D8.7

OPTIMAI commercialization and exploitation strategy – 2nd version

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OPTIMAI

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V0.2	06/05/2022	Final ToC	ENG
V0.3	18/05/2022	KERs and Individual Exploitation plans updates, new questionnaire for Values and Exploitation strategy	All partners
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	TELEVES SA	Spain	**TVES**
	MICROCHIP TECHNOLOGY CALDICOT LIMITED	United Kingdom	**MTCL**

LIST OF ABBREVIATIONS

Abbreviation	Definition
AI	Artificial Intelligence
API	Application Programming Interface
AQ	Autonomous Quality
AR	Augmented Reality
ARM	Advanced RISC Machines
BSI	British Standards Institution
B2B	Business to Business
C&D	Communication and Dissemination
CBA	Cost Benefit Analysis
CNN	Convolutional Neural Network
CV	Computer Vision
DID	Decentralized Digital Identity
DIDA	Digital Industries Data Analytics
DLT	Distributed Ledger Technologies
DoA	Description of Action
DSS	Decision Support System
EA	Exploitation Agreement
EC	European Commission
E2E	End to End
FPGA	Field-Programmable Gate Array
FTO	Freedom-to-Operate
GUI	Graphical User Interface
HCI	Human-Computer Interfaces
KER	Key Exploitable Result
ICT	Information Communication Technology
IIRA	Industrial Internet Reference Architecture
IoT	Internet of Things
IP	Internet Protocol
IPR	Intellectual Property Rights

ISO	International Organization for Standardization
IST	Information Sciences and Technology
KER	Key Exploitable Result
LoD	Level of Detail
LSTM	Long Short Term Memory
ML	Machine Learning
MQTT	Message Queuing Telemetry Transport
NA	Not Available
NDA	Non-Disclosure Agreements
NESSI	Networked European Software and Service Initiative
OPC UA	Open Platform Communications United Architecture
PCB	Printed Circuit Board
PMI	Project Management Institute
PPDR	Public Protection and Disaster Relief
QC	Quality Control
QIF	Quality Information Framework
RA	Reference Architecture
RAMI	Reference Architectural Model Industry
R&D	Research and Development
RFID	Radio Frequency Identification
ROI	Return on Investments
SWOT	Strengths, Weaknesses, Opportunities and Threats
TBD	To Be Defined
TCP	Transmission Control Protocol
TRL	Technology Readiness Level
UC	Use Case
UI	User Interface
UX	User eXperience
VPC	Value Proposition Canvas
ZDM	Zero Defect Manufacturing

Executive Summary

D8.7, OPTIMAI commercialization and exploitation strategy – 2nd version, updates the content of previous deliverable D8.6 under the light of the needs and decisions that have been taken by the Consortium in the progress of the technological solution. Being at the middle of the project (M18) the OPTIMAI solution has been shaped and each partner has a clearer idea of the results that can be expected at the end of the project. For this reason, the exploitable results have been updated, merged or added, as well as the individual exploitation plans have been consolidated. The Exploitation Strategy at Consortium Level and the Exploitation roadmap here presented have been depicted considering the outcomes of the market analysis and the needs of the stakeholders, as well as the intentions of the OPTIMAI partners.

The IPR Assessment has been undertaken in order to guide partners over possible exploitation strategies, as well a study on possible Standardization activities has been conducted in order to consolidate the OPTIMAI solution and make it living also after the end of the project.

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1 Introduction

1.1 Deliverable Structure

The goal of this document is to present a detailed plan for all exploitation activities that will be scheduled for the second reporting period of the OPTIMAI project. Also, this deliverable reports on all the activities performed by the OPTIMAI partners during the first 18 months of the project as reported in the following sections. The activities, and the current deliverable, follow up on the OPTIMAI Exploitation strategy as well as the individual/clustered exploitation plans (including all the necessary activities to maximise the project's impact) discussed in the deliverable *D8.6 - OPTIMAI commercialization and exploitation strategy – 1st version* and *D8.10 - Report in Market analysis and segmentation – 1st version*, both delivered at M12.

Apart from the Introduction and the Conclusion, the document hosts:

- **Section 2**, the work performed within the context of T8.6 led by ENG, with all partners' contributions: the methodologies followed to identify and describe the OPTIMAI KERs (*Key Exploitable Results*) and the Individual Exploitation Plans are presented. Moreover, the Exploitation Strategy and Roadmap are depicted, including a potential business model, (also resulting from the participatory design activities carried out at the Consortium level) as well as an early business plan taking into account also the sustainability issues of the platform after the end of the project (at this stage mainly in terms of value proposition, positioning, costs, and ROI). These latter will be finalised during the second reporting period and discussed in the final deliverable for the work-package 8 (*D8.8 - OPTIMAI commercialization and exploitation strategy – 3rd version*, due on month 36) that will incorporate the definition of commercial and non-commercial exploitation business models, further evaluated and validated in the OPTIMAI demonstrators.
- **Section 3**, refers to the activities undertaken under *Task 8.5 - Knowledge management and IPR protection* led by UNIMET, detailing the methodologies followed for the IPR Assessment, and presenting the plan for the second part of the project. This connection is important as the proper management of the project KERs exploitation has to take into account the management of the IPRs of all contributing partners. In particular, the IPR management will be carried out throughout the project and will evolve in conjunction with the finalisation of the KERs.
- OPTIMAI's exploitation strategy also includes interaction with standardization bodies, in order to have a wide acceptance of the proposed technology and solutions by the industrial domain. Towards this end, **Section 4** presents the standardization activities of *Task 8.3 - Standardization activities* led by EVT: a detailed description of the industrial and technical standards that are applied in OPTIMAI, as well as possible new standards that can be generated by the Project are introduced.

1.2 OPTIMAI Solution

OPTIMAI intends to develop an industry environment that will optimize production, reducing production line scrap and production time, as well as improving the quality of the products through the use of a variety of technological solutions, such as **Smart Instrumentation of sensors network** at the shop floor, **Metrology**, **Artificial Intelligence (AI)**, **Digital Twins**, **Blockchain**, and **Decision Support** via **Augmented Reality (AR)** interfaces.

Regarding the **multimodal sensory network** for quality control, the sensors' integration has started for the OPTIMAI production lines. Indicatively, the installation of a camera sensor and actuation device has been successful for KLEE whereas TVES is integrating a laser sensor in their production line. The needs of each pilot site regarding the specific sensors and the generated data have been defined. The ethical and legal aspects have been considered, as well as installation limitations and possibilities per shop floor and production line particularities. Based on the needs, the installation of more metrology sensors (laser sensors, industrial cameras, and machinery sensors (temperature, vibrations etc.), is in progress.

A **middleware layer** is one of the core components of the OPTIMAI system, that will coordinate sensorial data under a common framework, allowing for the collection of timestamped, registered, and semantically fused data as well as two-way communication for actuation and data collecting. The OPTIMAI middleware instance has been deployed and the FINoT platform API documentation has been circulated to technical partners that can now execute API calls for authentication, objects management, historical data retrieval and subscription management. A cybersecurity module is embedded in the middleware, protecting each industrial network from cyber-threats.

The **Blockchain API** is being developed to enable traceability and validation of any data transaction within the OPTIMAI System regarding measurements data collection, requests for machinery reconfiguration or health check. The critical data that will be stored in the block-chain have been defined for each use case in the pilots' sites. Additionally, smart contracts have been created for certain defect types, e.g., cracks detected on the TVES antennas.

A series of AI approaches for zero defect manufacturing have been developed that will feed the different OPTIMAI modules. **AI techniques** have been developed for defect detection, the analysis of multisensorial quality inspection data and the identification of faults' causes upstream in the production process. Among others, a **defect detection** methodology has been developed that allows to transfer laboratory accuracy in the shop floor in a cost-effective manner. This method has been successfully tested in the lab for MTCL PCBs, and is intended to be tested in real shop floor conditions by the end-users. This methodology will be replicated in the other pilot sites. Regarding **defect prediction**, different prediction models have been developed and tested in the lab to identify probable defects or mechanic faults based on historical data (Persistence, Arima, LSTM, LSTM - normalised) whereas a simulation method based on finite elements is under development.

Digital twinning is in progress for the virtualization and simulation of the production process including sensors and manufactured parts, to enable undisruptive and optimized production

planning. The Virtual Components software licenses have been created and used by the consortium to build the production lines' digital twins. The TVES digital twin has been completed and is intended to be connected with the production line sensors network. AI deep models will be used to automatically pinpoint anomalies on sensory signals regarding defects on manufactured products or defective operation of production equipment.

Finally, the context-aware **AR environment** is being developed with a human-centred approach to support optimised decision making for shop floor operators. Human-Computer Interfaces (HCI) are being developed based on Computer Vision (CV) methods and AI to understand operator intents. With respect to **computer vision** techniques, the instance segmentation AI model has been developed and applied in the lab for objects of interest from all pilot sites e.g. TVES antennas, MTCL PCBs and Wafer, KLEE valve block. Pose estimation and gesture recognition are in progress to identify the operator intents based on gestures vocabulary which has been defined for all pilots' sites. Additionally, in order to detect the objects of interest in video frames, tracking algorithms have been developed. Synthetic datasets extraction is in progress to enable the method of few shots learning for the AI models. AI models will provide overlay information and concrete actions for industrial optimization on AR glasses for the operator to quickly proceed with actuation or reconfiguration of production parameters. The information and the user scenarios have been defined through dedicated workshops among technical partners and end-users, where initial wireframes and mock ups have been designed and validated by the end-users. More iterations will follow to meet the emerging needs.

A **Decision Support System (DSS) and early notification** web interface is being developed for pc and tablet users. This system will support operators in decision making by providing timely notification to the appropriate operator and device, based on the current context. The functionalities will support decision making on the fly by providing a) instant recommendations to the operators for manual action controls in the production line, and b) context-related notifications for automations that have been executed. Additionally, the system will support time consuming decisions by providing visual data analysis for real time production line monitoring and for detected defects (historical data) that can support operators to identify measurement and defects patterns though time. DSS will also send related information to the AR environment to allow instant reaction by the operators.

Finally, an **intelligent marketplace** is being developed for profiling, indexing, and repurposing scrap materials and defected parts which will be directly available to the markets. The marketplace also will allow users to exchange AI models for quality inspection.

To better frame the overall updated OPTIMAI solution, the System Architecture (coming from *D2.5 - The OPTIMAI architecture specifications*) is reported below.

