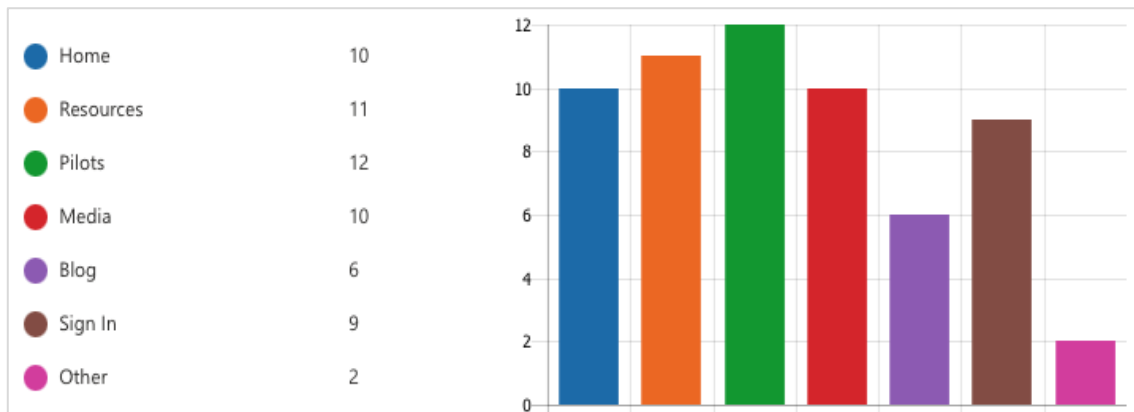


Figure 5 – Results about the most desired website sections

The most voted sections were:

- Pilots – description of the activities carried out by the project pilots and of the problems that were solved by the technologies created under the scope of the STAR project,
- Resources – list of materials and assets related to AI and STAR activities,
- Media – refers to a specific type of resources whose purpose is to communicate and promote the users about the project results,
- Home – a homepage that presents the Market Platform to the visitors and guides them through the available content, and
- Sign In – section to allow the authentication of users and management of their personal information.

Those sections were the most voted and will be the main inputs for the identification of the main areas of the Market Platform.

With fewer votes were the Blog (6) and Other (2) sections, where the Other corresponded to the following suggestions:

- Community, and
- Categorisation of topics to which a user can subscribe to follow that topic.

2. Please add some comments about the website structure.

"Following the examples of other projects like H2020 INFINITECH, KNINE.Hub, AI4EU, I think it would be great to develop a website/marketplace in which different users can sign in and subscribe to content relevant for them specifically. I would like to see open demonstrators of the application of AI solutions in order to be used as an inspiration for future research and solutions."

In this open-ended question, recommendations were made to investigate some of the already established Market Platforms and VDIH platforms for inspiration, reinforcing the

need to have a user management mechanism with customisable profiles to allow users to receive notifications based on their interests. Moreover, it is suggested that the Market Platform should support the execution of open demonstrators to allow users to play and better understand the technologies applied to AI Solutions.

3. What kind of resources do you expect to see on the website?

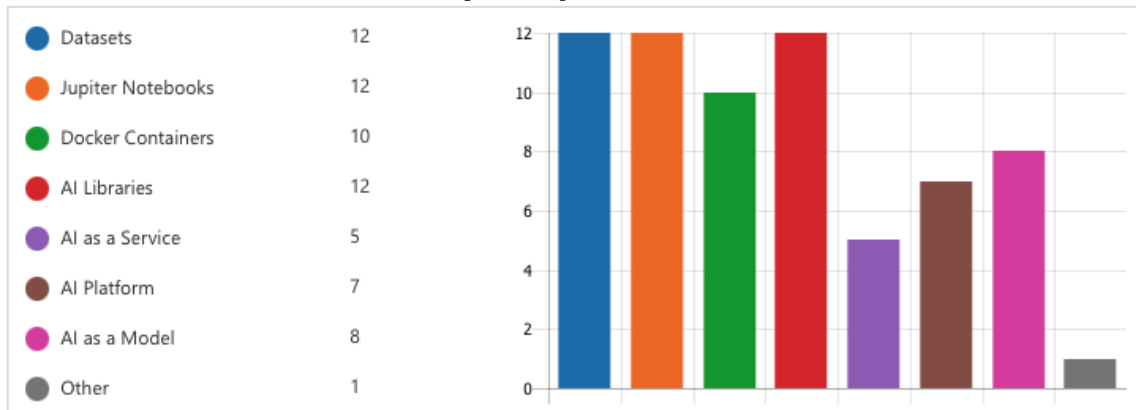


Figure 6 – Results about the type of resources that should be supported

The most voted expected resources for the website were Datasets, AI Libraries, Jupiter Notebooks and Docker Containers. The less voted categories were AI as a Model, AI Platform and AI as a Service. Additionally, other categories were suggested, such as Trainings, Webinars and Blogs.

According to the answers to this question, among the resources that should be made available on the Market Platform are AI Libraries and Datasets. Some of those will probably be presented to users as Jupyter Notebooks to allow them to better understand and test the technologies. AI Platforms and AI as a Model also appear as relevant kinds of resources, where some of them may be distributed as Docker images.

4. Who would be the target stakeholders of the STAR Market Platform?

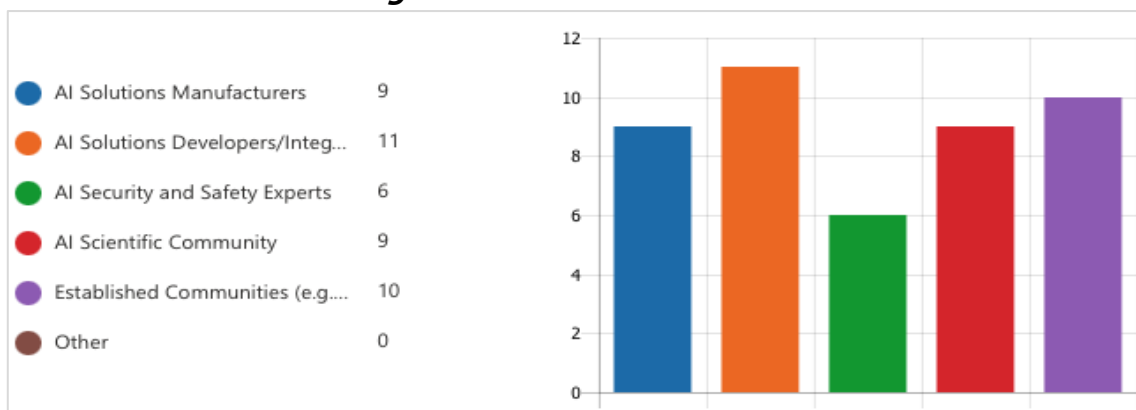


Figure 7 – Results about the target stakeholders

The most voted target stakeholders were AI Solutions Developers/Integrators, Established Communities (e.g., AIOTI, BDVA, AI4EU), AI Solutions Manufacturers and AI Scientific Community. The AI Security and Safety Experts categories gathered fewer supporters. These results help in the identification of the target audience of the Market Platform, which

will reflect on the language used across the platform and on the highlights presented by the most exposed sections of the Market Platform, such as the Homepage.

2.3 Objectives

The analysis of the results of the survey supports the identification of the main objectives of the STAR Market Platform according to the view of the project consortium. Therefore, the main objectives according to the survey results are:

- The Market Platform needs to have a **user management system** to allow users to authenticate before accessing some of the platform functionalities and **define personal preferences** to enable the platform to provide personalised information according to the user's interests.
- The platform must provide a **searchable catalogue of AI assets**, capable of listing **different kinds of assets**, ranging from AI platforms and libraries to datasets. Assets should support **different visualisation and distribution mechanisms**, such as Jupyter Notebooks and Docker Images.
- With the purpose of providing more information to users about the work being developed in the AI domain, the Market Platform provides the user with **different resources distributed using different mediums**; being either PDFs, presentations, videos or other interactive support that can be useful **for the training of users**.
- The **success stories of STAR pilots**, the **AI solutions used**, and **their results** should be shared through the Market platform to be used as examples and inspire users to build novel AI solutions.

Based on the results of the survey and the resulting objectives, the Market Platform needs to provide a wide range of functionalities. Most of those functionalities can be implemented using a Content Management System (CMS), such as Liferay, that with its plugin system and marketplace, provides a large flexibility for the implementation of the Market Platform core.

The need for a searchable catalogue of AI assets requires the definition of an adequate data model that allows to describe and characterise the assets. To aid this process, the IoT-Catalogue platform will be used for indexing, not only AI assets but also their usage on STAR pilot use cases. IoT-Catalogue provides not only an engine for discovering assets but also a set of visual elements to support the adequate presentation of assets information to users.

3 Background

Developing a Market Platform is a huge challenge, but a lot of work has already been done on the subject as well. STAR Market Platform will be built upon existing tools that provide the base functionalities. This section presents a summary of the technologies that are used as the baseline of the Market Platform, focusing on why they are being used and what they can provide to make the Market Platform successful:

- **CMS Platform – Liferay:** Stands as the baseline of the platform, providing the base functionalities. Its plugin system is also explored thus providing the advanced functionalities needed by the Market Platform.
- **IoT-Catalogue:** Provides the graphical interface for the assets and the success stories and the model to make them navigable and searchable in the Market Platform.
- **IoT-Catalogue Liferay Plugin:** Provides IoT-Catalogue functionalities to the Liferay CMS.

3.1 CMS Platform – Liferay

Liferay¹ is a Content Management System (CMS) that allows non-technical users to store, organise, and publish web content easily.

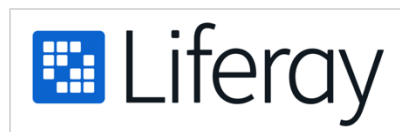


Figure 8 - Liferay CMS

Using Liferay as a web platform²

We can't even begin to imagine what you're thinking of building, but whatever it is, you're going to put your heart and soul into it. Building it on Liferay's web platform can give you a leg up. It provides everything you need to support your application, so you can concentrate solely on what you're building, and not the rest of the features your users expect to come along with it.

Imagine your application for a moment. Does it require users to register on your site? Can users comment on content contained in your application? Is there something that users can tag or categorise? If you think about the layout of the application, would it benefit from modularisation? Could you make use of a rich JavaScript framework with many components built into it? How about security—will you need to make information available to some users, but not to all users? Liferay DXP has all of this and more available to developers.

Liferay DXP's development framework is a great help when you're building an application for the web, for mobile, or anything in between. For example, bug fixes to your applications are easy to apply, because Liferay applications are hot deployed to the running server. Liferay's Marketplace gives you a ready-made shopping center for your applications. And Liferay's

¹ <http://www.liferay.com/>

² <https://help.liferay.com/hc/en-us/articles/360017875312-Using-Liferay-as-a-web-platform>

web services and JSON architecture make it easy for you to share data from your applications with other systems running on different platforms.

You get all this and much more. It's a very powerful platform, and certainly worth your investigation. Read the developer section of this site to learn more.

A great integration platform³

If you're building an enterprise system, portals were designed in the first place to be a single point of entry to your users' applications and content. Since Liferay DXP integrates well with user directories such as LDAP and Active Directory, along with single sign-on systems such as SAML and OpenSSO, it fits well into your enterprise systems. This allows you to use it as an integration platform for existing applications.

Liferay DXP, since it adheres to the JSR standard for portlets, was designed from the ground up for application integration. You can add any application installed on the system to any page in the portal. You can make use of APIs provided by other systems to integrate their data into an application window in Liferay. And applications you create with Liferay's Service Builder framework are web service-enabled from the start.

The Liferay also has a hub for selling, sharing, and downloading Liferay-compatible applications. These apps allow Liferay users to easily and efficiently bolt on additional functionalities and accelerate time-to-market. For developers, the hub can serve as a way to showcase their capabilities and distribute their apps through half-a-million-plus Liferay deployments worldwide. The hub leverages the entire Liferay ecosystem to develop, share, and transact apps in a user-friendly, one-stop site⁴.

3.2 IoT-Catalogue

The IoT-Catalogue is a web based tool developed by UNPARALLEL, available in <http://www.iot-catalogue.com/> developed to be the one-stop-source for Internet of Things (IoT) knowledge, innovations and technologies, aiming to help IoT stakeholders (developers, integrators, advisors, end-users, etc.) to take the most advantage of the Internet of Things for the benefit of society, businesses and individuals. It is an explorer for innovations in IoT applications and technologies; it is a web-based tool that enables to pick & choose IoT solutions; it is a wide repository of knowledge, use cases, contacts, etc. of the Internet of Things.

A key purpose of the 'IoT Catalogue' is enabling users to explore IoT solutions based on domain-related Value Propositions and/or ICT Problems described on use-cases defined along with applications domains. The 'IoT Catalogue' also enables users to inspect solutions and technologies from other domains that might fit their intents or analyse use-cases similar to their projects thus promoting synergies and reusability between application domains.

