



# eXplainable AI in Manufacturing – the XMANAI project experience

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The Manufacturing Partnership Day # BluePoint Brussels

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# XMANAI at a Glance



## *XMANAI eXplainable MANufacturing Artificial Intelligence*

- **Grant Agreement:** 957362
- **Start Date:** November 1<sup>st</sup> 2020
- **Duration:** 42 Months (review at M12, M30 and M42)
- **Total Funding:** 5.998.902,50€
- **Consortium:** 15 Beneficiaries + 1 Linked party

## • **Coordination Team:**

- Project Coordinator: TXT e-solutions S.p.A. (Michele Sesana)
  - Technical Coordinator: SUITE5 (Fenareti Lampathaki)
  - Scientific Coordinator: Fraunhofer FOKUS (Yury Glikman)
- **Topic:** ICT-38-2020 – Artificial intelligence for manufacturing
  - **Funding Scheme:** RIA – Research and Innovation action



# Consortium Balance



Type/ role	Consortium Partners
Large industry	TXT, WHIRLPOOL, FORD, CNH
SMEs	UBITECH, DBL, SUITE5, AIDEAS, TYRIS, KBIZ, INNOVALIA
Research	POLIMI, FRAUNHOFER, ATHENA, UNIMORE (third party)
Demonstrators	WHIRLPOOL, FORD, CNH, UNIMETRIK

Role in a XMANAI	Consortium partner
Manufacturers / Business Experts	TXT, WHIRLPOOL, FORD, CNH, POLIMI, INNOVALIA
Data Science/ Analytics	SUITE5, AIDEAS, ATHENA, TYRIS, DBL
Data Management and Sharing Experts	FRAUNHOFER, ATHENA, SUITE5, KBIZ
Security and Ethics in AI and Manufacturing	DBL, UBITECH

# XMANAI Motivation





# XMANAI Concept (WP1)

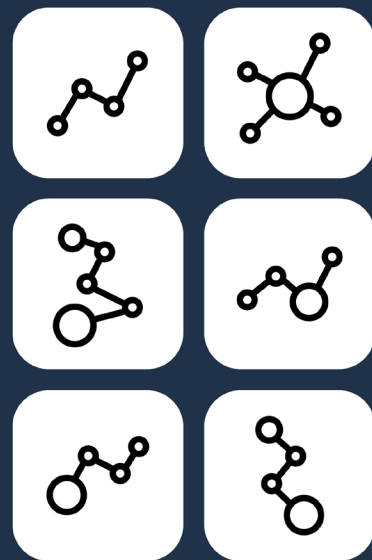


**XMANAI**  
is an european project  
that wants to put  
**EXPLAINABLE AI**  
at the service  
of manufacturing domain

# Main Objectives (WP2-3-4-5)

FIRST OBJECTIVE

## XAI MODELS



SECOND OBJECTIVE

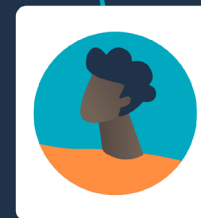
## XAI-RELATED ASSETS LIFECYCLE MANAGEMENT