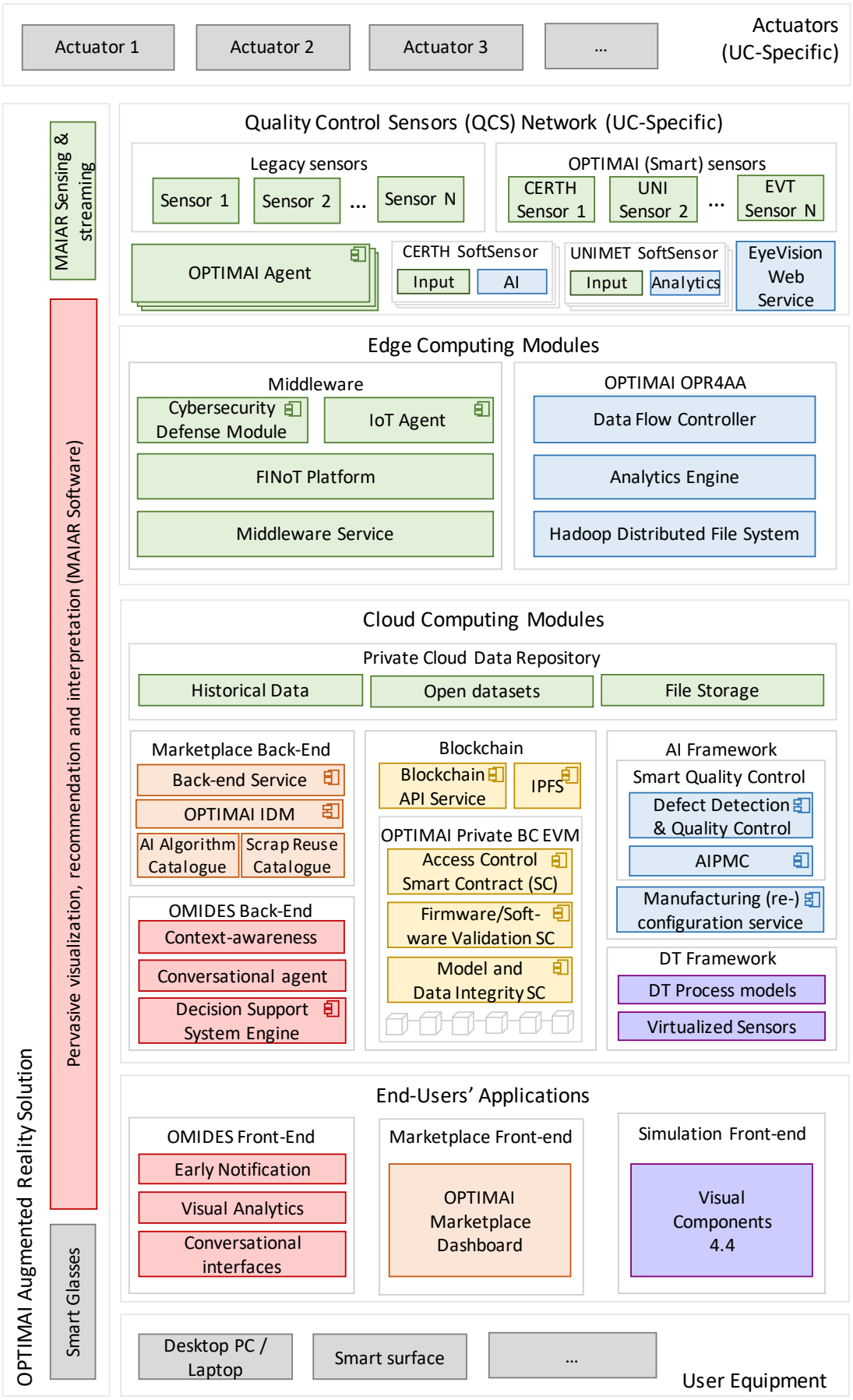

Figure 1-1: OPTIMAI System Reference Architecture (from D2.5)

1.3 Lesson Learnt from Market Analysis

The cooperation between *Task 8.4 - Market analysis and segmentation* and *Task 8.6 - Exploitation plan and roadmap to market* is crucial for the success of the whole Project, since the first one provides the know-how needed to get an appropriate Exploitation Strategy and Plan, ensuring that the developed solution will address the challenges of the specific market. Moreover, it is very important to understand who the competitors are, how they operate, what are their business and revenue models. By fulfilling the above gaps, OPTIMAI Consortium will be able to conduct and calculate an initial approach of the pricing policy of the final offered solution that will be reported in the final version of *T8.6* deliverable.

A preliminary analysis of OPTIMAI market has been conducted as part of *D8.10 - Report in Market analysis and segmentation – 1st version* (M12). The deliverable presents the market, its segments and potentials for the final offering, as well as the methodology and initial approaches that are required to conduct and calculate a Cost Benefit Analysis (CBA).

AI in Smart Manufacturing Market can be segmented on the basis of components, technology, and applications[1]. The segmentation that seems more promising in terms of Exploitation is the one that splits the possible scenarios depending on the application. Among the applications listed in *D8.10*[2], those that have a high relevance within OPTIMAI are reported in Table 1.3-1, with an indication with respect to their translation within OPTIMAI, both in terms of technology and in terms of Use Case.

Use Cases considered as a reference here, are the three formalised in DoA and then reported and deep-dived in *D2.6 - OPTIMAI use cases definition,* i.e.:

1 *Use Case 1 – Zero defect quality inspection*
This use case focuses on detecting defects, analysing their causes and predicting emerging deficiencies.
2 *Use Case 2 – Production line set-up/calibration*
This use case develops an automated quality control loop between inspection and machine setup and builds a context aware interaction environment for operator and production equipment.
3 *Use Case 3 – Production planning*
The third use case targets the virtualization of the production line that will enable low-cost, less time consuming and efficient production planning.

[1] From *D8.10 - Report in Market analysis and segmentation – 1st version* Paragraph 2.4.1

[2] Full list of AI applications in Smart Manufacturing (from *D8.10, Paragraph 2.4.1.3*): Predictive Maintenance & Machinery Inspection, Quality Management, Asset Tracking and Management, Supply Chain Optimization, Real-Time Workforce Tracking and Management, Industrial Robot / Robotics & Factory Automation, Production Planning, Material Handling, Field Services, Safety Planning, Cybersecurity, Energy management, Emergency and Incident Management, Business Process Optimization, Business Communication

It is important to evidence that the following table reports only the applications that more fit with the project demonstrators, keeping out of this analysis the enabler technologies that, despite being present in OPTIMAI solution, are not validated in any of the use cases.

Table 1.3-1: OPTIMAI features and Use Cases mapped over AI application Market segments identified

Application	OPTIMAI Feature and Reference Use Cases
Predictive Maintenance & Machinery Inspection	Use case of reference: **Use case 2.** **Decision Support Framework for Timely Notifications**: OPTIMAI will develop and deploy an integrated decision support framework that is connected to AI-based solutions, allowing stakeholders to be informed about the current problematic situation and act accordingly regarding the inspection actions that need to be taken to address the problems. Moreover, forecasting capabilities help preventing future problems, including better planning of maintenance activities. **Digital Twinning** of manufacturing processes will be able to operate as a virtual prediction function orchestrator to deliver customised cognitive and predictive (fault detection, identification, and forecasting) services. The **Augmented Reality framework** will also be used to superimpose found defects or malfunctions on top of parts or equipment, allowing human operators to rearrange the equipment and make a more informed scraping, maintenance, and production planning decisions.
Quality Management	Use case of reference: **Use case 1.** OPTIMAI adheres to EU and international Industry 4.0 norms and guidelines [1, 2], focusing on quality control methodologies, as it aims to improve smart manufacturing efficiency through automation and boost the sector's growth in Europe and beyond. The **Quality Control Sensor Network** is a multimodal sensory network with edge-processing capabilities for improved acquisition and pre-processing to support in real-time the operators for decision making and the production line via re-configuration of the machinery parameters to optimise production and increase the quality of manufactured products. This network comprises a variety of sensors for quality control and production monitoring. Metrology sensors, such as laser sensors, industrial cameras, electronic microscopes, and ultrasonic probes, will be used in conjunction with machine sensors to monitor typical production characteristics (e.g., power, temperature, vibration etc.). Depending on the specifics of each pilot, different combinations of sensors will be deployed for each end user. OPTIMAI focuses on the deployment of complementary sensors to provide a complete picture of all quality-critical production phases. Finally, **Digital Twin for Simulation and Forecasting,** AI will be trained using production equipment configuration parameters and registered (time-stamped) quality control procedures. These pairs of production parameters and quality control outcomes will be utilized to develop a cause-and-effect map that will be connected with digital twins and AI.

Production Planning	Use case of reference: **Use case 3.** The production Planning application is enabled by **digital twinning Twin for Simulation and Forecasting.** The virtual twin will hold all relevant data for a manufacturing process and, when combined with AI prediction models, will provide a simulation testbed for production planning. By delivering technological solutions that enable enterprises to support high variability production and readily react to rapidly changing production orders, OPTIMAI will cut ramp-up time. This will be accomplished through production virtualization, which will allow for rapid testing and validation of new product types, as well as (semi)-automated equipment (re)configuration methods based on AI, AR, and CV. Any re-calibration that may be required in early production will be automated in real-time via quality control feedback or considerably accelerated by OPTIMAI's context aware AR framework, which will allow human operators to quickly modify a machine's configuration. OPTIMAI will boost productivity by detecting flaws in real time and taking corrective action in real time, limiting the negative impact of malfunctions and defects.
Material Handling	Use case of reference: **Use case 3.** Keen on sustainability and efficiency in terms of material handling (also considering the shortage of some components due to pandemic COVID-19) is guaranteed by the **Intelligent Marketplace for (AI sharing) and scrap re-use. The Marketplace will have a section** where all damaged parts will be indexed and so can be easily consulted to re-use these scraps for various purposes like R&D testing, machine refurbishment or reconditioning. The marketplace will keep track of a defective part's whole profile and will allow users to search for it using both text and 3D similarities.
Business Process Optimization	Use case of reference: **Use case 3.** The overall scope of the OPTIMAI solution is the Business Process Optimization as a whole. OPTIMAI aspires to significantly affect industrial production, facilitating businesses to improve their competitiveness and increase their market share, with increased quality of products, through the early detection of defective manufacturing parts and the prediction of defective manufacturing processes, and their in-time mitigation via quick re-configuration of machinery. Additionally, OPTIMAI will allow businesses to quickly respond to market needs, providing quick prototyping and efficient production planning when introducing a new type of product manufacturing in the production line, through digital twins and simulation. Furthermore, OPTIMAI will increase profit margins for businesses, due to the optimization of production in terms of time and cost (increased capacity of the production line, optimized planning and simulation tested parameters transferred to the real production line, reduced production time, reduce re-configuration time with AR HCI) and resources management (reduced scraped manufacturing parts & materials via defective products reduction, re-use of scrap).

The present mapping, as well as the overall Business Strategy and Plan that will be described in the next section, are intended to be a valid baseline for the second version of the Market Analysis, *D8.11 - Report in Market analysis and segmentation – 2nd version* (M24).

2 Exploitation Strategy

In this section, an updated view of the commercialisation and (individual and joint) exploitation strategy, as well as the exploitation roadmap, are presented in line with the project evolution in month 18. The strategy, which follows on the initial one defined at M6, will be finalised by M36 and incorporates key strategic features to exploit OPTIMAI as well as some important business strategy elements (typically found in a business plan) which are already important to define (e.g. value proposition) and include some business shaping analyses such as Value Proposition Canvas (VPC) and Business Model Canvas, while other typical analysis (SWOT, competition matrix etc.) will be conducted in the second half of the project.

The OPTIMAI exploitation strategy builds on the project's key assets (KERs) presented in Section 2.2 and the two main pillars of the strategy are:

1 **Joint exploitation of the project results in the scope of the OPTIMAI ecosystem**: as described in Section 2.4, the OPTIMAI partners will engage in joint exploitation activities within the project's(business) ecosystem. These activities will include the provision of technical support and services, business support, training and other consulting services to stakeholders' enterprises making use of the project platform and tools.