³ <https://help.liferay.com/hc/en-us/articles/360017875312-Using-Liferay-as-a-web-platform#a-great-integration-platform>

⁴ <https://web.liferay.com/marketplace-overview>

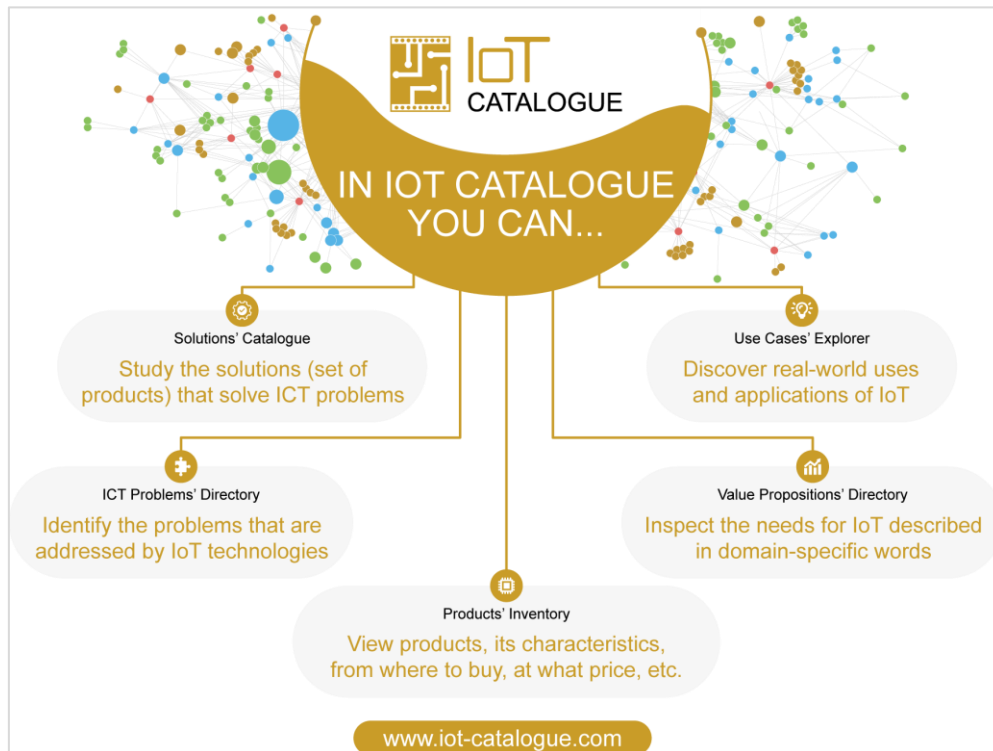


Figure 9 - IoT-Catalogue overview

The two main functionalities from the IoT-Catalogue used in the Market Platform are the Products and the Use Cases, which are highlighted in the next section.

3.2.1 Products

The IoT-Catalogue has a defined and structured way to present the product information. Product is a resource that is owned by an individual or corporation that can bring some type of benefit. A Product can be viewed as something that, in the future, can generate cash flow, reduce expenses, or improve sales, regardless of whether it is a manufacturing equipment or a patent.

It has information divided by bars, as shown in Figure 10, including the name, short and long descriptions, characterisation, a list of references which may include documentation, repositories and more, a media gallery with photos and videos enriching the asset and the possibility for a Live Demo, according to a strict model that can be viewed in ANNEX 1.

NOVAAS - NOVA Asset Administration Shell

The NOVAAS is an implementation of an Asset Administration Shell (AAS) technological concept introduced by the Reference Architecture Model for Industrie4.0 (RAM4.0) which establishes the guidelines and methodology for industry digitalisation, i.e. for integrating industrial assets into an interoperable Industrie4.0 communication backbone.

Standard: Industrie4.0 AAS
Developer: FCT NOVA
Contact: p7@nova.pt
Types: Software, Platform, Management
Trend: Industrie 4.0
TRL: 6
Website: gplab.com

Description

The NOVAAS an implementation of an Asset Administration Shell (AAS) that is a technological concept introduced by the Reference Architecture Model for Industrie4.0 (RAM4.0) which establishes the guidelines and methodology for industry digitalisation, i.e. for integrating industrial assets into Industrie4.0 communication backbone. In particular, it refers to the main problem of acquiring/providing data across multiple heterogeneous and geographically distributed data sources while improving the resilience and robustness of the industrial environment to device failures and cyber-attacks. Therefore, it meets the needs for a kind of "lingua franca" to guarantee interoperability between different assets. By taking this as starting point, the AAS can be defined as: 'A standardized digital representation of an asset, cornerstone of the interoperability between the applications that are responsible to manage the manufacturing system'; 'The AAS together with the related asset represent the I4.0 component'.

The Asset Administration Shell (AAS) provides a standardized digital representation of manufacturing systems while unifying all the data generated during their life cycle and allowing for their run-time assessment and management. It establishes the cornerstone for the interoperability with applications managing the industrial system by defining all the necessary mechanisms for extracting, collecting, finding, and interpreting specific data from the underlying physical entity. To do that, the AAS holds digital models (organized in sub-models) – describing selected views/perspectives of the physical entity – and includes the technical specifications for connecting them to the industrial. The concept of AAS is specified on the basis of the

Reference

Documentation
 1 Document 1 Repository

NOVAAS: A Reference Implementation of...
 G. di Orio, P. Maló and J. Barata, NOVAAS: A Reference Implementation of Industrie4.0 Asset Administration Shell wi...

Media Gallery

3 photos

Live Demo

TRY IT

Start LIVE DEMO

Metadata

7 Metadata

4 Deployment Time	1 Deployment Ease	3 Usability Score	23000 € CAPEX
259 € OPEX	26108 € TDC	37454.79 € Benefit Estimate	

General Information

Reference

Media Gallery

Live Demo

Metadata

IoT Catalogue
 What is IoT?
 IoT Trends
 Open Source Licences
 Products
 Use Cases
 Value Propositions
 ICT Problems
 Components
 Learning
 Stores
 Manufacturers
 Software

Explore
 About
 Acknowledges
 History
 Features
 Usage
 Privacy
 Licenses
 Terms & conditions

Talk With Us
 Contact

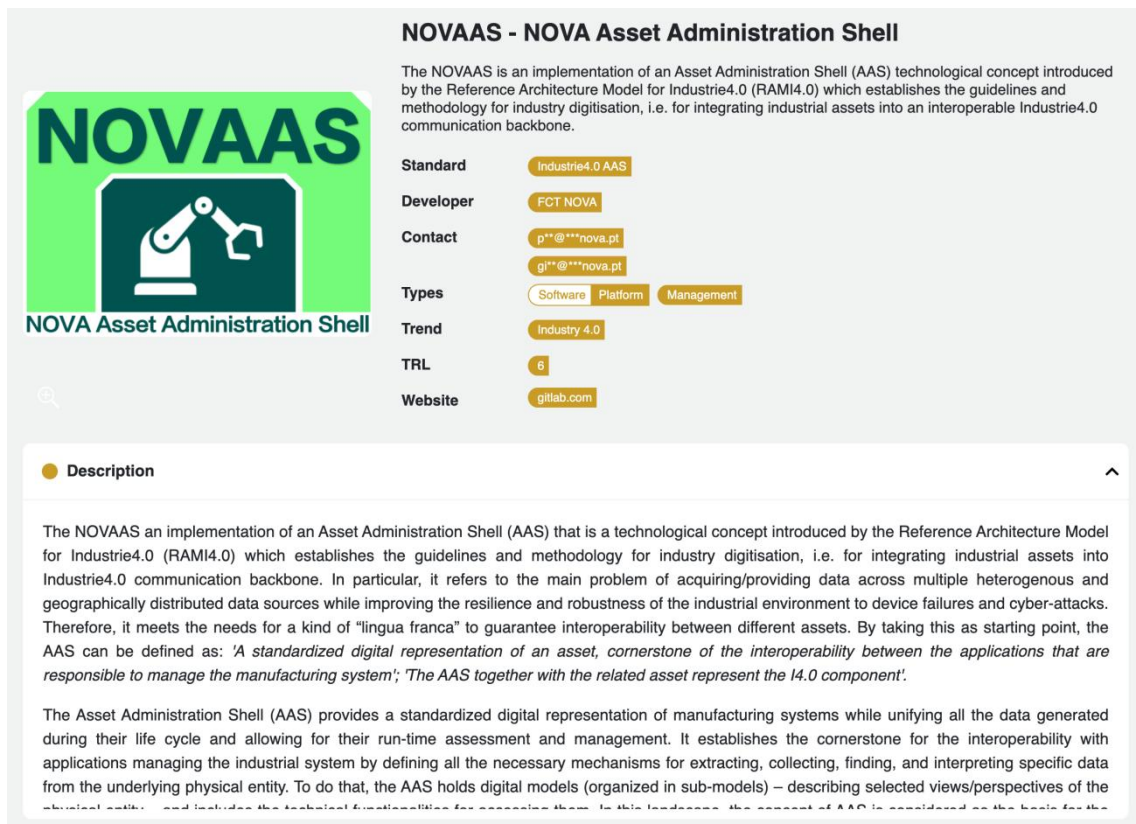
UNPARALLEL

Copyright © 2022 UNPARALLEL Innovation, Lda

Figure 10 - Product Page Overview

- General information

In Figure 11 there is the name, a logo, short and long descriptions, and a categorisation using tags that help describe the product.



NOVAAS - NOVA Asset Administration Shell

The NOVAAS is an implementation of an Asset Administration Shell (AAS) technological concept introduced by the Reference Architecture Model for Industrie4.0 (RAMI4.0) which establishes the guidelines and methodology for industry digitisation, i.e. for integrating industrial assets into an interoperable Industrie4.0 communication backbone.

Standard	Industrie4.0 AAS
Developer	FCT NOVA
Contact	p**@**nova.pt gl**@**nova.pt
Types	Software Platform Management
Trend	Industry 4.0
TRL	6
Website	gitlab.com

Description

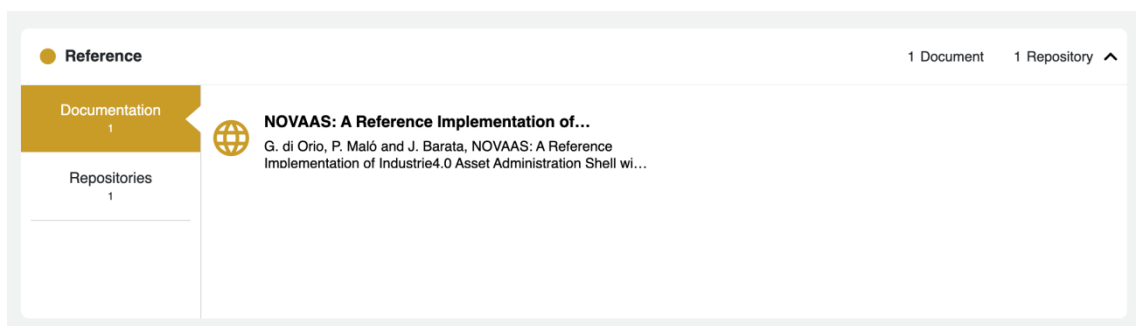
The NOVAAS an implementation of an Asset Administration Shell (AAS) that is a technological concept introduced by the Reference Architecture Model for Industrie4.0 (RAMI4.0) which establishes the guidelines and methodology for industry digitisation, i.e. for integrating industrial assets into Industrie4.0 communication backbone. In particular, it refers to the main problem of acquiring/providing data across multiple heterogenous and geographically distributed data sources while improving the resilience and robustness of the industrial environment to device failures and cyber-attacks. Therefore, it meets the needs for a kind of "lingua franca" to guarantee interoperability between different assets. By taking this as starting point, the AAS can be defined as: 'A standardized digital representation of an asset, cornerstone of the interoperability between the applications that are responsible to manage the manufacturing system'; 'The AAS together with the related asset represent the I4.0 component'.

The Asset Administration Shell (AAS) provides a standardized digital representation of manufacturing systems while unifying all the data generated during their life cycle and allowing for their run-time assessment and management. It establishes the cornerstone for the interoperability with applications managing the industrial system by defining all the necessary mechanisms for extracting, collecting, finding, and interpreting specific data from the underlying physical entity. To do that, the AAS holds digital models (organized in sub-models) – describing selected views/perspectives of the physical entity, and includes the technical functionalities for accessing them. In this landscape, the concept of AAS is considered as the basis for the

Figure 11 - General Information

- Reference

There is a reference zone, identified in Figure 12, containing all the references related to the product (e.g., documentation, repositories, openAPIs, and any other useful information for the viewers).



Reference 1 Document 1 Repository

Documentation 1

Repositories 1

NOVAAS: A Reference Implementation of...
G. di Orio, P. Maló and J. Barata, NOVAAS: A Reference Implementation of Industrie4.0 Asset Administration Shell wi...

Figure 12 - Reference

- Media Gallery

Figure 13 shows the media gallery, which can be used not only for photos, but also for videos. This can be used to demonstrate the process of installing the product, the product already working or other relevant information which can be transmitted through these formats.

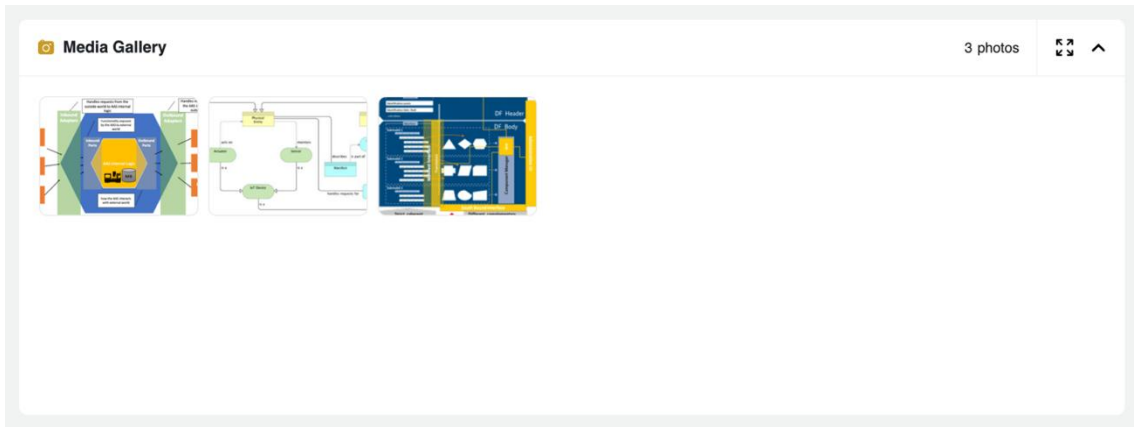


Figure 13 - Media Gallery

- Live Demo

In Figure 14, a sample of the Live Demo zone is portrayed. This is where users can launch the Demo, or even create their own.