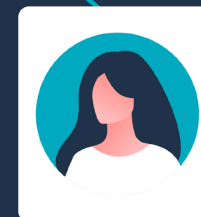
THIRD OBJECTIVE

## COLLABORATION BETWEEN ACTORS

Business expert



Data Engineer



Data Scientist

# Validation in Demonstrators



## FORD

AI for production optimization



## WHIRLPOOL

AI for product demand planning



## CNH

AI for process/product quality optimization



## UNIMETRIK

AI for smart semi-autonomous hybrid measurement planning

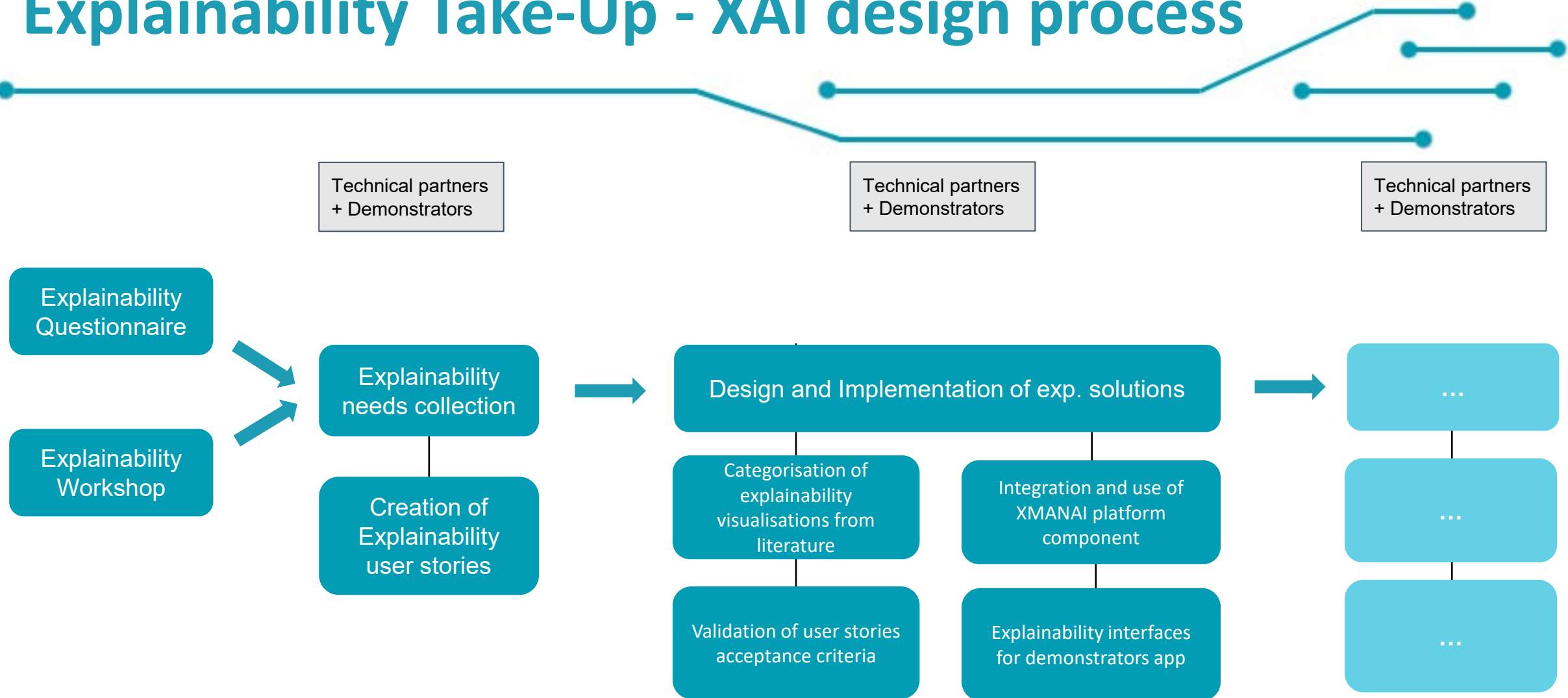


# Project Status

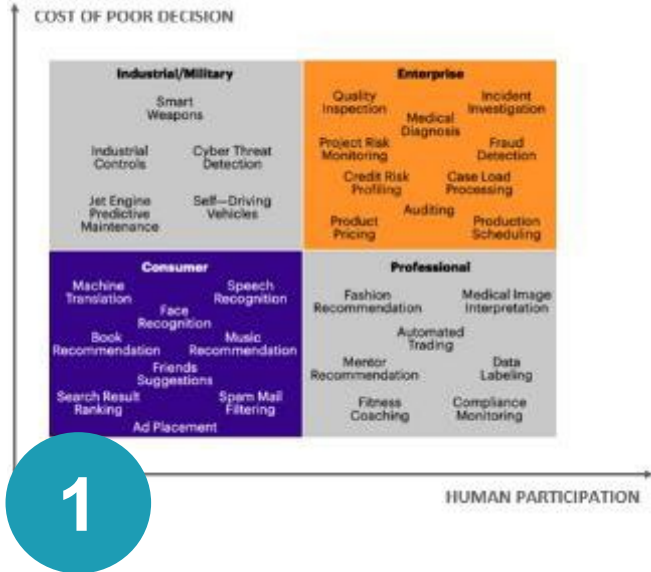
**XMANAI** is now at M35 out of a duration of M42. The project is now in the middle of the second project iteration.