2 **Partners' individual exploitation plans**: as detailed in Section 2.3, partners are already involved in business and/or research activities in manufacturing and/or AI and ICT. OPTIMAI is enabling them to strengthen and expand these activities, enhancing their existing products and service portfolios as well as enabling them to acquire greater market shares. All partners were requested to update their initial plans.

2.1 Exploitation Methodology

The OPTIMAI Exploitation activities aim at transforming the project's outcomes into exploitable assets to answer the needs of target market segments and to prepare for market entry in the European manufacturing industry. The overall exploitation strategy and objectives are summarised in the figure below and have been conceived to be aligned with the project Work Plan, phases and delivery of results.

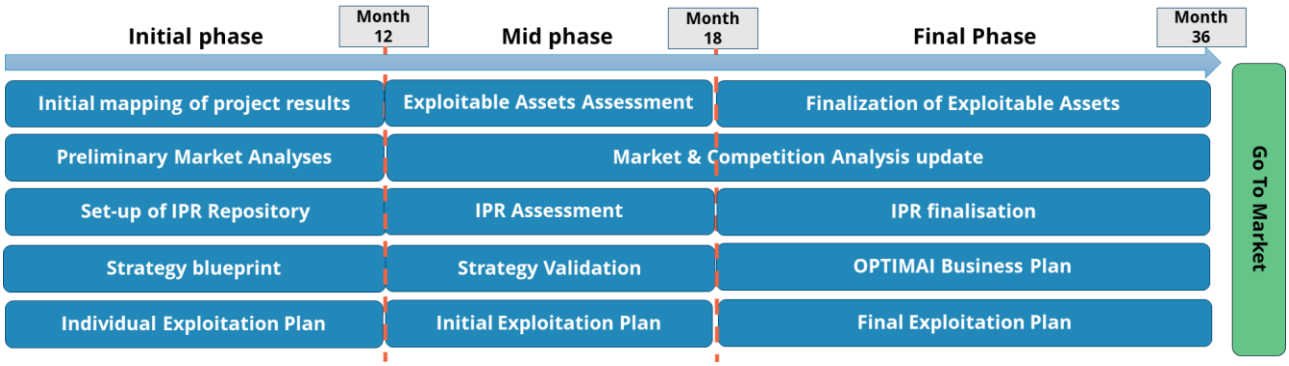

Figure 2-1 – OPTIMAI Exploitation Strategy

2.1.1 Initial Phase

The methodology applied in the Initial phase (M1 to M12) and its outcomes have been reported in *D8.6 - OPTIMAI commercialization and exploitation strategy – 1st version*. It included an initial results' definition for OPTIMAI KERs (Key Exploitable Results) and the set-up of the structures (Key Exploitable Results Repository) to be used during the project lifecycle. As well, in D8.6 each partner's Individual Exploitation commitments and intentions were drafted.

2.1.2 Mid Phase

During the **Mid Phase** (running from M13 to M18), the KERs Repository has been maintained, apart from the previously shared template (available in D8.6 and for convenience reported in Annex I - KERs Repository Template, new information about Identified Risks (for the successful exploitation of the described KER) has been requested (see sub-paragraphs of 2.2 for KERs updates).

Furthermore, during the Mid Phase each KER owner has been requested to answer the following questions, in order to highlight the Business Value of the asset, its Innovative potential and Customer Value. The idea is to get as many insights as possible for each KER in order to set the path for a concrete Exploitation strategy and Plan. The list of questions follows:

Business Value:

- Which is the target market segment?
- What problem or challenge do you try to solve with your solution?
- How is your product different from others on the market and why that solution should be chosen among others?
- How will you measure the delivery of business value?
- Provide a score from 1 to 5 (where 1 is low and 5 is high) for each of the following benefits:
  - Reducing costs
  - Minimizing risk
  - Ensuring customer/stakeholder satisfaction
  - Providing innovation
  - Shorten delivery time
  - Decreasing complexity
  - Increasing quality

Innovation Value:

- What is the new element of the solution that distinguishes it from the state of the art?
- With respect to the graph below where would you place your solution?

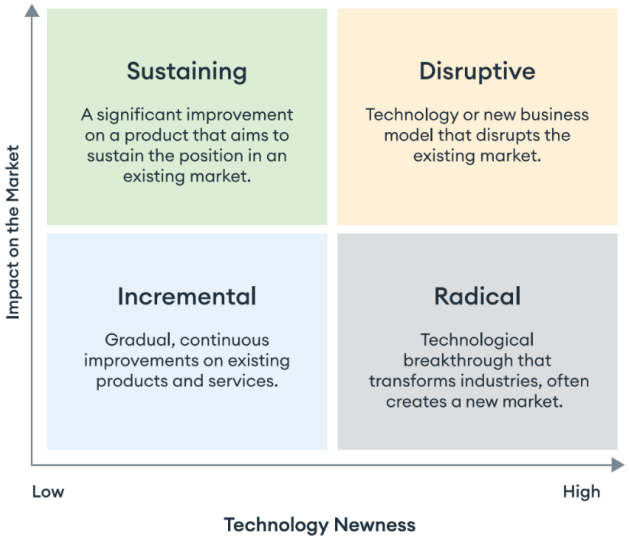

Figure 2-2: KER positioning over Innovation Matrix [3]

Customer Value:

- Who is the direct beneficiary of the solution?
- From the end-user perspective, why the solution should be chosen? What are the exact benefits of user value worth considering to deliver?

Finally, among the activities run during mid-phase, an IPR assessment through the analysis of exploitable results per partners and their IPR related plans for the end of the project has been executed. The analysis is presented in the Section 3 of this document.

2.1.3 Final Phase

In the **Final exploitation phase** (M19 to M36, to be reported in *D8.8*), a Business Plan for OPTIMAI will be crafted. The Assets and their Value propositions will be updated both to follow the project results' evolution and to match the results of the demonstrators, in order to ensure the business mission and propositions are aligned to actual user needs. In this phase, the product positioning will be consolidated.

A post-project phase is also foreseen and will start after the end of the project implementation, featuring the actual commercialization roadmap and activities for OPTIMAI based on the Exploitation Plan defined in the previous phases.

2.2 Updates on Key Exploitable Results

To ensure better and more complete exploitation of the OPTIMAI solution's possibilities, the total solution was divided into different Key Exploitable Results. This subdivision will allow the partners to better position the products/services in the market, according to market trends, selling points, and market size. The organization of partners and their participation in the Exploitation will also vary between different KERs, according to different areas of action or expertise. The individual exploitation of the KERs will permit a more accurate and adequate exploration of their unique selling points and characteristics. The exploitation model will, then,

be organized in order to take into account the role of each partner, the delivery and deployment model, the licensing policy, and the pricing and revenues distribution policy for each KER.

The KERs collected in KERs Repository and presented in next sub-paragraphs, can be grouped into 3 major categories:

- Sellable KERs: they comprehend all solutions (hardware/software) that have been designed within the project and can generate earnings for the owner (co-owners). They are described from paragraph 2.2.1 to paragraph 2.2.15 included. They are reported as per their positioning with respect to the OPTIMAI Reference Architecture.
- Un-(directly)-sellable KERs: including models developed and know-how/expertise gained thanks to the project. They are not directly generating an economic worth, but their ownership will lead to an advantage on the specifics of the KER. They are listed from 2.2.16 to 2.2.21 included. For these KERs the Business/Innovation/Customer Values questions (as described in Mid Phase) are not always applicable.
- Demonstrator KERs: the value generated by the three project Demonstrators through the use cases developed during the 36M of OPTIMAI are reported from paragraph 2.2.22 to paragraph 2.2.24.

2.2.1 Integrated OPTIMAI platform

Description	Within the OPTIMAI platform several technological tools will be developed and integrated forming the OPTIMAI-Zero Defect Manufacturing solution consisting of all technological components for data acquisition, AI analysis, quality control, virtualization, decision support, and human machine interaction
Lead Partner	CERTH
Contributing Partners	All Partners
Relevant WPs	WP3, WP4, WP5, WP6
Relevant Deliverables (if any)	D6.3 (M35), D6.4 (M35)
Completeness (%)	35%
Expected Delivery Date	
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-users
Foreseen IPR strategy (if any)	Copyrighted
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights will be given under previous agreement between parties involved.
Individual or joint exploitation	As this refers to the entire OPTIMAI framework co-developed by all project partners, it is a joint exploitable result
Identified Risks	The operation of the platform is dependent from various sub-components, hence its performance is strongly affected by the individual software efficiency.

Business Value

The integrated OPTIMAI solution is intended to be used by several manufacturing industries such as automotive, airspace and electronics. The challenge is the development of one platform that on one hand integrates all the subcomponents that consist of the OPTIMAI project, including AR/VR, Blockchain, AI models, metrology and 3D scanning tools, decision support systems, on the other is flexible to potential customer needs.

The main goals of the Integrated OPTIMAI platform are customer satisfaction and an enhanced quality of the products.

Innovation Value

The key innovation within the OPTIMAI project is the on the edge integration of common manufacturing sensors in order to dynamically control acquisition parameters increasing that way the inspection modules leading to zero defect manufacturing. All of the real time collected data will be integrated into one platform that will analyse them, increasing that way the efficiency of the manufacturing procedures.

Customer Value

The beneficiaries of the suggested solution are Industry 4.0 actors, as well as the owners of manufacturing production lines. Concerning the end-users, the OPTIMAI solution will provide state of the art technological tools and sensors that are able to increase the performance of the applied manufacturing process.

2.2.2 Industrial vision sensors with AI-processing and seamless process integration

Description	Components for sensors (main focus: image processing) with integrated image analysis software and a large list of state-of-the-art communication interfaces and AI Hardware support.
Lead Partner	EVT
Contributing Partners	EVT (possible contributors: TVES, KLEE, FINT)
Relevant WPs	WP3
Relevant Deliverables (if any)	D3.1(M16), D3.2(M30)
Completeness (%)	35%
Expected Delivery Date	End of project (Continuous integration of results into products)
Type	Hardware/Software
Expected TRL by end of the project	TRL 7
Link (if applicable)	https://www.evt-web.com/en/products/
Target stakeholders	End users, Customer base of EVT
Foreseen IPR strategy (if any)	Patents
Sole owner or co-ownership	EVT will be sole owner
FTO - Freedom-to-Operate"	Access right will be given under agreement.
Individual or joint exploitation	Individual exploiting strategy.
Identified Risks	Shortage of semiconductor

Business Value

The target stakeholders of the “Industrial vision sensors with AI-processing and seamless process integration” comprehend all markets that benefit from industrial and non-industrial

vision, mainly machine building, automotive, consumer electronics, aerospace, logistics, pharma, food and beverage. The major challenge is the implementation of the algorithms to embedded systems, in order to maximize the efficiency, the process stability and the price with respect to the shortage of semiconductor.

EVT's aim is to always exploit research into working solutions: this is an iterative process, so further internal research will continue after the end of the project. Anyway, most of the work invested in OPTIMAI will be available in EVT's products after the project.

EVT's software EyeVision integrates a lot of image acquisition devices, 3D, 2D, 1D but also Thermal and Multi and Hyper-spectral cameras. The software runs on different platforms and provides a large range of algorithms for image processing and analysis. Including the results of the OPTIMAI project, such as Deep Learning algorithms and integration into state-of-the art middleware, our customers benefit from a scalable image processing platform that can be fully integrated into their factory.