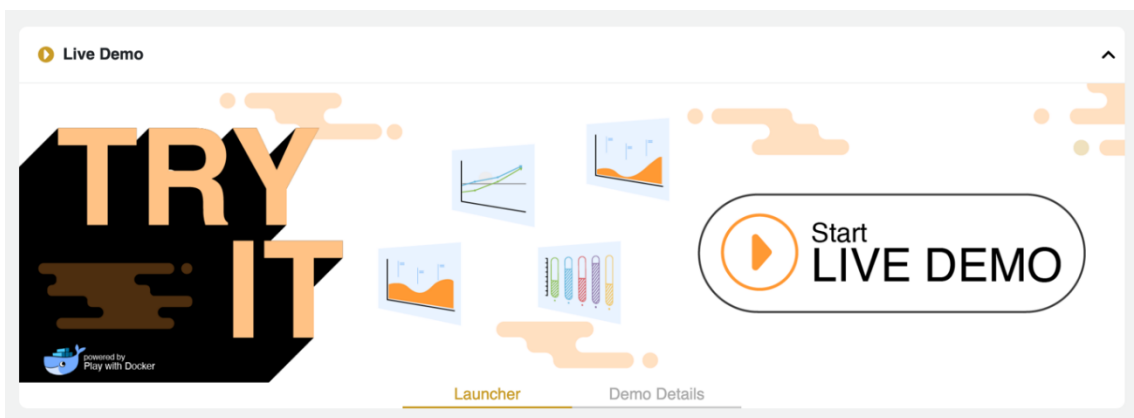


Figure 14 - Live Demo bar

Figure 15, Figure 16 and Figure 17 represent the Demo Details tab with three sections on the left-hand side that accommodate different subjects:

- Description section - allows the user to better understand what the demo is about,
- Technologies section - identifies the assets used in the demo, and
- Guides sections - explain how the Live Demo should be used.

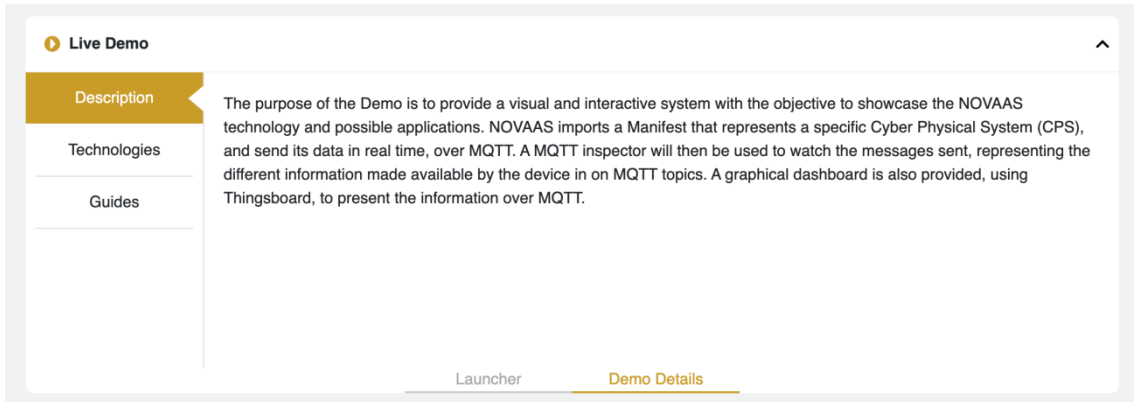


Figure 15 - Live Demo: Description

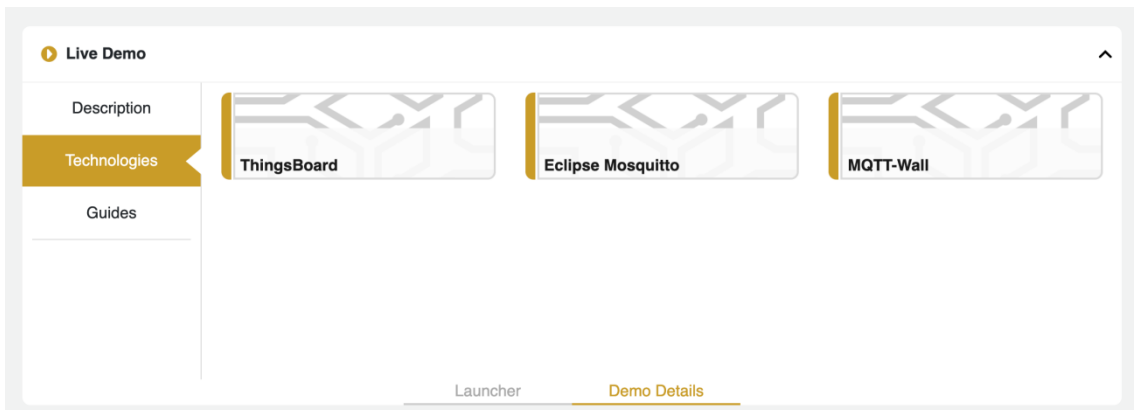


Figure 16 - Live Demo: Technologies

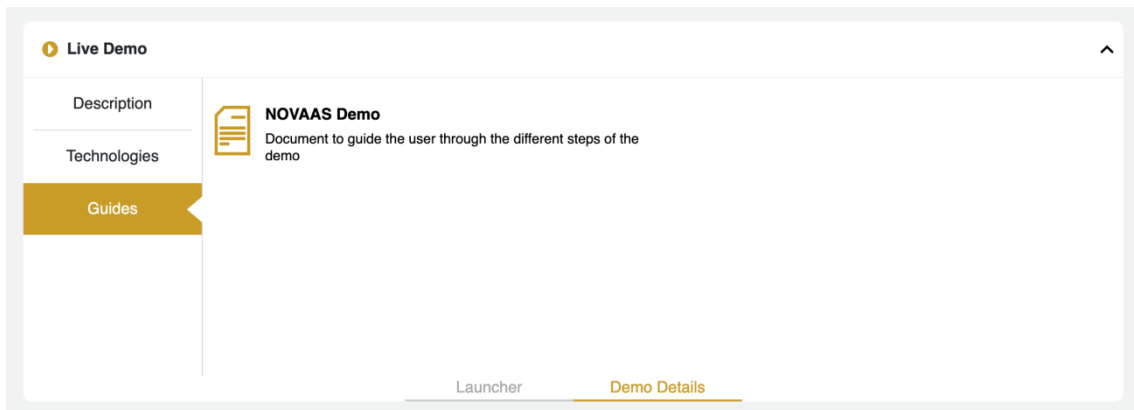


Figure 17 - Live Demo: Guides

When the demo is running (Figure 18) different pages show up according to the features that the demo intends to highlight. The user can then hide and show these pages and change the layout according to his/her preferences.

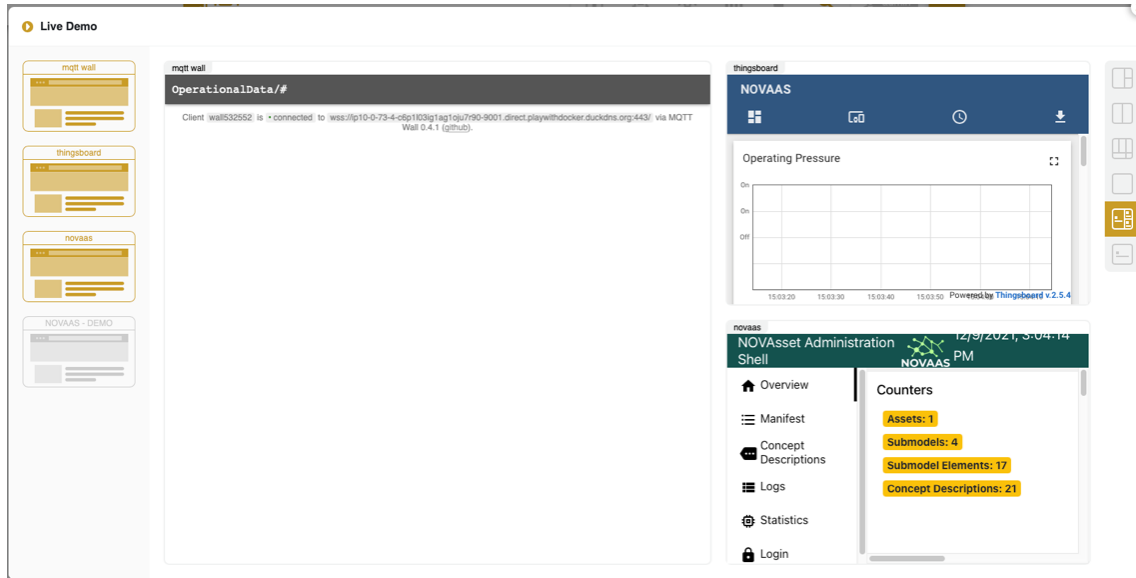


Figure 18 - Live Demo: Interaction

- Metadata

Additional information that helps to better describe the product.

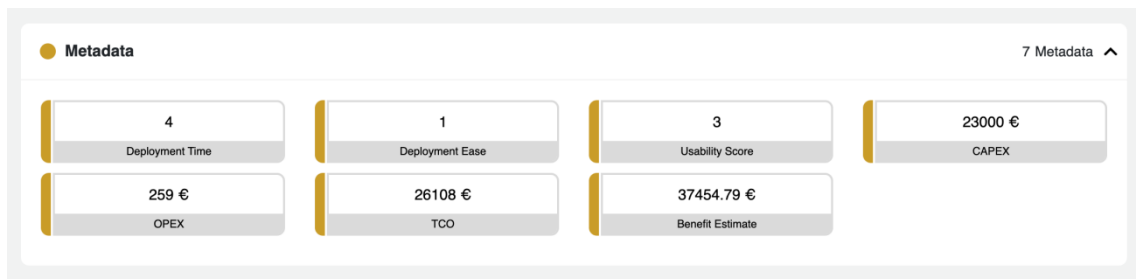


Figure 19 - Metadata

3.2.2 Use Case

The IoT-Catalogue also has a defined and structured way to present the information about a use case. Use Case is where the user can share their experience in a real-world scenario using value propositions, ICT problems, functions, target, domains, and products. These models provide an effective way to characterise the information making the content structured and easy to understand, according to the model presented in ANNEX 2.

The figure below portrays the use case page, which contains its description organised into several categories, namely: status; statistics; team involved; characterisation with values propositions, ICT problems, functions, target and domains; set of assets used in that validation; KPIs; Media gallery and Relevant documentation.

The screenshot displays the 'ICT Catalogue' interface for a case study titled 'Added-Value Weeding Data'. The interface is organized into several sections, each with a corresponding label on the right side:

- General Information:** Includes a summary of the case study, a map of Germany, and filters for Countries, Regions, Places, Components, Value Propositions, and ICT Problems.
- Status:** Shows the project status as 'Completed' and includes filters for Countries, Regions, Places, Components, Value Propositions, and ICT Problems.
- Places:** Lists 'Maastricht' as the location, with details for 'Pumpkin' (Type of Production), 'Organic' (Conventional or Organic), and '150 ha' (Size of Production).
- Team:** Lists team members: 'WUR' (Netherlands), 'NEXCOM' (Netherlands), and 'AGROM' (Austria).
- Characterization:** Details 'Value Proposition' (e.g., Reduce Weeding Hours, Increase Yield), 'ICT Problem' (e.g., Distinguish Crops from Weeds), 'Function' (e.g., Generate Reports, Measure Weather Conditions), and 'Target' (e.g., Farmer Community, Soil, Farm, Domain, Farmer).
- Solution:** Lists various solutions such as 'Meteobot Weather Station Pro', '360FarmNet', 'Ag Leader SMS Software', 'Ag Leader GPS 6500 RTK', 'NEXCOM NISE 3600E', and 'Allied Vision Stingray F-048C'.
- Performance & Impact:** A bar chart showing economic impact across different categories: Personnel (13.33%), Personnel (82.3%), Reduced L... (100%), Reduced L... (0%), Spine... (100%), NEXCOM (100%), and Yield inc... (85%).
- Media Gallery:** Displays a gallery of 7 photos and 1 video related to the case study.
- Documentation:** Lists 1 document titled 'IuP2020 poster UCL3'.

The footer of the interface includes navigation links (Home, Products, Open Source Licenses, Products, Use Cases, Value Propositions, ICT Problems, Components, Learning, Store, Manufacturers, Software) and contact information (Explore, About, Acknowledges, History, Features, Usage, Privacy, Licenses, Terms & conditions). The logo for 'L'IMPACT' is also visible.

Figure 20 - Use Case Overview

- General Information

In the figure below, it is possible to see that the general information category includes the name, a logo, the use case description, keywords, and a summary zone.

The summary zone gives an overview of the use case, as it shows the different places where the use case is taking place, as well as statistics about it. Other tabs are also available there: Regions, where a mapping between the different use cases and the place is displayed; Place, where the characterisation about all places related to the use case is provided.