Activity	1 <sup>st</sup> Iteration	2 <sup>nd</sup> Iteration
Project Requirements	Concluded	Concluded
Platform Components Development and XAI algorithms	Concluded	Concluded
Integrated Platform Delivery	Concluded	Ongoing
Demonstrator Assessment	Concluded	To be done

# Explainability Take-Up - XAI design process

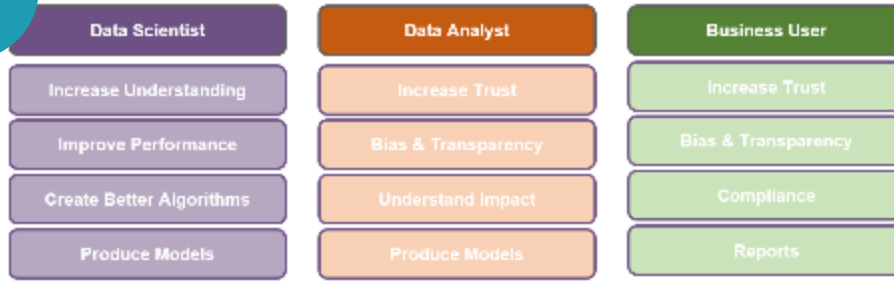


# Explainability Questionnaire

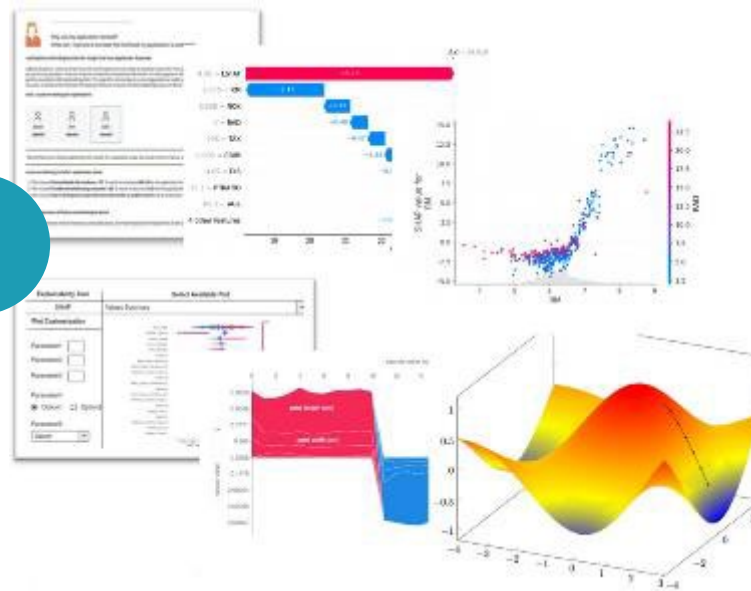


1

2



4



3

Business Requirement Description	Select your Business User Story for your UCs
XMANAI shall show direct and visual alarms to alert about critical situations	
XMANAI should allow an operator to understand the root causes in every working situation	
XMANAI should provide advices in terms of production plan	
XMANAI should provide measurements of the deviation between the predicted plan and the real production.	
XMANAI should allow a central planner to have a correct forecasting of D2C	
XMANAI should provide an interactable HMI able to improve the comprehension of the suggestion provided by the XAI and to navigate them.	
XMANAI should support the Blue Collar Worker is doing the maintenance/troubleshooting procedures with AR/XAI connection.	
XMANAI should provide product quality risks starting from production parameters including explanation of why certain conditions happened or are forecasted to happen.	
XMANAI shall be able to provide information to detect easily the sources of problems.	
XMANAI shall be able to analyze and communicate results	
XMANAI shall create predefined measurement routines and explain why they are the correct ones.	
XMANAI shall perform improved visualizations of item annotations and value logic.	