EVT is monitoring their production and marketing/sales activities actively. Benefits like cost reduction, delivery time and risk minimization are reviewed in regularly development meetings. Customer and stakeholder satisfaction is monitored by an active customer service, including talks about requirements and their satisfaction as well as surveys. Sales and Support are in contact with the customer base to assure that the complex products can be controlled easily by unexperienced users. EVT is active member in different standardisation organizations, innovation is one of the company's aims.

Innovation Value

The solution mainly combines a lot of innovative technologies in one product: starting with easy process integration based on low cabling effort, a user-friendly comprehensive configuration based on an easy to use GUI, the sensors can be integrated directly into the field.

Deep learning algorithms, power full 3D analysis, innovative data structures enable even a lay men to use the software for their solution. The new communication protocols allow the sensors to be integrated into any segment of the customer's factory.

EVT's solutions can be placed in the "Sustaining and Incremental" areas in the graph.

Customer Value

The direct beneficiary of the solution is customer base of EVT (in different fields), as indirect beneficiary could be other technical partners in the project. The sensors that are being developed during the Project combine state-of-the art image processing and AI support with a seamless process integration.

EVT is developing tools to simplify the annotation and training of CNN based deep neural networks, the tools are directly integrated into the sensors.

EVT implements and simplifies the use of state-of-the-art communication protocols and makes them easily applicable from the software.

Development and improvement of the industrial Vision interfaces into the sensors allow to use the sensors of EVT as a source of images for external software, even with integrated pre-processing or image analysis if required.

2.2.3 Egocentric, adaptive AR recommendation and visualization (E2E software solution)

Description	(Includes the previous KERs for *AR Visualisation Framework*; *Manufacturing reconfiguration autonomous agent*; *GUI Toolkit*; *Decision maker for adaptive context-aware interactive AR, Recommender system for operations at the shop floor*) and [background] adaptive Decision Making for leveraging the effectiveness of visualized information. This software solution will utilise the OPTIMAI architecture and will implement a ubiquitous AR decision-support solution tailored for the manufacturing environment. This solution will utilise an egocentric vision for predicting potential defects in the manufacturing line and assist workers in what steps to take to prevent them. It will link to a proprietary, Unity-based rendering environment (thus targeting both ARM and other hardware architectures) for displaying important information to manufacturing operators, related to the quality level of production. It will support gesture-based interaction, provided via interdependent Unity scriptable components, with augmented/holographic user interfaces displayed on smart glasses hardware, with the purpose of re-adjusting industrial equipment parameters on-the-fly. Furthermore, an ML-based agent for recommending the appropriate activities to the operators, when possible, towards adjusting the manufacturing pipeline for avoiding product defects will also be supported. User interface elements, such as widgets and Unity scriptable components will further extend native functionality with support for personalization, including low-level adaptability (e.g., change of widget colour and positioning) as well as high-level adaptability (e.g. customizable Level of Detail – LoD display about worker profile and situational context) based on Decision-Making support for adaptive Intelligent User Interfaces, which is also employed in the software solution.
Lead Partner	FORTH
Contributing Partners	CERTH; YBQ
Relevant WPs	WP5
Relevant Deliverables (if any)	D5.7 (M20); D5.3 (M22); D5.4 (M33); D5.8 (M33)
Completeness (%)	65%
Expected Delivery Date	31/08/2022 (first); 30/09/2023 (second)
Type	Software
Expected TRL by end of the project	TRL6-7
Link (if applicable)	N/A
Target stakeholders	Industry 4.0; Public Protection & Disaster Relief; Law Enforcement; Entertainment Industry

Foreseen IPR strategy (if any)	1. Document the concept and original content in detail in scientific publication(s); 2. Provide detailed drawings, descriptions, plans and records that prove the concept and work as intellectual property of FORTH; 3. Obtain non-disclosure agreements (NDAs) from partners.
Sole owner or co-ownership	Sole owner
FTO - Freedom-to-Operate"	Yes
Individual or joint exploitation	Individual
Identified Risks	The utility may be limited if the network environment in the target factory environment is insufficient to handle the necessary computations/connectivity transfers. Competing solution from other vendors.

Business Value

The solution can be exploited among different sectors, including manufacturing, public protection and disaster relief (PPDR), medical cultural creative, entertainment, etc. After the end of the project, the success of that KER will be measured through the stakeholders outside the project that will show an interest in the proposed solution. Further step would be needed with these stakeholders to analyse their requirements to generalize the proposed solution to fit various operational contexts.

The main objectives of the E2E software solution are provide innovation and minimise the risk to the stakeholders while decreasing the actual complexity in order to get customer satisfaction. Integration of IoT obtained signals for intelligent decision-making regarding visualisation based on AI analysis of the current wearer's state and context of use.

Innovation Value

The Innovation gained by the Egocentric, adaptive AR recommendation and visualization, express in sustaining current processes with wearable context-aware AR system fully integrated with the IoT environment, enabling intelligent decision support based on readings obtained from the real (visual), augmented (digital info) and ambient (IoT) environment.

Customer Value

Direct beneficiaries of the solution are Industry 4.0 actors, including use cases outside the scope of ZDM. The customer should choose the E2E software proposed, to get egocentric context-aware recommendations, personalisable AR user interfaces, greater situational/contextual awareness and more informed decision-making on the spot.

2.2.4 Computer vision module for AR

Description	This exploitable result will include computer vision techniques for understanding operator's intentions from contextual and motion analysis. To this end techniques for activity and gesture recognition will be developed for analysis ego-centric video from the camera on the AR glasses. In addition, to understand context algorithms

	for detecting particular objects of interest and separating them from the background, will be developed that will include production parts, tools or production equipment.
Lead Partner	CERTH
Contributing Partners	FORTH, UNIMET, YBQ
Relevant WPs	WP5,WP6
Relevant Deliverables (if any)	D5.1 (M20) D6.1 (M15) D6.2 (M30)
Completeness (%)	35%
Expected Delivery Date	
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-users
Foreseen IPR strategy (if any)	Service
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights will be given under previous agreement between parties involved.
Individual or joint exploitation	both independently and in conjunction with other components.
Identified RIsks	The time performance of the algorithms may be affected if the network conditions are deficient due to the large volume of computations.

Business value

Manufacturing industries, healthcare industries, supply chain industry, automotive, service and maintenance processes in factories are the target market segment. The solution of the computer vision module in the AR environment is a generic tool that can be adapted in a variety of production processes according to the role of the operator/corresponding actor. The challenge in this part is to increase the human-machine interaction in terms of speed and productivity. The use of smart glasses enables real – time access to necessary information about the machinery or products and the hands-free feature provides flexibility for workers while they are performing their tasks. Our computer vision algorithms are linked to state-of-the-art methodologies which aim to real-time performance with low computational cost. In addition, the techniques that are going to be developed can be applicable to any factory, despite the variety of the manufacturing processes.

After the end of the project, it is going to be analysed the stakeholders' requirements in order to make generic the proposed solution in a way that can be integrated in various operational contexts.

The delivery of business value will be measured through successful experiments on pilot sites during the project, the impact in the stakeholders from different factories (interested to integrate this module in their manufacturing process).

Innovation Value

The innovation of the computer vision module for AR is that Wearable AR system display the necessary information on real – time, as the corresponding algorithms provide real -time performance and employ state-of-the-art models in the area of computer vision.

The solution is placed on the "Sustaining" side of the graph (Figure 2-2), allowing an improvement compared to the state of the art in an existing market.

Customer Value

Workers/operators/technicians/engineers in the manufacturing processes in Industry 4.0.

The proposed solution increases the workers' productivity since they obtain real-time information in the AR glasses, even if their hands are occupied.

2.2.5 Middleware / Data Repository / Virtual Sensors and Actuators

Description	The Middleware or Distributed Data Management System is a software platform which provides a resources' virtualisation layer while providing a specific horizontal module that can handle all intra and inter communication protocols and procedures. This software module can be used to virtualize sensors and can enable the prediction and estimation of the sensor's future physical readings; these readings will be compared to the actual real values stemming from the physical counterpart sensors. The Middleware platform also provides secure interfaces between the various units, components, sensors and subsystems and it supports the network protocols required to exchange control and store data and information needed to facilitate operations and services in an environment with many different networking and system components. Moreover, the Middleware provide a universal API for handling the data exchange, hosts and executes the Data Fusion mechanisms and provides an administrative web console for visualisation of raw data that is coming from the various sensors and devices.
Lead Partner	FINT
Contributing Partners	FINT (possible contributors from: EVT, YBQ, ENG, UPV, UNIMET, KLEE, TVES, MSL)
Relevant WPs	WP3
Relevant Deliverables (if any)	D3.3 (M18) D3.4 (M30)
Completeness (%)	45%
Expected Delivery Date	2023-06-30
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	FINT
Foreseen IPR strategy (if any)	FINT hereby excludes from its obligation to grant Access Rights to all Background other than generated by research personnel involved in the project as well as to all Background other than explicitly needed for the project.
Sole owner or co-ownership	FINT

FTO - Freedom-to-Operate"	Specific background will be accessible royalty-free strictly on a need-to know basis and in the context of work plan as defined in the Grant Agreement
Individual or joint exploitation	It can be exploited both individually and jointly with other components and partners
Identified Risks	The final solution might not have or might not consider all needed interfaces for interconnection of the various sensors/machines limiting the overall possibilities

Business Value

The target market includes both governmental and private organisations that are required to analyse and evaluate all kind of data in order offer a better service, foresee and/or prevents events, improve production and/or support the environment. More specifically, smart factories, transportation, agriculture, energy supply networks and facilities, air quality monitoring and smart cities monitoring are the main segments that FINT is targeting.

The Middleware or Distributed Data Management System that is provided by FINT is a FIWARE-based software platform that has as main challenge to handle as a single software a multitude of heterogeneous data sources as well as different sensing equipment. Heterogeneity concerns several aspects, such as the nature, structure, source, and semantics of data. The target is to offer a software that can be the main component of a facility where the end user can integrate almost any sensor, 3rd party analytics or AI models, and management services.

The differences of the Distributed Data Management System is that it:

- Provides handling, fusion, storage, retrieval, and management services for any IoT data;
- Offers virtualization of objects, lists their attributes, displays raw data, displays last measured figures, calibrates sensors and devices;
- Provides an API for connectivity with 3rd party solutions and platforms;
- Provides integrated security features for data protection and integrity;
- Maintains historical data and analysis of measurements;
- Manages all connected devices;
- Generates notifications and alerts based on user defined thresholds;
- Is capable to incorporate blockchain and AI modules.

FINT is targeting to have a fully operational system at the end of OPTIMAI project. The target is to have a fully proven technical solution, however aspects concerning the business offering and possible commercial subscriptions schemas might not be ready and will need to be elaborated after the project completion.
The business value can be measures by the savings that the company/organisation can achieve by utilising the solution in its production line. Also, the capacity of new available information is another business value that can be measured.

Innovation Value

From a technical perspective FINT is working on different flavours of the solution, preparing alternative configurations for each targeted market, as different configuration and calibration thresholds of sensors are required for each of the market domains.

From a software perspective, the Distributed Data Management System is built in such a way that allows its usage in different market domains with very few modifications, whereas the dashboards and APIs need specific adaptations per domain.

Based on the graph (Figure 2-2: KER positioning over Innovation Matrix) the KER would be placed as Radical.

Customer Value

Possible end customers include factories of any size, train/metro operators, port authorities and marinas, farmers and cooperatives, municipalities, energy supply companies and photovoltaic/wind parks, hospitality, buildings/parks/parking operators and organisations that deals with environmental monitoring.