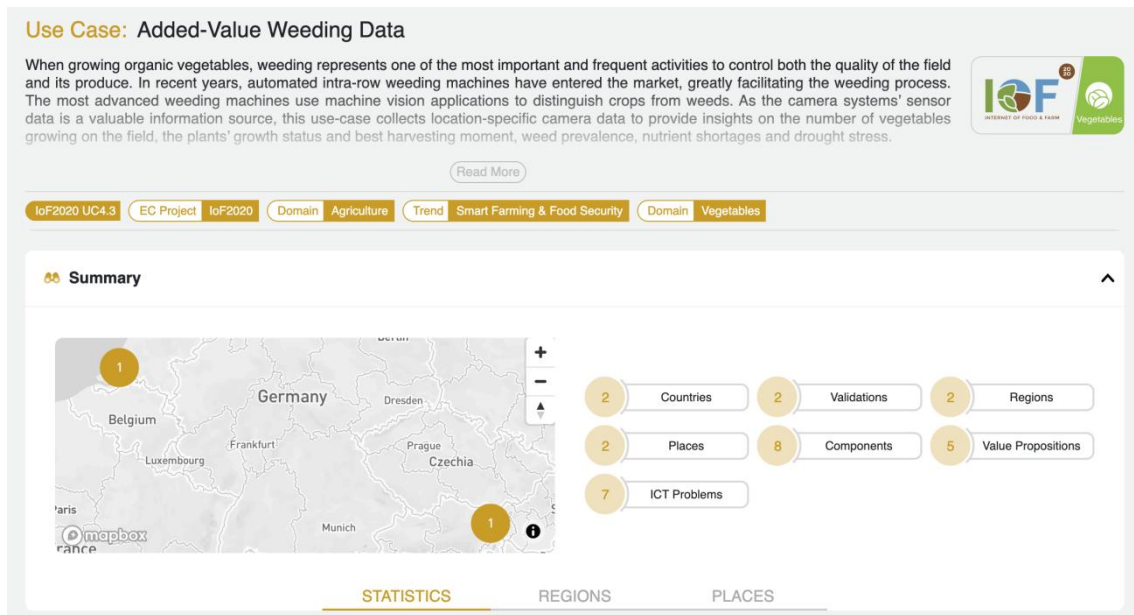


Figure 21 - General Information

- Status

The Status category is portrayed below. According to Figure 22, on the left there is a status indicating whether the use case is going to start at a certain date, it is ongoing or it has already finished. On the right-hand side, some statistics about the selected use case are available.

Notice that, at the top, there is a selector which allows switching between different use cases within the main use case. This selection changes the content of the remaining categories of the use case page.

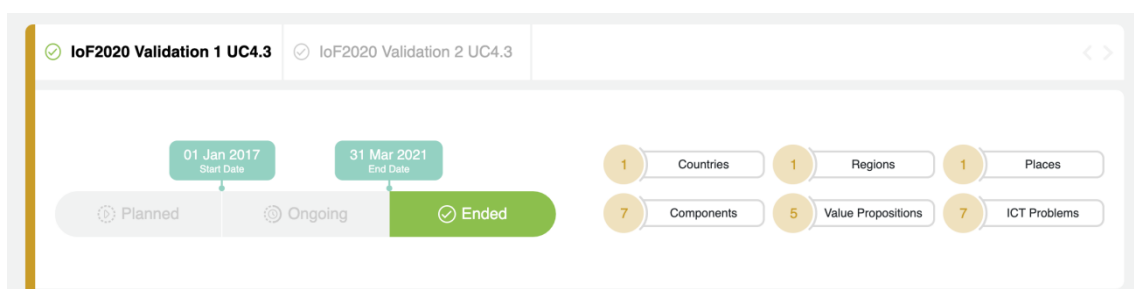


Figure 22 - Status

- Place

In Figure 23, the Place category is represented. It allows the user to see a list of the places with their characterisation and the location represented on a map.

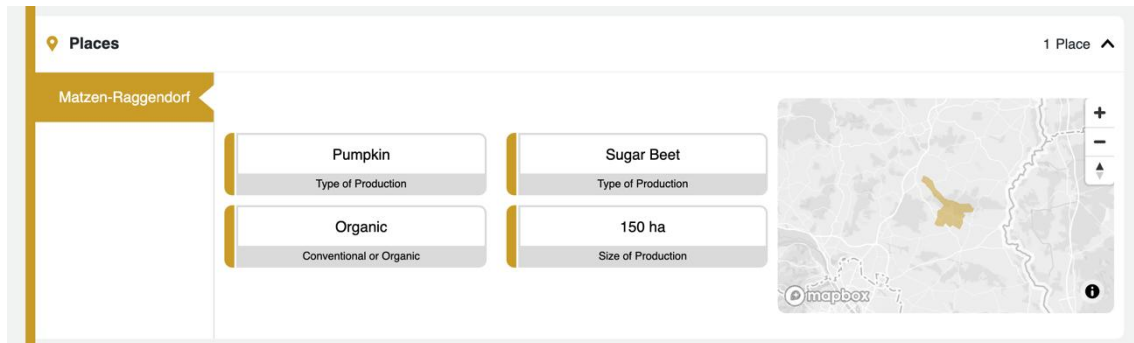


Figure 23 - Place

- Team

Figure 24 represents the Team category, which provides the user with a list of contacts in case they want more information about the use case itself or the entities involved in it.

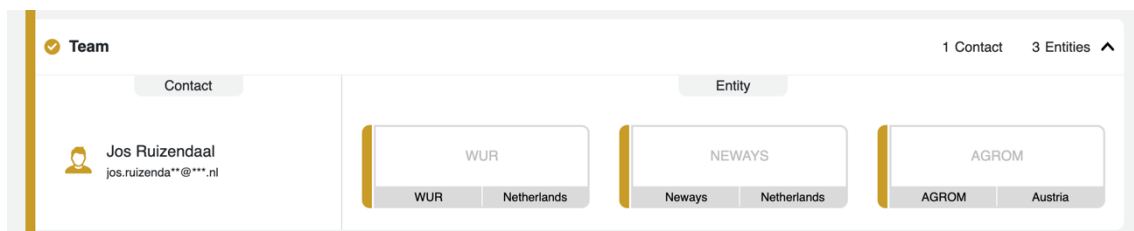


Figure 24 - Team

- Characterisation and Solutions

The Characterisation category conveys an easy way to navigate through the use case information and acknowledge the relationship between the different elements, on account of the IoT-Catalogue model. Taking Figure 25 into consideration, when choosing one Value Proposition, the ICT Problem, Function, Target and Domains are highlighted, and vice-versa for each of them. Furthermore, not only does this selection affect the characterisation bar, but it also changes the solution bar's content showing the required products.

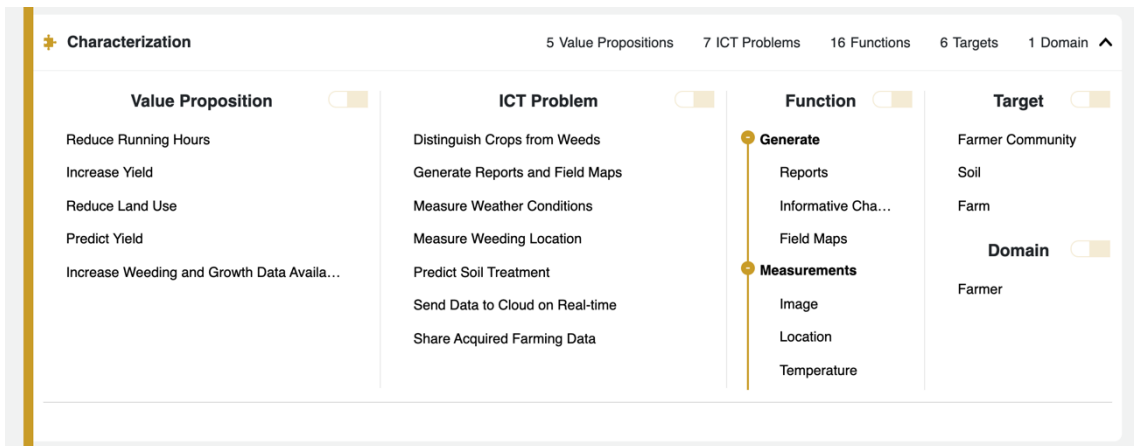


Figure 25 - Characterisation

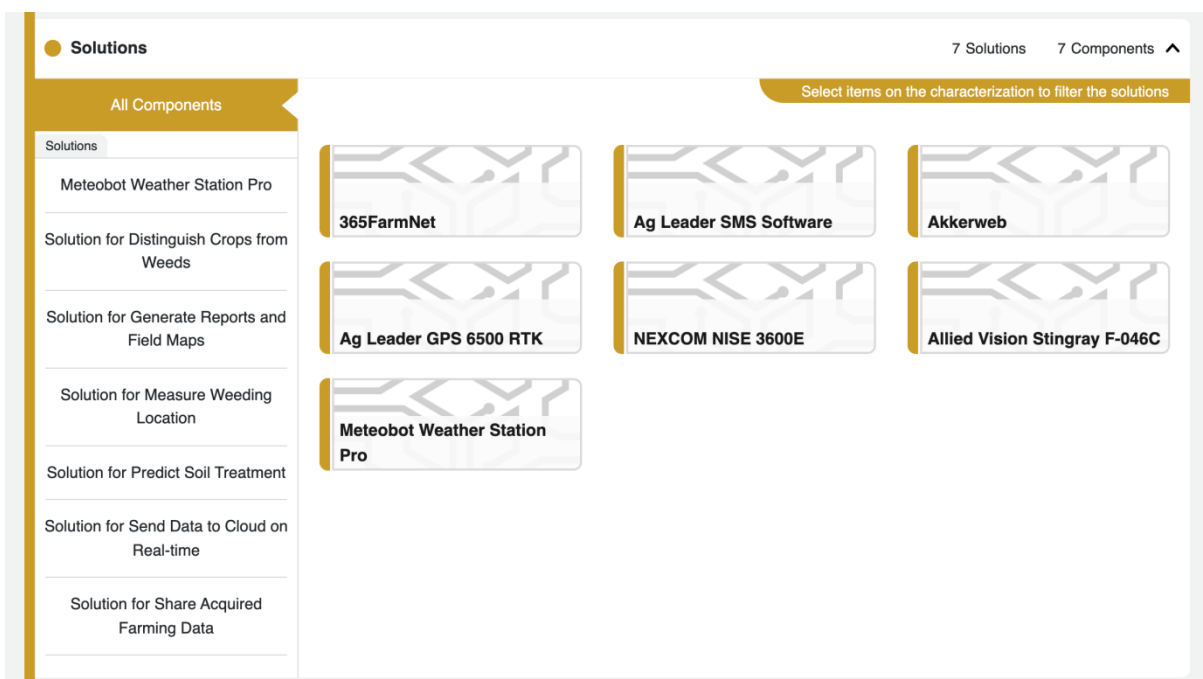


Figure 26 - Solutions

- Key Performance Indicator

The KPI is a quantifiable measure of performance over time for a specific objective. KPIs provide targets for teams to shoot for and, with that, know if the objectives were accomplished.

With this feature from IoT-Catalogue, it is possible to identify the evolution throughout the years and verify if they reached the proposed targets. The aspect of the KPIs in IoT-Catalogue is available in Figure 27, Figure 28 and Figure 29, which represent the following tabs, respectively:

- Summary - contains the last values available of each KPI displayed in a bar chart divided into categories.
- Evolution - conveys the evolution over time for the selected KPI.

- Notes - allows adding relevant notes to pass on to other readers across all KPIs or for a specific one.