# Explainability user journey – User Stories

User journeys and analysis of XAI needs

**user stories:** Synthesis from demonstrators use cases, questionnaires and user journeys

**Explainability output and visualization**  
Classification and categorisation of explainability visualisations from literature and matching of user stories requirements

Phase of journey	Assessment of the user's journey (XAI needs)	XAI usage (in XAI applications)	How the user (the user) for the XAI application will contribute to user's (what) needs: do we have those needs?
Actions What does the user do?	[Icons]	[Icons]	[Icons]
Touchpoint What opportunities did the user have?	[Icons]	[Icons]	[Icons]
User Thought What is the user's thought in the different use cases?	[Icons]	[Icons]	[Icons]
Process Who does a process in the process / which are their responsibilities?	[Icons]	[Icons]	[Icons]
Process ownership Who is in charge of this?	[Icons]	[Icons]	[Icons]
Opportunities	[Icons]	[Icons]	[Icons]

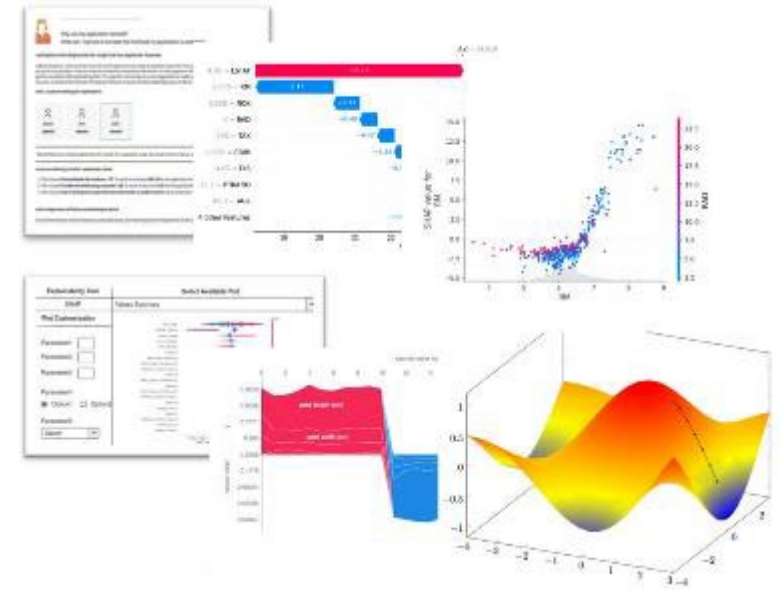
  
**OPERATOR**  
**3. Monitor Production**

As an operator  
**I want to** check the state of the machine and report to the system whether the problem has been solved  
**So that** better feedback can be provided for future predictions.

Acceptance Criteria

1. The interface collects troubleshooting feedback regarding the results of the procedure
2. Based on the results and the procedure applied, the interface provides further steps or not

2. PRODUCTION CONTROL



# Take Away Messages



- XMANAI is 100% focused on **XAI development and take-up** in **manufacturing** enterprises to transform the AI black box in a glass box providing trust on AI
- First project Iteration completed delivering a **novel platform, XAI models** and **XAI take-up and evaluation** by four demonstrator
- Second project Iteration is ongoing and will close in the first semester of 2024
- **Explainability take-up by demonstrators** has been challenging and required to create a methodological process starting from XAI awareness/understanding to the actual technology take-up in processes

# Thank you for your attention!

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