The Distributed Data Management System provides interoperability and support for a wide range of different interfaces while it can be provided in different flavours and configurations. The solution should be chosen because it can serve as an "all-in-one" platform allowing the end-user to use it as the main tool for the integration of its various sensors, data, and algorithms. The exact benefit of the user is the ability of new data insights, the overall robustness as well as the quality of service that can be experienced when utilising and exploiting such a platform.

2.2.6 AR Smart Glasses

Description	Smart Glasses for the Industrial environment, together with relevant software libraries
Lead Partner	YBQ
Contributing Partners	possible contributors from: CERTH, FORTH
Relevant WPs	WP5
Relevant Deliverables (if any)	D5.5 (M20), D5.6 (M30)
Completeness (%)	30%
Expected Delivery Date	30/06/2023
Type	Hardware/Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-User
Foreseen IPR strategy (if any)	
Sole owner or co-ownership	YBQ
FTO - Freedom-to-Operate"	Access rights to software libraries will be given under agreement. It will be exploited both individually and jointly with other partners.
Individual or joint exploitation	It will be exploited both individually and jointly with other partners
Identified Risks	NA

Business Value

The target segment is focused on manufacturing companies having production lines operating h24 7/7, where is crucial reducing or avoiding lines stops. Moreover, companies producing high value goods (i.e., aeronautics parts) or producing waste not easy to recycle are the main target of YBQ solution.

The difference of the product with competitors lies on the ability of defect detection thanks to pose estimation and tracking and to defect detection algorithms trained by Machine Learning algorithms. Further, cutting edge gesture recognition algorithms developed will facilitate the UX/UI with the device.

After the end of the project, further industrialization effort will be needed to achieve TRL9 and to fit the certifications needed to launch the product on the market.

Innovation Value

The innovation value is mainly focused on the ability of the device to allow:

a) accurate pose estimate and track the line operators' gestures in order to avoid risks and to optimise performances;
b) accurate defect detection thanks to train the detection system by real video dataset of operations using machine learning techniques running in the edge.

The solution is placed in the "sustaining" quadrant (see Figure 2-2: KER positioning over Innovation Matrix), allowing an improvement in detection and tracking features compared to the state of the art of wearable devices, in an existing market of quality assurance tools for production lines, that is expected to grow in the coming years.

Customer Value

Manufacturing companies are direct beneficiaries of the solution. From the manufacturer point of view, the benefits are:

a) a reduction of scrap in production;
b) a reduced time to detect and time to resolve in case of production line problems;
c) an increase of safety for the line operator.

From the end-user perspective, the solution will be chosen for:

a) the tailored ability to integrate alerts in the field of view with sensors on the line;
b) an increased level of safety thanks to pose estimation and tracking ability;
c) a lower learning curve of using AR smart glass thanks to a better UX for tailored hand gesture design.

2.2.7 Security middlebox

Description	The Security Middlebox facilitates the use of acceleration (FPGA or ARM based architecture) for detecting and analysing cybersecurity threats, for monitoring and managing the AI and cybersecurity algorithms and provides the communication/interfacing modules,

	that will enable the interaction with other external components (central logging server, software agents, etc.)
Lead Partner	FINT
Contributing Partners	FINT (possible contributors from: CERTH, EVT, YBQ, ENG, UPV, TRI)
Relevant WPs	WP3
Relevant Deliverables (if any)	D3.5 (27)
Completeness (%)	20%
Expected Delivery Date	2023-03-31
Type	Hardware/Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	FINT
Foreseen IPR strategy (if any)	FINT hereby excludes from its obligation to grant Access Rights to all Background other than generated by research personnel involved in the project as well as to all Background other than explicitly needed for the project.
Sole owner or co-ownership	FINT
FTO - Freedom-to-Operate"	Specific background will be accessible royalty-free strictly on a need-to know basis and in the context of work plan as defined in the Grant Agreement
Individual or joint exploitation	It can be exploited both individually and jointly with other components and partners
Identified Risks	If not implemented correctly it can become a network bottleneck node preventing the rapid data transfer/communication between the sensors and the core platform. Moreover, a very careful set of algorithms for cybersecurity threats should be implemented in order to be sure that all possible cases will be handled successfully by the device.

Business Value

The target segment of the Security Middlebox solution is almost of industries that are prone to cybersecurity threats, and this included the Energy Sector, Smart Factories, the Information Technology Sector, the Communications Services, Lottery Sector (shops and/or online platforms), Insurance Sector and Retail Shops. The main problem that the Security Middlebox wants to solve is provide a solution that will help companies and organisation to defend themselves (and their digital assets and their data and privacy) against cyber threats and cyber-attacks.

The main differentiation points of our solution are:

- Parallel operation of different providers security features/algorithms/applications on a single device;
- Easy deployment methods.

FINT is targeting to have a fully operational device at the end of OPTIMAI project. The target is to have a fully proven technical solution, however aspects concerning the business offering and

possible commercial subscriptions schemas might not be ready and will need to be elaborated after the project completion.

The value for the business by using the specific solution is that when placing it as part of the production line and workflow insights like estimation of the level of risk for each protected asset, will become possible.

Innovation Value

The new elements that distinguish it from the state of the art is:

- The Cyber Security Services are tailored to fulfil the needs of Smart Factories in terms of efficiency and costs;
- It is based on Hardware-based technology (Edge Acceleration);
- It can provide Security Information and Event Management services;
- It can watch the company's network;
- Identify the threats and initiate the countermeasures;
- Perform advanced monitoring and visualization.

Based on the graph (Figure 2-2) the KER would be placed as "Radical".

Customer Value

Possible end customers include factories of any size, train/metro operators, port authorities and marinas, farmers and cooperatives, municipalities, energy supply companies and photovoltaic/wind parks, hospitality, buildings/parks/parking operators and organisations that deals with environmental monitoring.

Also the ICT and partners with access to the above beneficiaries through current sales channels, like Telcos, Cloud Providers, Cyber Security Service Providers.

The solution should be chosen due to the flexibility and novelty-focused way of acceleration hardware utilisation for detecting rapidly cyber security threats. The exact benefit is that the solution can provide acceleration of 300% - 2000% of sophisticated security applications in-premise without the use of expensive high-end servers.

2.2.8 On-the-edge processing component

Description	The AI Edge Processing Service module is part of the OPTIMAI edge node architecture and enables the deployment and operation of AI services on-the-edge. Hence, it will directly relate to the AI services developed in OPTIMAI, and will target sensor acquisition optimization, real-time analytics modules and adaptation of intelligent manufacturing assets. In particular, AI Edge Processing Service module, developed on top of the so-called "DIDA Platform", will enable: • Pre-processing of sensors data for an efficient dispatching to other OPTIMAI components and deployment of AI services on-the-edge, reducing execution latency;

	• Big data analysis using AI algorithms running on top of DIDA modules (Digital Industry Data Analytics); • Data acquisition, pre-processing of data, enhancing the on-the-edge smartness of sensors.
Lead Partner	ENG
Contributing Partners	Possible contributions from: CERTH, FINT, EVT, YBQ, UNIMET, UAB
Relevant WPs	WP3
Relevant Deliverables (if any)	D3.6 (M18) D3.7 (M24)
Completeness (%)	40%
Expected Delivery Date	2022-12-31
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	https://gitlab.com/optimai/on-the-edge-processing-component
Target stakeholders	Other OPTIMAI solution providers for integration, algorithms providers and industrial companies (end-users)
Foreseen IPR strategy (if any)	The potential revenue model associated with this component is based on the offering of set-up, support and integration services in order to help the user in the initial and running phases. As specific IT Skills are required, different levels of training services will be also offered.
Sole owner or co-ownership	ENG
FTO - Freedom-to-Operate"	Access Rights shall be given under previous agreement between parties involved.
Individual or joint exploitation	It will be exploited both individually and jointly with other components
Identified Risks	No risks have been identified so far.

Business Value

The On-the-edge processing component is based on DIDA (Digital Industries Data Analytics) Platform, a platform based on open source FIWARE and Apache components aiming to cover the entire industrial data value chain adopting a data-driven approach (from data ingestion to data representation). To this end three main data categories can be identified, namely: Situational Data, Data in Motion, Data at Rest. Data is collected through a context broker or a general enabler and is then propagated to other components, within DIDA Platform, to perform different kind of processing (AI based processing) or to persist the data.

Key-value of On-the-edge processing component is its modularity and its openness that let possible a one-time-deploy with a customized package specifically designed to the end-user. The On-the-edge processing component, thus, enables AQ (*Autonomous Quality*) loops without the need for the end-user to owe the required contextual expertise.

Innovation Value

Innovation value represented by On-the-edge processing component consists in its simplicity. An end-user, without the necessary expertise, can run its designed and customized DIDA instance and watch it working out-of-the-box.

With respect to graph in Figure 2-2, the On-the-edge processing component is placed on "Radical" square, being able to deeply transform and innovate existing industrial processes without the specific expertise on-premise.

Customer Value

Possible customers include factories of any size, on 7 different possible sectors:

- White goods & Appliances,
- Plastic injection,
- Metal machining,
- Ceramic pressing,
- Aerospace,
- Automotive & Electronics,
- Additive manufacturing.

Customer benefits are:

- The ability to generate knowledge from raw data,
- The extreme easiness to operate when exploiting such a platform,
- The easiness to maintain/upgrade the platform thanks to its openness nature.

A secondary category of end-users that has been identified are AI service providers that may benefit of the On-the -edge processing to run their algorithms.

2.2.9 3D Scanning & Dimensional Analysis

Description	Metrology services applied to chip production line through hardware and software appliance and customization with standardize interoperability of metrology data. This includes the integration of these components and data with other technical developments in the OPTIMAI project. (Calibration of QC systems methodology under assessment, will be defined as the project evolves)
Lead Partner	UNIMET
Contributing Partners	TBD
Relevant WPs	WP3 (Others will be clarified later)
Relevant Deliverables (if any)	D3.1(M16), D3.2(M30), (Others will be clarified later)
Completeness (%)	15%
Expected Delivery Date	TBD
Type	Hardware, software, knowledge
Expected TRL by end of the project	TRL7
Link (if applicable)	N/A at this moment
Target stakeholders	End users, technological partners, Automotive, aeronautics, rail, wind, electronics and consumer industries
Foreseen IPR strategy (if any)	License
Sole owner or co-ownership	Sole owner
FTO - Freedom-to-Operate"	Yes. UNIMET developments that are being used in the project for further R&D are developed in-house and UNIMET is proprietary

Individual or joint exploitation	Individual exploitation. Joint exploitation based on this result as part of other developments have to be agreed between partners
Identified Risks	No risk identified at this point (TBD)

Business Value

The target market are the industries of manufacturing, automotive, consumer electronics, aerospace, energy & power, medical and others, as the solution is a dimensional Quality Control tool applicable to many types of production lines. The challenge intended to approach is the zero-defect manufacturing and the seamless interoperability of dimensional data in the industry. To know if the solution will need further R&D after the end of the project it is needed to assess the solution and integration in the use case at its entirety (at later stages in the project). UNIMET's 3D scanning devices services are high-precision, high-velocity, with a wide scope of applicability, the data processing and analysis software is highly compatible with different measuring equipment and data formats integrated with the last version of QIF standard, and the calibration mechanisms provided are certified by ENAC to perform the calibration of any measuring equipment.