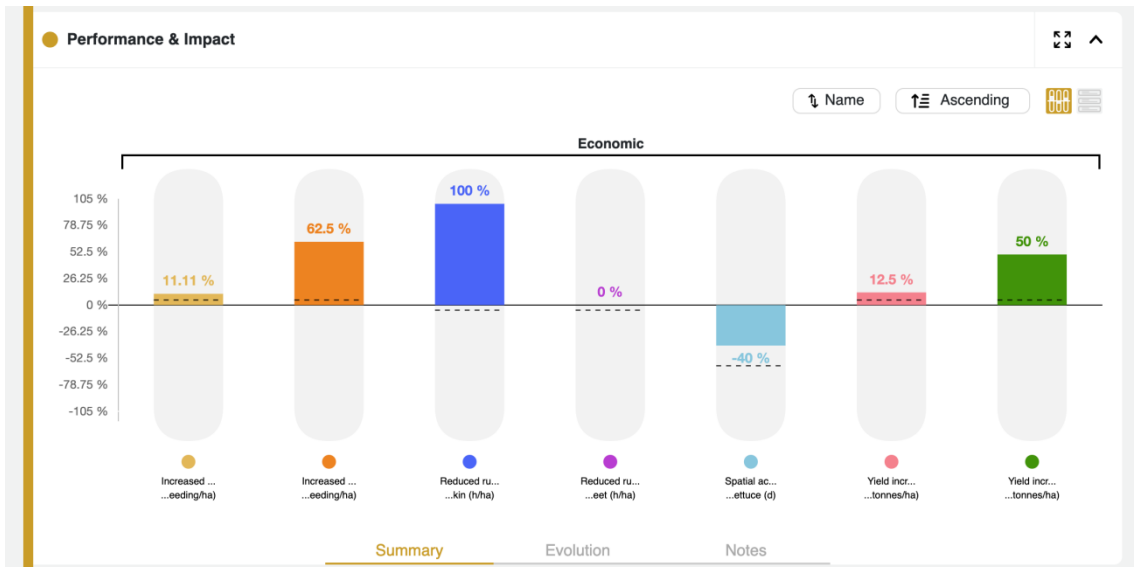


Figure 27 - Performance & Impact: KPIs Summary tab

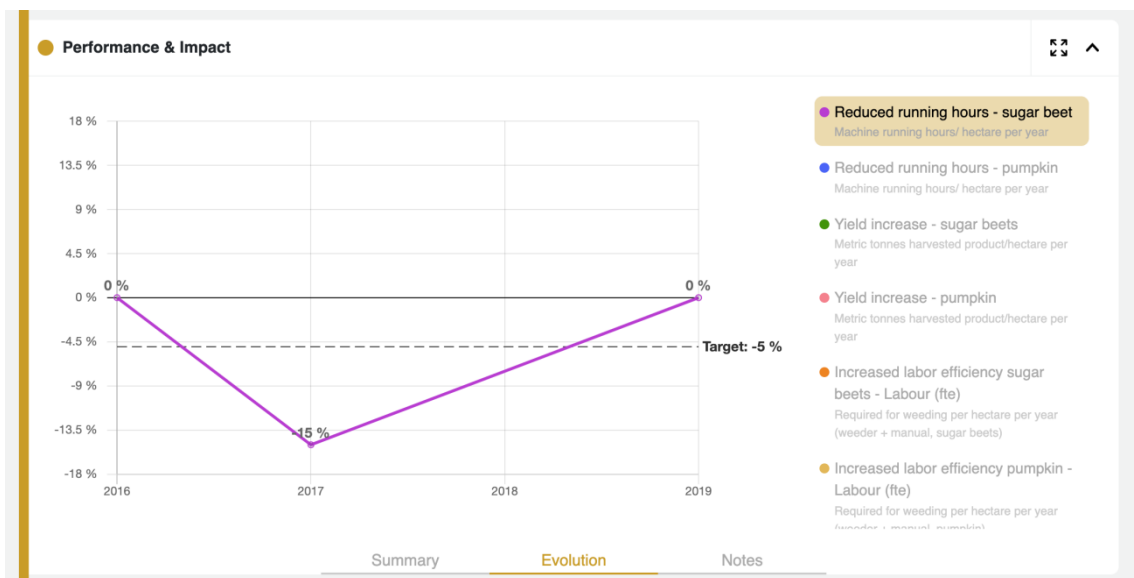


Figure 28 - Performance & Impact: KPIs Evolution tab

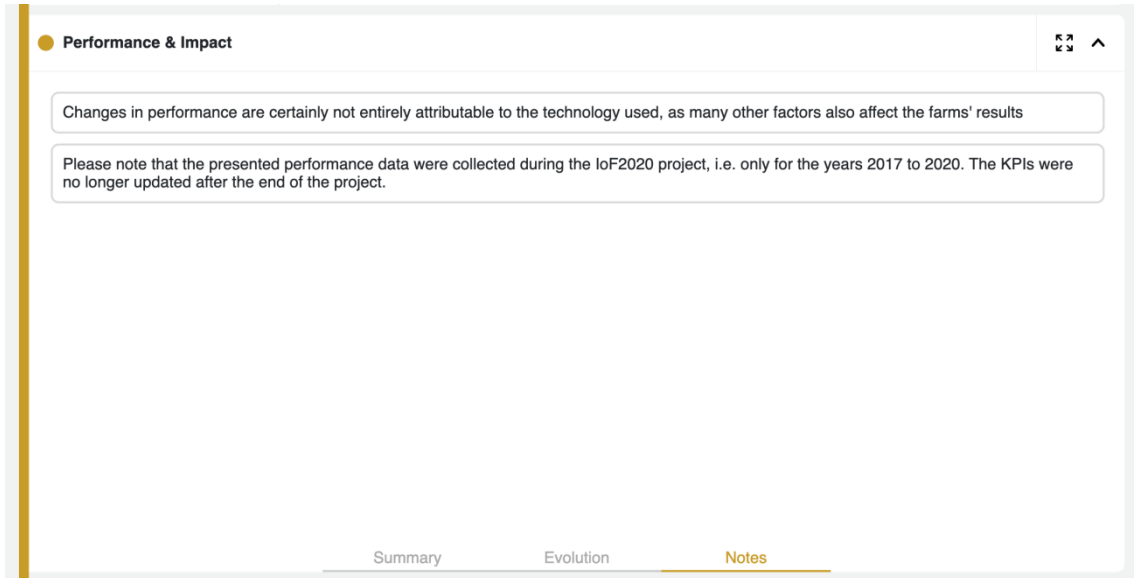


Figure 29 - Performance & Impact: KPIs Notes tab

- Media Gallery

The Media Gallery (Figure 30) contains images (e.g., representing the aspect of a product used in the use case or a use case itself) and videos (e.g., talking about the use case).

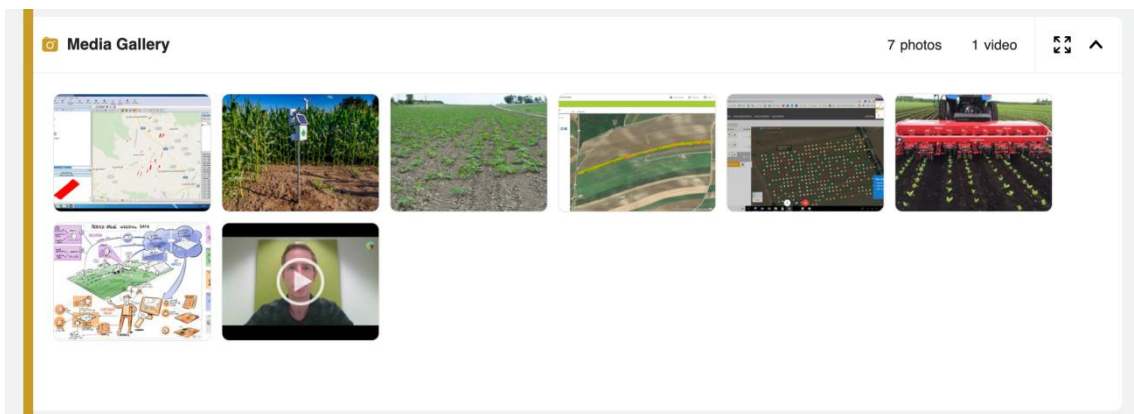


Figure 30 - Media Gallery

- Documentation

The documentation category (Figure 31) allows sharing relevant documents in the context of the use case (e.g., a poster exposing important information that was elaborated for a meeting).

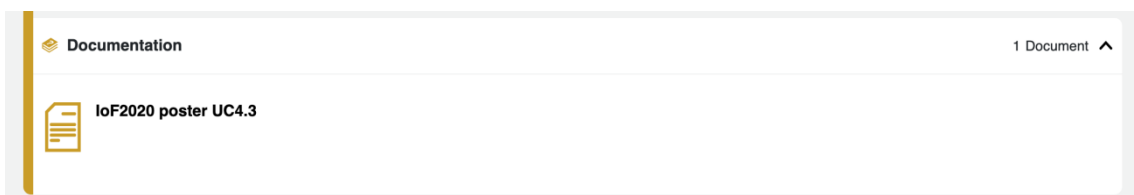


Figure 31 - Documentation

3.3 IoT-Catalogue Liferay Plugin

The plugin allows an external platform to integrate data from IoT-Catalogue, ensuring nothing is shown unless it has permission. This plugin is available as an open-source project, and it is hosted on the UNPARALLEL Innovation public GitHub page: <https://github.com/unparallel-innovation/iot-catalogue-plugin-Liferay>. Please note that this plugin is incessantly subject to updates as new requirements emerge.

The plugin allows a Liferay instance to show the content of IoT-Catalogue elements (assets and success stories). They will be integrated with the Liferay ecosystem therefore the elements will be displayed using the Market Platform theme and they will be searchable using the Liferay default search engine. The use of the plugin will also allow to represent visual elements from IoT-Catalogue, while ensuring it is still well-organised using the model from IoT-Catalogue.

The IoT-Catalogue Plugin Architecture is represented in Figure 32.

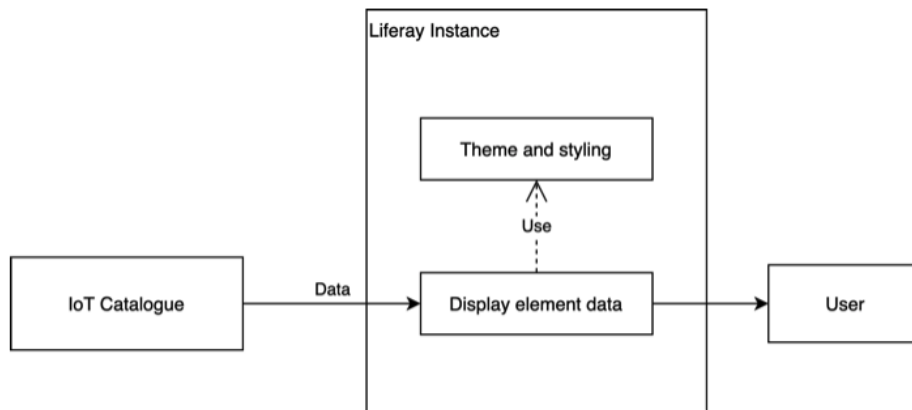


Figure 32 - Plugin Architecture

A more technical overview will be given below, and a description will be given about each plugin concept and the corresponding key points:

- IoT-Catalogue:
 - The running instance of IoT-Catalogue.
 - Contains endpoints to allow connection with external entities.
 - According to this architecture, it is responsible for providing the data.
- Liferay Instance:
 - A server which is running a Liferay instance with the IoT-Catalogue plugin installed.
 - According to this architecture, this Liferay instance is going to display the data provided by IoT-Catalogue, to the user.

Data Persistence

In order to take advantage of all Liferay internal features (e.g., search and data indexing), the data received from IoT-Catalogue by the Liferay instance must be persisted and synchronised in its own database.

So as to feed the data persistence layer of the Liferay instance with IoT-Catalogue elements, a data subscription must be established between IoT-Catalogue and the Liferay Instance.

Data Subscription

- When the Liferay instance asks for data on IoT-Catalogue, a data subscription is made which will allow IoT-Catalogue to send data about the elements to the Liferay instance.
- With the aim of using all the features provided by the Liferay instance, including the search, the data received is persisted on Liferay.
- When the data changes on IoT-Catalogue, a real time update is sent to the Liferay instance to keep the Liferay database up to date.
- When the user removes the data description from the Liferay instance, all the data persisted on the Liferay instance is deleted.

4 Market Platform

The Market Platform is the place where users can consult the information representing the results of the project in one place, enhancing the user experience. Following the information model and the analysis on how to convey it, the next step should be finding a way to present that, taking into consideration the opinion of the consortium which was gathered through a survey. With that in mind, this chapter focuses on the process that led to a decision on the visual aspect of the Market Platform, as well as on the most technical aspects related to its implementation. It is organised as follows:

- **Market Platform Look & Feel:** Describes the creation of two different look & feel designs and the process of selecting which one to use in the Market Platform.
- **Navigation:** Addresses the structure definition, not only from the content's point of view but also from the navigation perspective. For this, the results from the survey mentioned in the Market Platform chapter from this deliverable have been taken into consideration, giving us great help in modelling the sitemap navigation.
- **Implementation plan:** Describes what kind of technology is going to be used and the required procedure needed for the implementation.

4.1 Market Platform Look & Feel

In the first place, two different design options (Figure 33) were created to have the possibility of choice. The first design option is based on the design of the STAR project (i.e., background images and logo) and was completed by adding the word Market Platform. The second option followed an original approach, in order to create an own brand for the Market Platform and was inspired by some keywords from the Grant Agreement, such as AI Systems, Learning Machine and Human-Centric, which originated from an image with the concept of Digital VS Real World.

These two design options were sent to the Consortium and the voting was carried out through a doodle making the Digital VS Real World Concept, the Design option chosen for STAR Market Platform. The chosen design is discussed below, and the other design option has been documented in ANNEX 3.



Figure 33 - Design voting options

4.1.1 Design guidelines

To better understand the entire development of the winning design, the explanation was divided into categories:

- Inspiration
- Main Image
- Logo Creation
- Homepage Mock-up

4.1.1.1 Inspiration

The inspiration for the second design was in some of the project keywords – AI Systems, Learning Machines, Human-Centric. These keywords developed an idea for the creation of a new logo and main image. Since AI is one of the big pillars of STAR, the idea of combining a wired brain with the real brain for the project logo emerged. With that in mind, a mood board was created to portray some of the possible results of such a combination, as represented in Figure 34.



Figure 34 - Digital VS Real World: Mood board

4.1.1.2 Main Image

The main image was drawn in a way that highlights the AI intelligence in the system, with the brain connected and thinking about all the prediction needs and manufacturing developments in an industrial look.

The lightest colours were chosen based on the STAR logo and paved the way for the design of the homepage.

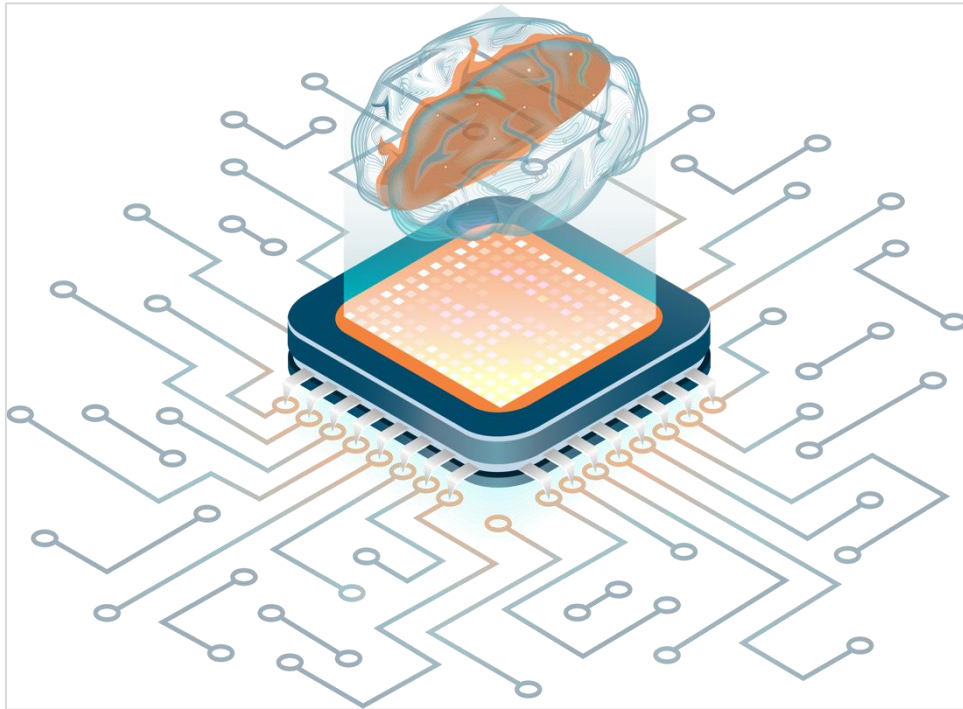


Figure 35 - Digital VS Real World: Main image

4.1.1.3 Logo Creation

With the aim of creating a brand for the Market Platform, the icon was also designed with a wired brain and the connections between the physical and virtual worlds, keeping the colours and font from the main image. The name of the project was also included to make the link between the Project and the Market Platform clear, in case a user does not know the Project.



Figure 36 - Digital VS Real World: Logo

4.1.1.4 Homepage Mock-up

For the second landing page concept, the approach was, once again, to go for cleaner and lighter colours even though using variants of the STAR main colours (dark blue and orange) for contrasting purposes.

The search bar at the top, standing out from the soft background, enables the user to easily search for information on the website. Below, the counters on a dark blue background highlight the amount of content that the website contains.

The sections underneath clearly show the recent, updated, or last information available on the Market Platform, with a summary of what that content refers to, or icons that make for a modern and clean design.

The sign-in bar intends to motivate users to log in and see information that is only available when authenticated.

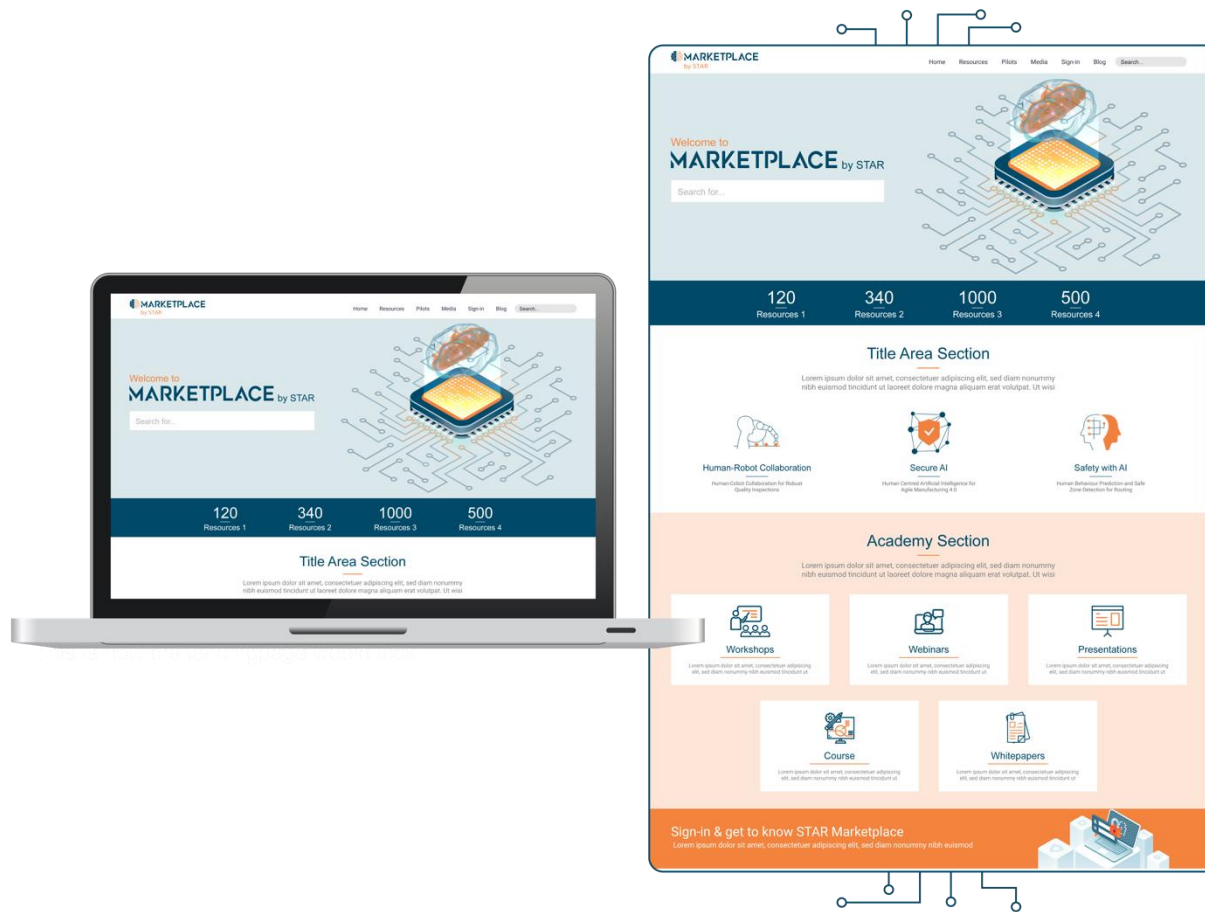


Figure 37 - Digital VS Real World: Homepage

4.2 Navigation

This chapter describes the structure of the Market Platform, not only from the content's point of view but also from the navigation perspective. The survey explained in the Market Platform Objectives was taken into consideration, which considerably helped when it came to modelling the navigation. The wireframing technique was used, as it allows to walk through the structure of the website without getting side-tracked by design elements such as colours and images.

From the analysis of the survey, the sitemap represented in Figure 38 was obtained.

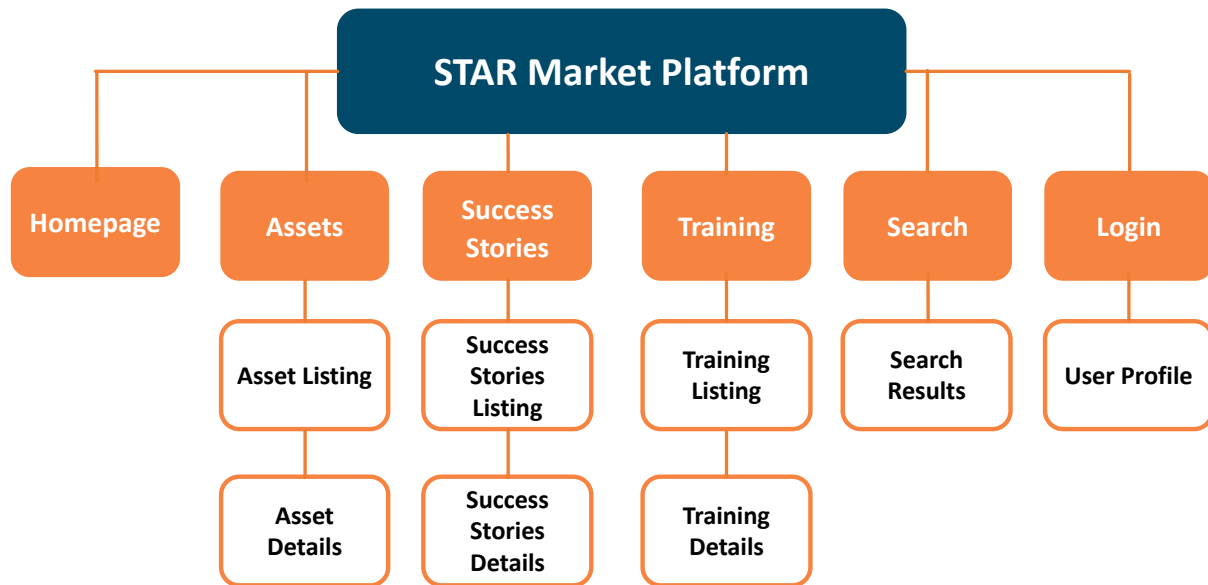


Figure 38 - Sitemap

In this subchapter, the wireframes represent pages and content allocation using the following symbolism:

- A box with a cross is a placeholder for an image or widget, and
- A white-background box mainly represents text fields⁵.

4.2.1 Market Platform Layout

The page is divided into three parts, as shown in Figure 39, namely: the Header remains unchanged on every page; the Body changes accordingly; the Footer is the same on every page and stays at the bottom of the page.

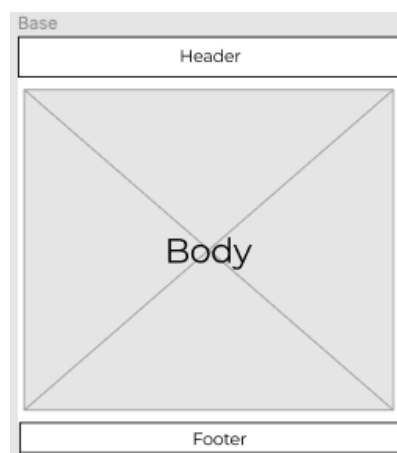


Figure 39 - Wireframe structure

⁵<https://www.figma.com/blog/how-to-wireframe/>

4.2.1.1 Header

The header appears at the top of every page and contains the Logo, Assets, Success Stories, Search and Login, according to Figure 40. The Assets page can be consulted in Figure 45, Success Stories in Figure 46 and Training Resources in Figure 47. Selecting an option will redirect the users to the corresponding page.



Figure 40 - Header section

As for the login section (Figure 41), both the login with the email and the login with a third-party method (e.g., using a social network) will be supported.

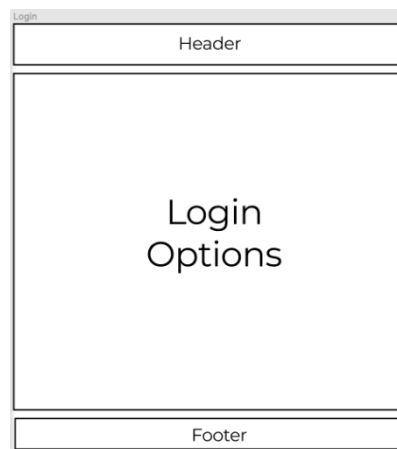


Figure 41 - Login Section

The search section (Figure 42) is self-explanatory since it will show the results of a search performed by the user. It can either be presented in a list or grid and provides handy filters that contribute to faster results.



Figure 42 - Search Section

4.2.1.2 Footer

At the bottom of the page, there will be the footer with a project disclaimer, a sitemap, and a contact form.

4.2.2 Homepage

The homepage has different sections, as portrayed in Figure 43. The Homepage contains multiple sections to highlight certain information, like a new asset release, an oncoming workshop, news, or any other relevant information, with Main Area 1 being larger than Areas 2 and 3. There is also a statistics section to show, for example, the number of assets available in the Market Platform.

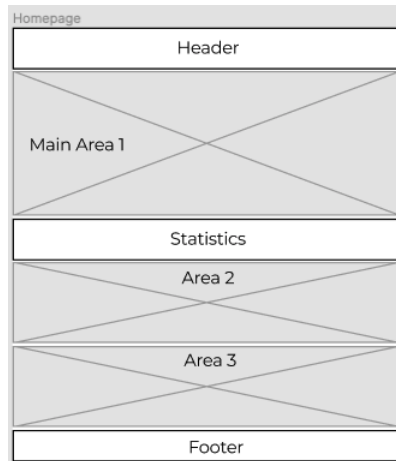


Figure 43 - Homepage

4.2.3 Resources Listing

The listing page is useful for presenting multiple items of the same type, which happens in Assets, Success Stories and Training Resources pages. This area can support different views (e.g., list, grid and map) and also advanced filters in order to easily obtain the desired information.

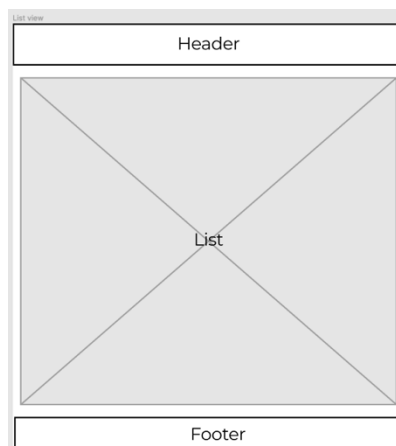


Figure 44 - Listing view

4.2.4 Assets

The structure of the Assets page is represented in Figure 45.

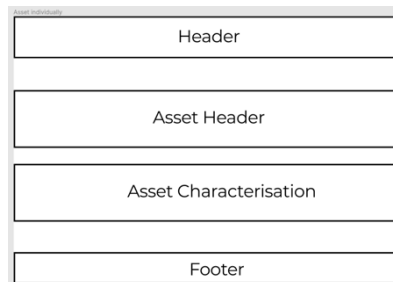


Figure 45 - Assets page

The sections are:

- Asset Header – contains a photo of the asset, the name, the description and a brief characterisation.
- Asset Characterisation – includes a more detailed characterisation of the asset and can have the following information from the IoT-Catalogue (including the visual elements):
 - Sub Asset – lists the assets that the main asset depends on to work properly,
 - Used On – identifies the Use Cases where the asset is used,
 - Live Demo – provides a working instance of the asset for instant testing,
 - Reference – accommodates the asset’s documentation having the possibility to be API specification, repositories like GitHub/Gitlab or a PDF file with instructions on how to use the asset, and
 - Gallery – displays multimedia featuring the asset.