To have an automatic quality control system accompanied of calibration mechanism directly affects the manufacturing costs as the defects in manufacturing parts can be detected in less time, at early stages, with much more efficiency; directly or indirectly affecting the aspects mentioned in the table above.

Innovation Value

Solution is not yet integrated in the pilot to see its full scope, or if additional developments will be needed. However, the solution for dimensional analysis is compatible with various 3D measurement devices, offers full traceability and powerful information analysis, with high-precision devices for data capture that permit to optimize the dimensional information generated, processed and used for different purposes. On the other hand, we have ENAC certification in dimension, moment and temperature, and we can perform the calibration of measurement equipment. We generate and manufacture calibration patterns and special calibrated tools.

UNIMET's solutions can be placed in the "Sustaining and Incremental" areas in the graph Figure 2-2).

Customer Value

The direct beneficiary of the solution is the end user's owner of a manufacturing production line (in different fields), as indirect beneficiary could be other technical partners in the project. The objective is that end-users could automate and have more efficient mechanisms for quality control processes.

2.2.10 AI models for zero defect

Description	AI approaches for detecting flaws and forecasting potential ones when equipment or materials are near to the margin of error will

	be developed for real-time sensory data analysis. To address the data scarcity of defective parts, reference datasets will be created early in the project's lifecycle, and open datasets containing both healthy and defective samples will be used. Not only will supervised AI models be used in the research, but also unsupervised methods for anomaly detection and deep generative models for novelty discovery, which have a lot of scientific and innovative potential. Time series models will be utilized to forecast over 1D signals for defect prediction, while deep recurrent networks will be trained based on successive sensory measurements for defect prediction.
Lead Partner	CERTH
Contributing Partners	UTH, EVT, ENG, UNIMET, VIS
Relevant WPs	WP3, WP4
Relevant Deliverables (if any)	D3.6(M30), D4.3 (M33)
Completeness (%)	45%
Expected Delivery Date	
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-users
Foreseen IPR strategy (if any)	Service
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights will be given under previous agreement between the parties involved.
Individual or joint exploitation	It will be exploited both individually and jointly with other components
Identified Risks	Most of the risks identified are associated with the limitations of the corresponding AI models used. Specifically, potential risks may include the difficulty to cope with the scarcity of defective data samples and the disproportional amount of normal over defective instances. Moreover, the employment of defect detection and prediction algorithms on the edge, if not efficiently implemented, may slow down the production line.

Business Value

The target market segment is comprised of several industries such as manufacturers (electronics manufacturing, hard metal manufacturing, machinery manufacturing, etc.), electrical and power, and the medical industry.
The main challenge addressed by Zero Defect Manufacturing (ZDM) is the mitigation of failures within the manufacturing process through the use of modern AI techniques, to address the limitations of traditional quality inspection methods. The aim is the minimisation of defective parts during production. Compared to other existing methodologies, we aim to implement state-of-the-art Machine Learning (ML) algorithms for defect identification and prediction, to optimize the manufacturing process. Additionally, emphasis will be placed on lightweight methods that can operate on the edge without significantly degrading performance.

To obtain a fully operational solution, the developed methodologies need to be tailored to fit the needs of any particular industry in which they will be implemented, and thus further internal research will be necessary.
The main objectives of the AI models for zero defect are the cost reduction and the quality increase.
The successful development of the above-mentioned algorithms will attract the interest of stakeholders outside the project.

Innovation Value

The innovation lies on the defect detection and prediction pipeline that can operate real time on the edge. The Innovative potential of the solution is considered to be disruptive.

Customer Value

Direct beneficiaries are the end-users of the project, whereas due to its generality, the proposed ZDM methodology can also be easily adapted and applied in other use industrial cases.

2.2.11 Blockchain framework

Description	Within an actual production line, Distributed Ledger Technologies (DLT) will give a decentralized solution for real-time validity and traceability. Appropriate mechanisms and smart contracts for industrial applications will be deployed to implement: access control (ownership, permissioning) and management for produced data through the adoption of Decentralized Digital Identities (DIDs), validation of firmware or software installed on sensors and OPTIMAI middleware, the integrity of data produced and exchanged from/to the critical sensors of the production line through data logging, iv) immutable data produced and exchanged from/to the critical equipment. A transparent yet strong blockchain layer towards zero-defect manufacturing will be ensured by common security protocols and standards (including standardized data encryption).
Lead Partner	CERTH
Contributing Partners	FINT, ENG
Relevant WPs	WP3
Relevant Deliverables (if any)	D3.5 (M30)
Completeness (%)	25%
Expected Delivery Date	
Type	Framework
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-users
Foreseen IPR strategy (if any)	Copyrighted
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights will be given under previous agreement between the parties involved.
Individual or joint exploitation	It will be exploited both individually and jointly with other components

Identified Risks	Blockchain allows for peer-to-peer information transmission without the use of a middleman. The interacting parties may be exposed to new hazards that were previously addressed by central intermediaries.

Business value

The blockchain framework proposal is generally aimed at Industry 4.0. Blockchain is a decentralized, distributed digital ledger that logs in and monitors transactions across numerous peer nodes, ensuring that the records can't be tampered with retrospectively without altering the network's consensus. As a result, industries should incorporate defect management solutions into their systems from the start in order to reduce the number of defects and issues in blockchain applications.

Most database systems are built on a centralized client-server design. A client in this system has the authority to change data stored on the centralized server. The centralized authority has control over the whole server database and may control and make choices on the different access control policies specified on the data stored in the database. They also have the power to verify users' credentials before allowing them access to the database. Blockchain may be an effective alternative for resolving challenges in traditional centralized systems. A blockchain is a collection of interconnected blocks that may be used to store and exchange data in a distributed and transparent manner. Each block contains data and uses pointers to connect to other blocks. Such connections safeguard the blockchain's integrity and tamper resistance. When new data is uploaded to the blockchain, it creates a connection to the free end, which expands the blockchain by one block or unit. As more data is contributed to the blockchain. If one of the blocks in the chain is changed, cryptographic linkages are broken, causing the entire blockchain to be disrupted. It also allows the user to check the data's integrity. With the adoption of decentralized systems, the risk of a centralized control system may be minimized.

After the end of the project further research may be needed in order to get a fully operational solution.

Innovation value

The innovative pillars of blockchain are:

1) Decentralization: Data is stored decentralized/distributed across several users/nodes. There is no centralized database on a blockchain, thus participants may conduct transactions without relying on a central third party to keep track of data exchange or execute authorization. This avoids multiple-to-one traffic flows and the single point of failure issue.
2) Transparency: all transactions are logged in a register that is always available to all nodes. The transactions on the Blockchain are visible to all parties.
3) Trust: Each block carries information from the one before it. There is no communication with a third party. A digital distributed ledger stores all transactions in a blockchain network and verifies them with a digital timestamp. As a result, the network's nodes may

be audited and traced in the past. Participants must agree before data can be uploaded to the Blockchain network, which is different from a centralized network. As a result, people are more confident in creating, altering, or just viewing data.

With respect to Figure 2-2 the positioning of the Blockchain Framework is “Incremental”.

Customer Value

Industry 4.0 actors and manufacturing industries. The solution should be chosen by end-users for the features of Blockchain (decentralized, immutability, transparency, trust, etc.).

2.2.12 Intelligent marketplace

Description	The Intelligent Marketplace aims to help the manufacturing ecosystem to decrease scrap within their production line. The Marketplace will provide services to those third parties that would like to increase their production quality by minimizing their scrap. This can happen by using OPTIMAI’s AI algorithms for identification of potentially defective parts and prediction of defects and malfunctions. Moreover, the industrial users through the same platform will be able to provide and sell their defective parts, to other industries which may consider them as useful material (prior to the recycling process or after it - reuse of scrap for lab measurements and material properties studying).
Lead Partner	FINT
Contributing Partners	FINT (possible contributors from: CERTH, FORTH)
Relevant WPs	WP6
Relevant Deliverables (if any)	D6.3 (M15) D6.4 (M34)
Completeness (%)	25%
Expected Delivery Date	2023-10-31
Type	Software/Service
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	FINT
Foreseen IPR strategy (if any)	FINT hereby excludes from its obligation to grant Access Rights to all Background other than generated by research personnel involved in the project as well as to all Background other than explicitly needed for the project. Specific background will accessible royalty-free strictly on a need-to know basis and in the context of work plan as defined in the Grant Agreement
Sole owner or co-ownership	Possibly FINT will be sole owner, but still TBD
FTO - Freedom-to-Operate"	Access Rights shall be given under previous agreement between parties involved.
Individual or joint exploitation	It can be exploited both individually and jointly with other components and partners
Identified Risks	Competing solution on the market The final solution might have limitation in what functionalities it may provide for the hosting, handling and deployment of AI algorithms.

Business Value

The target market includes two different sectors: the first are the actual users and generators and the second are the facilitators or 3rd party providers. In the first category the smart factory can be the main user while in the second it can be technology and ICT companies or even telcos.

The main problem that the Marketplace tries to solve is the exposure of the AI algorithms developed during the project. The idea is to provide a platform where users can see and evaluate the results of an algorithm and choose to use it in their own infrastructure. Moreover, the same platform will facilitate the trading service of unused material and after production scrap that can be used from other industries.

The main differences of the OPTIMAI's intelligent Marketplace component are that it actually can reduce the wasted resources while be a tool that will make possible the exposure of AI algorithms. This can be achieved through the recording and indexing of defective parts to be re-used for R&D testing, refurbishing and other purposes. The intelligent Marketplace can support the sharing of AI algorithms, to help other organisations, use the AI models for defect detection and prediction. This functionality is not a common approach in most commercial Marketplaces.

FINT is targeting to have a fully operational Marketplace at the end of OPTIMAI project. The target is to have a fully proven technical solution, however aspects concerning the business offering and possible commercial exploitation including pricing policies might not be ready and will need to be elaborated after the project completion.

Overall benefits gained from the Intelligent marketplace are cost reduction and innovation.

The measurement of business value could be calculated at the end of a specific period of use based on the total amount of scrap that would be repurposed as well as how many algorithms would be used by other organisations. Both can provide additional revenue streams.

Innovation Value

The new element of the solution is the AI algorithm catalogue which is the main module responsible for the storage and exposure of the AI algorithms to those who are interested in. All stored AI Algorithms will be browsable based on its description and characteristics through a specific Dashboard module.

Based on the graph in Figure 2-2, the KER would be placed as Radical.

Customer Value

Possible end customers include factories of any size, energy supply companies and organisations that deals with environmental monitoring.

Through the Marketplace users will be able to provide detailed information of their scrap items / defective parts, declare the defective products that are produced and ask for advice regarding alternative methods for exploiting the defective products within their production line. In that sense, the user will have an interface which will allow the scrap owner to include his scrap in a market and view potential destination outcomes, from which the manufacturer will be able to

choose. The Marketplace will be the place they will be able to receive and place offerings for sale or purchase the scrap material from different industries.

Moreover, it will become possible through the Marketplace to browse and evaluate the available algorithms as well as their capabilities/functionalities and requirements in order to easily deploy them into their own production lines. AI models will be used for estimating future states, providing a simulation methodology that combined with inspection techniques will allow the prediction of emerging defects, closing the loop between defect detection and prediction.

2.2.13 Decision support and early notification framework

Description	The Decision Support System will improve end-user decision-making and provide notifications for predictive maintenance actions based on early detection of defects or prediction of upcoming malfunctions. The goal is to help worker execute complex tasks in an optimal way and have a global perspective on multistage production processes, effectively dealing with multi-dimensional data.
Lead Partner	CERTH
Contributing Partners	FORTH, ENG
Relevant WPs	WP5, WP6
Relevant Deliverables (if any)	D5.1(M20) D5.2 (M30), D6.1 (M15), D6.2 (M30)
Completeness (%)	25%
Expected Delivery Date	
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	
Target stakeholders	End-users
Foreseen IPR strategy (if any)	Service
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights will be given under previous agreement between parties involved.
Individual or joint exploitation	both independently and in conjunction with other components.
Identified Risks	Some of the risks associated with the Decision Support System include the misleading information provided to the user due to inaccuracies during defect detection or prediction, as well as the difficulty to successfully display semantic information to facilitate decision making.

Business Value

The target market sector includes industries such as manufacturing, health care, automotive, aerospace, and others. The challenge is to deliver appropriate notifications to the end-user on time and suggest the optimal actions.
Optimal recommendations for decision-making based on aggregated information analysis and context-awareness of the related actor's task.
In order to obtain a fully operational solution, the developed decision support methodologies should be modified to address the requirements of any particular stakeholder.

By implementing a decision support and early notification system, the end user's decision-making process is facilitated, and thus production time is significantly reduced, while simultaneously, the quality of the production process is improved. The successful development of the above-mentioned system will attract the interest of stakeholders outside the project.

Innovation Value

The developed system will be incorporated into a context-aware AR system, facilitating the intelligent decision-making process by aggregating and fusing semantic information on the end-user's field of view. For this reason, it poses under a "Sustaining" innovation.

Customer Value

Direct beneficiaries of the solution are all the above-mentioned industrial sectors, especially Industry 4.0 actors.
The benefits from the end-user's perspective include a context-aware recommendation system based on quality inspection results, which will be displayed on a personalisable AR framework.

2.2.14 Simulation Engine

Description	The simulation engine plug-in for production planning provides an extension for Visual Components 4.0 to handle the virtual models to evaluate the production scenarios and create the most efficient production plan, maximizing the use of resources, avoiding bottlenecks and minimizing to zero downtimes. The plug-in will introduce the interfaces to other tools developed within the project.
Lead Partner	VIS
Contributing Partners	N/A
Relevant WPs	4, 5 and 7
Relevant Deliverables (if any)	D4.7 (M24) and D4.8(M33)
Completeness (%)	20%
Expected Delivery Date	M33
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	N/A
Target stakeholders	End-users, system integrators, and systems providers
Foreseen IPR strategy (if any)	License
Sole owner or co-ownership	Sole owner
FTO - Freedom-to-Operate"	VIS developments are being used in the project for further development. Visual Components owns the development and plans to exploit the results commercially.
Individual or joint exploitation	Individual exploitation. VIS is open to cooperating with other partners to commercialize integrated solutions through partnerships.
Identified Risks	No risk has been identified at this point

Business value

Despite OPTIMAI's pilots targeting two main domains, electronics (particularly the sub domains, microelectronics and consumer electronics) and machinery, we foresee that the solutions developed in OPTIMAI can be applied to other fields such as automotive, aerospace, pharma, etc., after ad hoc tailoring.

VIS foresees the commercial viability of the results of OPTIMAI. Furthermore, once the solutions are tested in OPTIMAI's pilots, the dissemination of the results will be intensified in fairs and technical workshops targeting existing customers and prospects to get feedback and plan the commercial development.

Evolving the developments achieved in OPTIMAI into commercial products will follow the development workflow of Visual Components. Once tested in the pilots, the research results will be further evolved, introducing requirements collected from customers and prospects. The product will be validated in next to marked scenarios, and once the validation is completed can be initiated the release process toward commercial.

Enhancing productivity in a semi-automatic and autonomous ways facilitates the use of the simulation and the digital twin. This plug-in to the simulation engine will simplify the use of the simulation engine and enhance capabilities at the same time that will integrate with other solutions through the interfaces incorporated.

Innovation value

This development simplifies the utilization of simulation between the users within different domains, facilitating its use and increasing productivity.

The developed solution should be considered a “sustaining” solution, bringing a significant improvement into an existing market.

Customer Value

The solution targets the different segments, machine builders, system integrators and manufacturers (end-users of the production systems) from different verticals, electronics, machinery, automation, aerospace, pharma etc.

The solution brings an enhancement to an existing solution that can be applied to the different segments to improve productivity and integrate with different solutions.

2.2.15 Digital Twin

Description	The simulation modules developed within OPTIMAI to build the digital twin support a fast concept of the process model to be created within the virtual environment. The modules are parametric and highly configurable, facilitating their utilization by a wide variety of users independent of their technical background. The open interface based on Python allows for further customization to user needs for highly experienced users with programming skills. The process model simulation components facilitate the virtualization of the production system and the

	production workflow. The virtual layout is connected to the production facility enabling the digital twin.
Lead Partner	VIS
Contributing Partners	N/A
Relevant WPs	4,5 and 7
Relevant Deliverables (if any)	D4.1 (M21) and D4.2 (M33)
Completeness (%)	40%
Expected Delivery Date	M33
Type	Software
Expected TRL by end of the project	TRL7
Link (if applicable)	N/A
Target stakeholders	End-users, system integrators, and systems providers
Foreseen IPR strategy (if any)	License
Sole owner or co-ownership	Sole owner
FTO - Freedom-to-Operate"	VIS developments are being used in the project for further development. Visual Components owns the development and plans to exploit the results commercially.
Individual or joint exploitation	Individual exploitation. VIS is open to cooperating with other partners to commercialize integrated solutions through partnerships.
Identified Risks	No risk has been identified at this point.

Business Value:

VIS foresees the commercial viability of the results of OPTIMAI, despite OPTIMAI's pilots targeting two main domains, electronics (particularly the sub domains, microelectronics and consumer electronics) and machinery, the potential is that the solutions developed in OPTIMAI can be applied to other fields such as automotive, aerospace, pharma, etc., after ad hoc tailoring. Furthermore, once the solutions are tested in OPTIMAI's pilots, the dissemination of the results will be intensified in fairs and technical workshops targeting existing customers and prospects to get feedback and plan the commercial development.

Evolving the developments achieved in OPTIMAI into commercial products will follow the development workflow of Visual Components. Once tested in the pilots, the research results will be further evolved, introducing requirements collected from customers and prospects. The product will be validated in next to marked scenarios, and once the validation is completed can be initiated the release process toward commercial.
How the digital twin is built follows an iterative approach from system concept to engineering and connecting to the real scenario enabling the digital twin, bringing a new perspective to the market, which facilitates and accelerates the digital twin's deployment. This approach entails all the stakeholders involved in the production and integrates all the knowledge, maintaining the digital continuity.

Innovation Value:

This development extends the utilization of simulation to a broader number of users within different domains, facilitating its use and accelerating the deployment of new production

equipment or enhancing existing production systems. In addition, it simplifies the deployment and maintenance of the digital twin.

The developed solution should be considered a “sustaining” solution, bringing a significant improvement into an existing market.

Customer Value:

The solution targets the different segments, machine builders, system integrators and manufacturers (end-users of the production systems) from different verticals, electronics, machinery, automation, aerospace, pharma etc.

The benefit of user worth bought by the tool to the different segments to accelerate the deployment of manufacturing solutions, maintaining the digital continuity, improving productivity, avoiding errors, and enhancing quality.

2.2.16 OPTIMAI System Architecture

Description	This exploitable result refers to the description and elaboration of the OPTIMAI technical architecture, referring to the knowledge from the organizational structure of the envisioned IT system with guidelines, principles and relationships that dictate its design and its development over time. Its importance lies in the knowledge generated from the definition of the functional elements; interfaces; information flow; limitations; behaviours; characteristics; physical and logical properties, which can be applied also outside the specific use cases of the OPTIMAI project.
Lead Partner	FORTH
Contributing Partners	All
Relevant WPs	WP2; WP6
Relevant Deliverables (if any)	D2.4 & D2.5
Completeness (%)	90%
Expected Delivery Date	30/06/2022
Type	Knowledge
Expected TRL by end of the project	TRL7
Link (if applicable)	N/A
Target stakeholders	Industry 4.0/manufacturing enterprises, factory owners
Foreseen IPR strategy (if any)	1. Document the concept and original content in detail in scientific publication(s); 2. Provide detailed drawings, descriptions, plans and records that prove the concept and work as intellectual property of OPTIMAI partners.
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Yes
Individual or joint exploitation	Both
Identified Risks	Results are not sufficiently exposed/disseminated and thus fail to reach the target stakeholders/audience. Similar architectures are proposed by competing groups.

Business Value

The proposition of a flexible, modular service-oriented architecture, which incorporates key enabling technologies (e.g., AI, AR, Blockchain, DT, Edge computing, etc.) into a ZDM solutions ecosystem, is applicable across various industrial settings and domains. The actual Business Value will be measured considering the citation count of scientific-related publications.

Alignment to standards initiatives RAMI 4.0 and IIRA, clear placement of key enabling technologies in smart manufacturing, leading to a strong intention of decreasing the system complexity while increasing its quality.

Innovation Value

OPTIMAI gains the benefit of showcasing a pragmatic implementation of RAMI 4.0 (which is an abstract model) in the context of ZDM and zero-waste production planning, which can extend to other use cases outside the scope of the project.

Customer Value

The beneficiaries of the solution are Industry 4.0 actors, including use cases outside the scope of ZDM. The OPTIMAI RA, should be chosen among others from the customers, because it is a practical implementation of Industry 4.0 concepts and principles, and it is aligned with Industry 4.0 reference models.

2.2.17 Ethics recommendations & regulatory framework

Description	Ethics and legal requirements will be provided for pilot sites taking into consideration the particularities of national legislation of each pilot site.
Lead Partner	TRI
Contributing Partners	TRI, UAB, CERTH
Relevant WPs	WP7
Relevant Deliverables (if any)	D7.3 (M18)
Completeness (%)	100%
Expected Delivery Date	2022-06-31
Type	Guideline
Expected TRL by end of the project	
Link (if applicable)	Public deliverable available after acceptance from EC
Target stakeholders	TVES, KLEE, MTCL
Foreseen IPR strategy (if any)	
Sole owner or co-ownership	
FTO - Freedom-to-Operate"	Public distribution
Individual or joint exploitation	Ethics and legal requirements will be provided for pilot sites taking into consideration the particularities of national legislation of each pilot site.
Identified Risks	NA

Business Value

This KER is targeted primarily at our end-user partners (demonstrators), with secondary value for technical partners, providing ethical and legal guidance tailored to their national situations in the areas of data protection law, employment law, equality law, and health and safety law. This deliverable will furthermore be of value to similar industrial manufacturers hosting research projects in the UK, Spain and Greece in need of some ethical and legal information resources to support responsible research and innovation.

Innovation Value

The researchers are not aware of any compendium information resources detailing ethical and legal requirements for Industry 4.0 and human research participation in UK, Spain and Greece with the wide focus on data protection law, employment law, equality law, and health and safety law. As such, this is a novel informational resource.

The deliverable presents an incremental innovation, collecting a multitude of ethical and legal requirements into one convenient resource that serves as instructive reference material for industrial end-users without however providing new knowledge as such.