4.2.5 Success Stories

Figure 46 depicts the structure of the Success Stories page.

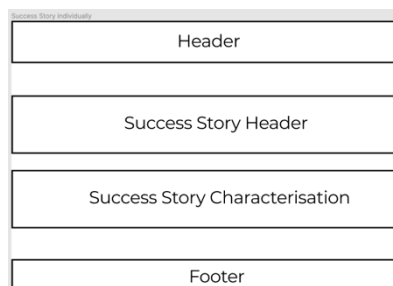


Figure 46 - Success Stories page

The Success Stories will be fed with information from the Success Story template and their respective validations, thus having the following sections:

- Success Story header – provides the Success Story name, description, keywords and a photo.
- Success Story Characterisation – displays the following information from the IoT-Catalogue (including the visual elements):
 - Summary – contains a resume of all the use cases, including a map with all the places where the use case is taking place and some statistics about it,
 - Use case status and statistics – indicates whether it has not begun, is in progress or has finished, along with its statistics,
 - Place information – lists the places involved in the use case with the respective characterisation,
 - Team information – shows the entities and users involved,
 - Characterisation – has an interactive area between Value Propositions, Information and Communication Technologies (ICT) Problems, Functions, Target and Domains,
 - Solutions – presents the set of assets used in each ICT Problem and is affected by the interaction in the Characterisation section,
 - KPIs – has one view showing the last value of each KPI and another one showing the evolution per year in each KPI,
 - Gallery – consists of a section where photos and videos are available, and
 - Documentation – contains files or important links.

4.2.6 Training Resources

Throughout the project, the assets and success stories will be released jointly with the corresponding documentation, either in the form of presentations, Webinars, links to Courses, White Papers or books. Such materials will be used to feed the Training Resources section of the Market Platform, as represented in Figure 47.

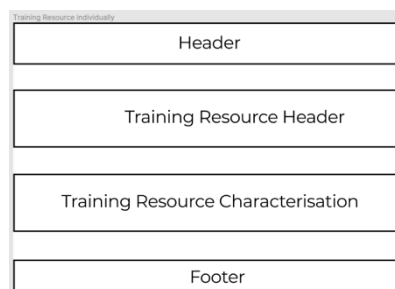


Figure 47 - Training Resources page

This page is divided into the following sections:

- Training Resource Header – consists of a photo, title, brief description, website and keywords.
- Training Resource Characterisation – can have multiple types of information (e.g., the subjects talked in a workshop, where the course will take place and their information, etc.) and a gallery to showcase photos and videos related to the training resource.

4.3 Implementation Plan

Having chosen the look and feel and knowing the technology used for the development of the Market Platform, it became necessary to define an implementation plan for the STAR Market Platform. Amongst the required capabilities in the Market Platform, the following stand out:

- User Management
- Social Login
- Statistics
- Integration with external plugin

Liferay has a hub storing Liferay-compatible application available which can add value to the Liferay instance. This will leverage the Liferay instance with more capabilities as it was required before, namely user management, social login and being capable of generating statistics about the information added.

In order to integrate the IoT-Catalogue plugin into Liferay it is either necessary to change the default visual components from Liferay, called Display provider, or to create new ones so that they match the chosen Market Platform look and feel design.

The Market Platform architecture is divided into the frontend and the backend. For the frontend, Liferay and IoT-Catalogue will be used for they both contain required visual elements. For the backend, it is necessary that Liferay uses Liferay-compatible applications according to the needs and has support to contain external plugins, like the one from IoT-Catalogue, which is going to provide the Market Platform features introduced in the IoT-Catalogue background chapter.



Figure 48 - Market Platform architecture

The implementation of the Market Platform will respect a flow that can be essentially divided into three milestones:

- **Milestone 1:** Integrate the IoT-Catalogue plugin with the Liferay instance, which facilitates the process of displaying the information by using IoT-Catalogue functionalities.
- **Milestone 2:** Implement the chosen design, for which the theme must be developed.
- **Milestone 3:** Liferay functionalities to reach the objectives.
 - Social login – contributes to smooth login and sign-up processes.

- User management – handles user registries and deals with different permission levels so that there can be private and public pages. The platform will thus be able to, for instance, keep track of which user made a certain comment, rate a resource and add a resource knowing the owner. All this interaction will make for an increasing community and, consequently, reach our goal of having more than 100 participants in the STAR Market Platform.
- Statistics – allows the user to view the growth of the Market Platform, in real-time, in terms of assets, Success Stories or any other relevant information.

5 Conclusion

The market platform for safe, reliable, and secure AI solutions in manufacturing provides a single-entry point to accessing resources and support services, being a vehicle for the promotion, dissemination, and exploitation of the project results. Since this deliverable is the first of the STAR's Work Package 7, it is important to mention that WP7 is responsible for the Virtualised Digital Innovation Hub for Secure and Safe AI in Manufacturing, and it is active during the execution of the project (from M01 to M36).

Through a survey within the consortium, a common understanding of how the Market Platform should look like, its sitemap, the content it should present and the functionalities and services that it should provide to users was defined. The results of the survey were compiled to identify the main objectives of the STAR Market Platform and the tools that can be used for implementing a platform and meeting the objectives. The main objectives identified were:

- The Market Platform needs to have a user management system to allow users to authenticate and set personal preferences, enabling different permission levels that give access to information according to their interests.
- The platform must provide a searchable catalogue of AI assets, capable of listing different kinds of assets, ranging from AI platforms and libraries to datasets.
- The success stories of STAR pilots, the AI solutions used, and their results should be shared through the Market platform to be used as examples and inspire users to build novel AI solutions.
- With the purpose of providing more information about the work being developed on the AI domain, the Market Platform makes available different resources either in the form of workshops, webinars, presentations, videos, or other training materials.

Considering the results of the survey and the outcoming objectives, the Market Platform needs to provide a wide range of functionalities. Most of those functionalities can be implemented using a Content Management System (CMS) as the baseline of the platform (e.g., Liferay), which provides advanced functionalities needed by the Market Platform through its plugin system.

The need for a searchable catalogue of AI assets requires the definition of an adequate model to describe and characterise the assets. To aid this process, the IoT-Catalogue platform will be used for indexing assets and their usage on STAR Success Stories, which then become navigable and searchable in the Market Platform. IoT-Catalogue additionally provides a set of visual elements to support the adequate presentation of the platform's content. These functionalities are going to be exposed through the IoT-Catalogue Liferay Plugin which allows to use IoT-Catalogue functionalities inside the Liferay CMS.

Moreover, two look and feel designs were created, introduced, and, finally, voted within the consortium so as to elect which one should be used. The structure of the Market Platform was also defined, not only from the content's point of view, but also from the navigation perspective. For this, the results from the survey mentioned in the Market Platform chapter have been taken into consideration, giving us a great help in modelling the sitemap navigation.

Finally, the kind of technology to be used and the implementation plan were unveiled.

5.1 Next Steps

In the next steps, the Market Platform is going to be implemented following the specification and steps available in this deliverable:

- Integrate the IoT-Catalogue plugin into the Liferay instance,
- Implement the design chosen by the consortium, and
- Add Liferay functionalities to achieve the desired objectives.

D7.2 that is due in M24 will report on:

- The final version of the Market Platform implementation, including information on its deployment and some statistics related to visitors and accesses,
- The progress of the Assets and success stories integration within the Market Platform,
- The Training resources made available through the Market Platform,
- Details on the defined certification programme designed by Task 7.4, and
- Results of the collaboration between the STAR Market Platform and the AI4EU platform.

ANNEX 1 Product template

This template gathers relevant information of a specific technological product, to be stored in the products’ repository. For that, it is organised into the following sections:

- **General Information:** The General Information section intends to portray the general aspects of the product, namely its name, type, and description, among others.
- **Features:** The Features section focuses on the product’s abilities, i.e., what the platform can do.
- **AI Model:** The Machine Learning Model section should only be filled if your product belongs to this category, otherwise leave it blank.
- **Implementation:** The Implementation section highlights the most technical aspects regarding the development of the product. It contains information such as the deployment requirements of the product, its communication capacities, and other correlated products.
- **Distribution:** The Distribution section describes the multiple ways in which the product can be accessed and used.
- **Reference:** The Reference section will provide useful documentation of the product, such as instructions manuals, datasheets, publications related to the product, training material, and so on.
- **Legal Aspects:** The Legal Aspects section contains the legal description of the product. Information like the associated license and the owner’s contact information will be available here.
- **H2020 Project-related Information:** The H2020 Project-related Information section contains additional details about the product in the context of the project, including its evolution throughout the project.
- **Market:** The Market section contains the description of the product from the business perspective. This includes the target market, business model, the approach to develop the market, competitors, where you can buy the product and the SWOT analysis.
- **Comments / Notes:** The Comments / Notes section contains additional information about the product that did not suit any other sections in the template.
- **Authorship:** The Authorship section contains the version history of the current template, i.e., the current version, its author, and the date of the last update.

Each section has a descriptive text and contains a variety of fields that may be mandatory.
All fields have important explanations that must be carefully read.

Before filling the template, please refer to the Annexes, for it will help you decide which type of product best suits your technological solution.

1 General Information	
The General Information section intends to portray the general aspects of the product, namely its name, type and description, amongst many others.	
Comp. Name	Name of the Product
Type	Indicate the type of the Product: Platform, Sensor, Gateway, Dataset, Machine Learning Model, Library, Extension, As a Service or Other Software.
Summary	Short summary of the Product (with a maximum of 280 char).
Description	Extended description of the Product (text, images, etc.)

Technical Categories	Choose one from the list of Technical Categories, in the Annexes.
Research Areas	Choose one from the list of Research Areas, in the Annexes.
Business Categories	Choose one from the list of Business Categories, in the Annexes.
Website	The website of the Product
Version	Version of the Product
Standards	List of Standards supported by the Product
GDPR Requirements	Explain how you are impacted by the GDPR requirement
Trustworthy AI	Explain how you are impacted by trustworthy AI requirement
TRL	Select the TRL of the Product according to European Commission H2020/HLG-KET Technology Readiness Level: <ul style="list-style-type: none"> ▪ TRL 1 – basic principles observed ▪ TRL 2 – technology concept formulated ▪ TRL 3 – experimental proof of concept ▪ TRL 4 – technology validated in lab ▪ TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies) ▪ TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies) ▪ TRL 7 – system prototype demonstration in operational environment ▪ TRL 8 – system complete and qualified ▪ TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

2 Features	
The Features section focuses on the product’s abilities, i.e., what the platform is able to do.	
Examples: <ul style="list-style-type: none"> ▪ Display the graphical map and aerial views for the field mapping. ▪ Get all of the important weather data for the next few days. ▪ The field mapping contains your nutrient balance. The nutrient report for your fertilisation measures is displayed graphically. ▪ Data Storage ▪ Machine Learning Engine 	

3 AI Model	
The Machine Learning Model section should only be filled if your product belongs to this category, otherwise leave it blank.	
Machine Learning Type	Type of Machine Learning: Supervised, Unsupervised, Semi-supervised, Reinforced, Deep, ...
Machine Learning Technique(s)	Machine Learning Technique(s) used: Classification, Regression, Clustering, ...
Machine Learning Algorithm	Machine Learning Algorithm: Linear Regression, Logistic Regression, Decision Trees, Naive Bayes, K-Nearest Neighbours, ...
AI-driven Application	The model’s application from the AI standpoint (Data Processing Machine Learning, Machine Vision Image Processing Robotics, Media and Language Knowledge Extraction, Digital Assistant Chatbots, etc.) and its limitations (e.g.,

	indicate the supported languages for text-related models)
Architecture	Architecture used: BERT, BiGAN, CNN, DAN, ELMo, etc.
Training Dataset(s)	Dataset(s) used in the model's training: ADE20K, BAIR, HRWSI, ImageNet, etc.
Model Format	Format of the model: TF.js, TFLite, Coral, ...
Fine-tuneable	Does the model allow fine-tuning (Y/N)?

4 Implementation		
The Implementation section highlights the most technical aspects regarding the development of the product. It contains information such as the deployment requirements of the product, its communication capacities and other correlated products.		
Deployment requirements	System/Hosting requirements for the deployment of the Product - e.g., Hardware: Sensor needs Arduino / Software: Application needs Node.js; TensorFlow 2 must be installed in order to load the ML model	
Communication capacities	Product communication capacities. For example, describe if the product connects to Wi-Fi, if it is input/output-configurable or if the platform connects to external services.	
Interaction with external services	Can the product interact with external services (Y/N)?	
Interoperability mechanisms	Describe which mechanisms were used to help at the interoperability level. This could be the use of data sources, visualisation interfaces, remote procedure calls (e.g., https://grpc.io) or others.	
SDK(s)	Software Development Kit(s) associated with the Product.	
Runs on	Indicate the Operating System (OS) required for the product to work (e.g., Linux, Windows, etc.).	
Tested on	For example, Ubuntu 14.0. Specify the version, because from version to version can change the behaviour of the product.	
4.1 Linked Products (each linked product must have its own filled template)		
Comp.	Comp. Name	Name of the Product
	Integration Type	How is the linked Product taking part in the main Product? (e.g., used as a library, integrated the source code, external service, part, etc.)

5 Distribution	
The Distribution section describes the multiple ways in which the product can be accessed and used.	
Source Code	Indicate the URL that gives access to the source code of the product. It can lead to GitHub, FTP or another download system and compilation will be necessary.
Binary	Indicate the URL that gives access to the product in the binary format. It can lead to GitHub, FTP or another download system.
Docker	Indicate the URL if the product is hosted in a docker hub or the docker-compose, if otherwise.
Package Manager	Indicate how the product can be accessed through a package manager (e.g., npm).
Other types of distribution	Indicate other formats through which the product is accessible (e.g., Jupyter Notebook) or describe it, if does not fit any of the previous options.
Execution Instructions	Indicate how the user can execute the product. This could be a tutorial available through a URL, a GitHub repository or using, for example, a script hosted somewhere.
6 Reference	
The Reference section will provide useful documentation of the product, such as instructions manuals, datasheets, publications related to the product, training material, and so on.	
Documentation	Files (e.g., PDF guides) or URL where the Product is described
API(s)	Information related to the API of the Product (e.g., swagger)

Plug-ins, Apps, etc.	If available, reference to catalogue of Plug-ins, Apps, etc.
Publications	List of publications related to the Product
Training	Training material regarding the Product

7 Legal Aspects		
The Legal Aspects section contains the legal description of the product. Information like the associated license and the owner's contact information will be available here.		
Type of use / distribution	Open-source, closed-source, internal, etc.	
Open-Source License	Open-source license (guide for open-source license ⁶)	
7.1 Owner(s)		
Entity 1	Entity Name	Name of owner entity
	Logo	Logo (image + weblink) of the owner entity
	Website	Website of the owner entity
	Contact(s)	Name and email of the contact(s) person
	Entity Type	Type of entity: Higher or secondary education establishment; International Organisation; Non-governmental organisation; Private for-profit organisation; Public organisation; Research organisation; Small or medium-sized enterprise; Other.

8 H2020 Project-related Information		
The H2020 Project-related Information section contains additional details about the product in the context of the Project, including its evolution throughout the project.		
Usage in Project	How the Product was used in the project (e.g., use case)	
WP(s) / Task(s)	Work package(s) or task(s) associated with the Product	
Deliverable(s)	Deliverable(s) related to the Product in the project	
Evolution	Technological	Advancements to the Product made during the project
	Business/Market	Business/Market development related to the Product
	TM	Level
Standard		Related Technology Maturity Level standard

9 Market		
The Market sections contains the description of the product from the business perspective. This includes the target market, business model, the approach to develop the market, competitors, where you can buy the product and the SWOT analysis.		
Target Market(s)	Main target market(s) of the Product	
Business Model	Business model for the exploitation of the Product (e.g., subscription, buy, service, etc.)	
Market Approach	Market development approach: how to approach the market(s)? with which instrument(s)?	
Competition	Other Products that you consider competitive with this Product	
Stores	List of stores where the Product is available (e.g., to purchase)	
SWOT	Strengths	Characteristics of the Product that give it an advantage over others
	Weaknesses	Characteristics of the Product that places it at a disadvantage relative to others

⁶ <https://www.iot-catalogue.com/openSourceLicences>

Opportunities	Elements in the environment that the Product could exploit to its advantage
Threats	Elements in the environment that could cause trouble for the Product

10 Comments / Notes
The Comments / Notes section contains additional information about the product that did not suit any other sections in the template.
Additional notes about the Product.

11 Authorship	
The Authorship section contains the version history of the current template, i.e., the current version, its author and the date of the last update.	
Author	Name and contact(s) of the person who provided the information contained in this template
Date	Date when the information in this template was provided

Table 1 contains the types of products supported in the product template.

Table 1 – Products Available types of products

Type	Description
Platform	Cloud service that provides Web-scale infrastructure capabilities to support digital solutions. For example, Ubidots (https://ubidots.com/) allows users to connect their hardware and digital services to its cloud, in order to deliver customised Cloud solutions.
Sensor	Hardware product that detects events in its surroundings and translates them into electrical signals. Depending on the type of sensor, it can be able to detect changes in temperature, proximity to other objects, humidity, pressure, amongst many others (https://www.futureelectronics.com/c/semiconductors/analog--sensors).
Gateway	Piece of hardware that ensures the flow of data between two or more networks. For example, the ALTA Ethernet Gateway (https://www.monnit.com/products/gateways/ethernet-gateways) is used to receive data from Monnit Wireless Sensors and transmit it to the iMonnit Sensor Configuration and Management Software.
AI Model	Results from running a specific Machine Learning algorithm on some data and represents what the algorithm has learnt, i.e., the rules that will be applied the next time a prediction is asked for. For instance, the spice (https://tfhub.dev/google/spice/2) model recognises the dominant pitch of the raw audio waveform taken as input.
Library	Set of robust routines that allows users to perform complex tasks without rewriting many lines of source code. For instance, in Machine Learning, libraries may provide several models, which can be used without deep knowledge of their most technical aspects (e.g., TensorFlow Hub - https://www.tensorflow.org/hub).
Extension	Piece of software that adds on extra functionalities to an existing program. For instance, AdBlock Plus (https://adblockplus.org) provides browsers with the ability to block undesired advertisements.
As a Service	Multiple services can be available in external websites. For example, https://www.raffle.ai .
Other Software	Other types of software that do not fit any of the previous definitions.

Below, you can find the list of Technical Categories supported in this template:

Table 2 – Products Available Technical Categories

Technical Categories					
Knowledge representation	Automated reasoning	Common sense reasoning	Planning and scheduling	Searching	Optimisation
Machine learning	Natural language processing	Computer vision	Audio processing	Multi-agent systems	Robotics and automation
Connected and automated vehicles	AI Services	AI Ethics	Philosophy of AI	-	-

Below, you can find the list of Research Areas supported in this template:

Table 3 – Product Available Research Areas

Research Areas					
Collaborative AI	Explainable AI	Integrative AI	Physical AI	Verifiable AI	-

Below, you can find the list of Business Categories supported in this template:

Table 4 – Products Available Business Categories

Business Categories					
AI for agriculture	AI for air traffic management	AI for fashion	AI for space	AI in autonomous driving and mobility	AI for law
AI in retail and ecommerce	AI in Human Resources	AI in health	AI for telecommunication	AI for robotics	AI for media
AI for IoT	AI for ambient intelligence	AI for industry and manufacturing	AI for finance & insurance	AI for environment and sustainability	AI for cybersecurity
AI for citizen services & education	AI for art and music	AI in software engineering	Trusted and Privacy preserving AI	Other	-

ANNEX 2 Use Case template

The use case section will specify problems in the real-world. This can be divided into multiple validations, for example according to the number of deployments. It will be organised in the following sections:

- **Use Case:** In this section, the use case which aggregates the validations will be identified.
- **H2020 Project-related Information:** The H2020 Project-related Information section contains additional details about the product in the context of the Project, including its evolution throughout the project.
- **Comments / Notes:** The Comments / Notes section contains additional information about the product that did not suit any other section in the template.
- **Authorship:** The Authorship section contains the version history of the current template, i.e., the current version, its author, and the date of the last update.

1 Use Case	
In this section, the Use Case which aggregates the validations will be identified.	
Name	Name of the Use case
Summary	Short summary of the use case (with a maximum of 280 char)
Description	Extended description of the use case (text, images, etc.)
Website	The website where the use case is mentioned, for example, the website of the project.
Domain(s)⁷	List of NACE revision 2 codes/titles
Type	It could be a Use Case, Pilot, Experiment or other. If other, please specify.

2 H2020 Project-related Information	
The H2020 Project-related Information section contains additional details about the product in the context of the Project, including its evolution throughout the project.	
Project	Acronym and title of the project where assessment was done
Website	Project website
Work in Project	Work done in the project related to the assessment
WP(s) / Task(s)	Work package(s) or task(s) associated with the assessment
Deliverable(s)	Deliverable(s) related to the assessment in the project
Notes	Any project-related notes regarding the assessment

3 Comments / Notes	
The Comments / Notes section contains additional information about the product that did not suit any other section in the template.	
Additional notes about the Use Case, e.g., Concept (technical concept of the Use Case), Ambition (innovation potential related to the Use Case), Exploitation (how the results of the Use Case can be exploited), etc.	

4 Authorship	
The Authorship section contains the version history of the current template, i.e., the current	

⁷http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2

version, its author and the date of the last update.	
Author	Name and contact(s) of the person who provided the information contained in this template
Date	Date when the information in this template was provided

The validation template will help to characterise a specific validation of a Use Case (via a pilot, an experiment, etc.) with clearly defined and realistic value propositions (objectives) having a deployment (places, solutions, team, ICT Problems, and products) and being measurable (using KPIs). It will be also necessary to identify ICT Problems and products. This section will have the following organisation:

- **Validation:** A Use Case will be divided into several validations, e.g., deployments in different regions to analyse potentially distinct behaviours.
- **Place(s):** This section will contain the characterisation of the place(s), as well as their local contact.
- **Team:** The Teams section provides all the entities which were involved in the validation and the contact responsible for the validation.
 - **ICT Problems:** The ICT Problems section is related with the technological problem's point of view. If you want to solve Value Propositions, ICT Problems need to be defined.
- **Products:** Please list the products used in this validation. For each product will be necessary to create a template giving more details.
- **Key Performance Indicator(s):** Describe how the use of the technologies have impacted your Use Case.
- **Comments / Notes:** The Comments / Notes section contains additional information about the product that did not suit any other sections in the template.
- **Authorship:** The Authorship section contains the version history of the current template, i.e., the current version, its author, and the date of the last update.

1 Validation	
A Use Case will be divided into several validations, e.g., deployments in different regions to analyse potentially distinct behaviours.	
Name	Name of the Validation
Use Case Name	Refer to the name of the Use Case which this validation belongs
Summary	Short summary (with a maximum of 280 char) of the Validation
Description	Extended description of the Validation (text, images, etc.)
Value Proposition(s)	Bullet list with value proposition(s) of the Validation: <ul style="list-style-type: none"> ▪ «Value Proposition #1 in the form ["Verb"] "direct object"» ▪ ... Examples: [Increase] Yield, [Reduce] Pesticide Use, [Improve] Water Quality, [Reduce] Scrap parts
Documentation	Assorted documentation related to the Validation
Image(s)	Photo gallery of the Validation
Website	The website of the Validation
Keywords	Set of keywords/tags that characterise the Validation

2 Place(s)		
This section will contain the characterisation of the place(s), as well as their local contact.		
Place 1	Name	Name of the place
	Location	Place location: Country, County, City, Address, GPS – to the level of detail that can be shared
	Characterisation	Characterisation of the present (as-is) state of the place. Examples:

Local Contact 1		Products, Production Lines, Processes, Machines involved, Type of production, Size of production, etc.
	Entity Name	Name of the local contact organisation
	Logo	Logo (image + weblink) of the local contact organisation
	Role	Role of the local contact organisation
	Website	Website of the local contact organisation
	Contact(s)	Name and email of the contact person(s)
	Entity Type	Type of organisation: Higher or secondary education establishment; International Organisation; Non-governmental organisation; Private for-profit organisation; Public organisation; Research organisation; Small or medium-sized enterprise; Other.

3 Team		
The Team section provides all the entities which were involved in the validation and the contact responsible for the validation.		
Contact Responsible	This is the entity or user which the audience could contact to know more about the validation. Name and Email should be at least provided. If desired the contact can be characterised using the terms used below.	
Entity 1	Entity Name	Name of the team member organisation involved in validation
	Logo	Logo (image + weblink) of the team member organisation involved in validation
	Role	Role of the team member organisation involved in the validation
	Address	Address of the team member organisation involved in the validation
	Website	Website of the team member organisation involved in the validation
	Contact(s)	Name and email of the contact person(s) in team member organisation
	Entity Type	Type of entity: Higher or secondary education establishment; International Organisation; Non-governmental organisation; Private for-profit organisation; Public organisation; Research organisation; Small or medium-sized enterprise; Other.

4 ICT Problems	
ICT Problems section is related with the technological problem's point of view. If you want to solve Value Propositions, ICT Problems need to be defined.	
Bullet list with ICT Problems of the Validation:	
<ul style="list-style-type: none"> ▪ «ICT Problems #1 in the form ["Verb"] "direct object"» ▪ ... 	
Examples: [Measure] weather conditions, [Measure] Soil Conditions, [Track] Location in Real Time	

5 Products	
Please list the products used in this validation. For each product will be necessary to create a template giving more details.	
Examples:	
<ul style="list-style-type: none"> • 365FarmNet • Davis Vantage Pro 2 	

7 Comments / Notes	
The Comments / Notes section contains additional information about the product that did not suit any other sections in the template.	
Additional notes about the Product.	

8 Authorship

The Authorship section contains the version history of the current template, i.e., the current version, its author and the date of the last update.

Author	Name and contact(s) of the person who provided the information contained in this template
Date	Date when the information in this template was provided

ANNEX 3 Design Alternative: Project Image

The first design option is based on the design of the STAR project, such as the background images and the logo just added the word Market Platform

To better understand the entire development of this design, the explanation was divided into categories:

- Inspiration
- Main Image
- Logo Creation
- Homepage Mockup

Inspiration

For the 1st Concepted developed for the STAR Market Platform, the design was based on the Project existing brand. So, the image, logo, colours, all these details were inspirations and merge to create a Market Platform image with a similar design. This image represents the mood board of inspiration to this first concept.



Figure 49 - STAR Design Based: Moodboard

Main Image

For the image, it was used the same background layout as the Project website. The lines with the dots and a dark blue, merge the two websites with a familiar layout and a recognisable image.



Figure 50 - STAR Design Based: Main image

Logo Creation

STAR logo was the base to the Market Platform brand. This way, was only added the Market Platform word into the existent logo, using the same colours. Making the Link between the AI and the Market Platform, as a reference to the AI systems developed by the project.



Figure 51 - STAR Design Based: Logo

Homepage Mockup

In the Market Platform homepage proposal, it was designed with a similar look to the STAR Project website. It was represented some areas with some default information to see the looks and feel that the Market Platform would look like.

With the different sections, the user can see all the information available in the Market Platform in a quick and modern look.



Figure 52 - STAR Design Based: Homepage Mockup