Customer Value

OPTIMAI project end-users are the immediate beneficiary, although the deliverable has sustainable value for other industrial end-users located in UK, Spain, and Greece.

The solution should be chosen as it provides a compendium of important highlights on ethical and legal requirements for Industry 4.0 human research participation that supports responsible research and innovation and supports the mitigation of ethical and legal risks.

2.2.18 OPTIMAI Regulatory Model

Description	Regulatory Models are complex systems with descriptive and normative components, built after a knowledge acquisition process to set the conditions of a normative (or regulatory) system. The purpose of the OPTIMAI Regulatory Model is two-fold: i) to ensure legitimate, effective, and efficient legal and ethical compliance following the legal and ethical framework and the societal values identified as applicable to the project; and, ii) to strike a right and fair balance between the projects' innovation goals and the protection of individuals' fundamental rights.
Lead Partner	UAB
Contributing Partners	TRI and Dr. Mustafa Hashmi (external expert)
Relevant WPs	WP9
Relevant Deliverables (if any)	D9.5 (M6); D9.6 (M12); D9.7 (M24); D9.8 (M36)
Completeness (%)	47%
Expected Delivery Date	2023-12-31
Type	Methodology
Expected TRL by end of the project	TRL7
Link (if applicable)	TBD
Target stakeholders	TBD
Foreseen IPR strategy (if any)	TBD

Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	TBD
Individual or joint exploitation	TBD
Identified Risks	NA

Comment

As an ethical and legal partner belonging to a public university, UAB contribution in OPTIMAI is not expected to be commercialized. The OPTIMAI regulatory model has been exclusively designed to be implemented throughout the lifespan of the project.

2.2.19 OPTIMAI Training

Description	The OPTIMAI training material and training activities aim to introduce relevant end-users and operators to the OPTIMAI concept and to train them in the use of the OPTIMAI tools. A training catalogue is developed as a set of instructional modules including user-friendly guidelines on how to operate the tools. Training is also provided on ethical, legal and other horizontal aspects.
Lead Partner	CARR
Contributing Partners	CERTH, FINT, VIS, YBQ, UTH, ENG, UNIMET, UAB, TRI, KLEE, TVES, MSL, EVT
Relevant WPs	WP7
Relevant Deliverables (if any)	D7.1 (M20), D7.2 (M30)
Completeness (%)	40%
Expected Delivery Date	2022-08-30
Type	Documentation
Expected TRL by end of the project	N/A
Link (if applicable)	https://optimai.eu/training-catalogue (available from 31/8/2022)
Target stakeholders	End users and other stakeholders with an interest in manufacturing operations
Foreseen IPR strategy (if any)	Identify materials that could be subject to license / patenting, Copyright on artistic / creative work. See the IP strategy for the individual components covered in the OPTIMAI Training.
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	Access Rights shall be given under previous agreement between parties involved. FTO referred to if the material has freedom to be created, used and marketed without infringing any prior intellectual property rights.
Individual or joint exploitation	Joint exploitation
Identified Risks	NA

Business Value

The primary target segment is the OPTIMAI end users, including workers, managers, installers, technicians. Secondary target segments include other stakeholders with an interest in training in manufacturing operations or in specific technological components provided as part of the KER. The aim is to provide end users with a good understanding of the functionalities of each

solution. This will increase acceptance of the solutions, improve effectiveness and reduce misunderstandings.

The OPTIMAI Training catalogue is tailored to the OPTIMAI solutions and is therefore unique on the market. It should be chosen as it human-centred by design and it places the end users at the heart of the solution.

Innovation Value

A one-stop-shop for training material related to the OPTIMAI solutions. The OPTIMAI training activities will boost human performance in industry. They will support operators' and service providers' work and decisions. The training is end-user-centred and user-friendly, comprehensible and accessible and developed around the needs and preferences of the end users. Much of the innovation value springs from the innovation value of the solutions covered in the training. For more information, see the KERs discussing the key OPTIMAI solutions.

Customer Value

Beneficiaries of the Training Material are the OPTIMAI demonstrators, through the documentation provided they learn to use the OPTIMAI solutions. The training can speed up the process of onboarding new staff, improve their knowledge and preparedness level and eventually lead to a decrease in production time. The OPTIMAI Training optimises the learning associated with the OPTIMAI tools.

2.2.20 Communication and dissemination strategy

Description	Impactful C&D strategy and design that can be applied and tailored to a broad range of fields and contexts. The strategy ensures maximum impact in the context of communication and dissemination. It constitutes a strategic plan for the dissemination of results and for awareness raising. The strategy describes the dissemination and communication objectives and approach and goes on to identify key audiences, messages, channels and material for dissemination. It outlines relevant publications and events to target for maximum impact.
Lead Partner	CARR
Contributing Partners	N/A
Relevant WPs	WP8
Relevant Deliverables (if any)	D8.2 (M6), D8.3 (M18), D8.4 (M36)
Completeness (%)	100%
Expected Delivery Date	2021-06-30
Type	Report
Expected TRL by end of the project	N/A
Link (if applicable)	D8.2 Communication and Dissemination Strategy
Target stakeholders	
Foreseen IPR strategy (if any)	TBD
Sole owner or co-ownership	Identify materials that could be subject to license / patenting,
FTO - Freedom-to-Operate"	Copyright on artistic / creative work
Individual or joint exploitation	Sole owner

Identified Risks	NA

Business Value

Primary target segments include industrial companies, research organisations, R&D projects.

The OPTIMAI communication and dissemination strategy is tailored to the project and is therefore unique. By the same token, the strategy can be seamlessly applied to other contexts. There exists a number of challenges for effective communication and dissemination which the strategy seeks to overcome. These challenges include the specified nature of the audiences which a project/initiative aims to reach and the most efficient way of communicating with these stakeholders. Further, the difficulty of conceptualising the outcomes of a project/initiative in a way that is immediately relevant to these stakeholders is acknowledged. The primary challenge that the strategy solves is ensure that all results are made available to relevant stakeholders, and that the reasons for the results being of interest, benefit and relevance to them is communicated effectively. This in turn facilitates exploitation and take-up of the results by end-users.

Its core value is based around ensuring that relevant information is delivered to the appropriate stakeholders in a suitable and easily accessible format and in accordance with agreed procedures.

Innovation Value

CARR's audience-focused approach to strategic communications and dissemination combined with first-class design has proved to go beyond the state of the art. The innovative strategy always considers the audience: what do they think, what do they say, what do they do? The strategy facilitates the influencing of behaviours and attitudes. It poses the questions what should they think, what should they say, what should they do? The strategy is built around the highly adaptable Carr Communications EPIC framework: Explore, Plan, Implement, Confirm.

Customer Value

The strategy serves as a solid base for ensuring that generated results are disseminated effectively and systematically. The strategy is valuable to all audience groups because it serves as an instrument that helps them see the big picture and understand the communications and dissemination objectives of the project/initiative. It benefits the users by demonstrating where they fit in and in which ways they can contribute and maximise the impact of the project/initiative.

2.2.21 OPTIMAI Business Model

Description	The business model that will be applied in OPTIMAI to bring the results of the project to the market. It will present the possibilities of advancing and developing the OPTIMAI system beyond the initial funding period. It comprehends also all preliminary activities performed in order to get the final OPTIMAI Business Model, including questionnaires

	and possible workshops that will be organized with the Consortium.
Lead Partner	ENG
Contributing Partners	ALL
Relevant WPs	WP8
Relevant Deliverables (if any)	D8.6 (M12) D8.7 (M18) D8.8 (M36) D8.9 (M36)
Completeness (%)	50%
Expected Delivery Date	2023-12-31
Type	Report
Expected TRL by end of the project	N/A
Link (if applicable)	N/A
Target stakeholders	OPTIMAI partners
Foreseen IPR strategy (if any)	N/A
Sole owner or co-ownership	Co-ownership
FTO - Freedom-to-Operate"	TBD
Individual or joint exploitation	Joint exploitation
Identified Risks	Individual exploitation activities are not easily traceable, mainly after the end of the project.

Business Value

The target segment is the OPTIMAI's Consortium, the work done within the project may serve as a pattern for further R&D projects. Its uniqueness is by design, since it has been defined within the Consortium (i.e., thanks to partner's input) and it is tailored on the OPTIMAI features.

Overall, the scope of the Plan is to help all KERs owners to minimize the risk of their activities and support them along their individual/joint exploitation.

Furthermore, the OPTIMAI Business Model may be exploited by third parties (external stakeholders – e.g. Sensors Vendor, Technological Provider, AI algorithms Provider etc.) that integrates (part of) the OPTIMAI solution with their commercial solutions.

Innovation Value

Mainly, the innovativeness is on the OPTIMAI solution. Within the Project, exploitation activities have been performed gaining from state-of-the-art models the keys to better fit on the OPTIMAI solution leading to a new methodology and unique model.

Customer Value

It is not proper to talk about customers, project partners may always refer to the proposed strategy and plan and eventually contact ENG for any further discussion/support needed.

2.2.22 OPTIMAI Pilots – Demo in KLEE

Description	OPTIMAI solution personalised to KLEE pilot. Pilot activities at KLEE will be undertaken with a view to test three use cases (UC) of OPTIMAI solutions, including UC-1 zero defect quality inspection, UC-2 production line set-up calibration, and UC-

	3 production planning. The objective of UC-1 is the automation of the inspection process in order to reduce costs related to quality control and production, and the identification of defects that are not identified through manual inspection in order to improve the final product quality (hydraulic lift power unit). UC-2 aims to support optimal set-up of the hydraulic unit valve block and UC-3 aims to develop digital twins of the hydraulic power unit that will be combined with AI models that map design choices to the power unit's performance and related defects.
Lead Partner	KLEE
Contributing Partners	Technical partners
Relevant WPs	WP7
Relevant Deliverables (if any)	D7.4 KLEE pilot evaluation (M24) - 1st version and D7.5 KLEE pilot evaluation - 2nd version (M36)
Completeness (%)	5%
Expected Delivery Date	End of Project (M36)
Type	Documentation / Demonstration
Expected TRL by end of the project	TRL 5
Link (if applicable)	NA
Target stakeholders	Operators, Technicians, Quality and Production Managers
Foreseen IPR strategy (if any)	Previous agreement between technology developers
Sole owner or co-ownership	No
FTO - Freedom-to-Operate"	Previous agreement between technology developers
Individual or joint exploitation	Individual and joint exploiting strategy
Identified Risks	NA

Business Value

- Reduction of mismatches,
- Improvement in process automation – quality inspection,
- Classification accuracy of defects,
- Speed-up of the quality inspection process,
- Improvement in pressure monitoring automation,
- Increased equipment productivity via defect prediction and early detection,
- Improvement in calibration automation,
- Speed up calibration of the valve block,
- Improve final product quality.

The business value will be measured through specific KPIs as identified at KLEEMANN's use cases.

Innovation Value

OPTIMAI will offer an Optimised Decision Support system that is expected to provide direct improvements to the specific workstation, but also to other production units.

Customer Value

The direct beneficiary of the OPTIMAI solution is the Internal customer including mainly KLEEMANN's employees, but also other shop floors, departments of the same factory or other production lines and manufacturing facilities of the Group around the world (Serbia and China).

2.2.23 OPTIMAI Pilots – Demo in Microsemi

Description	OPTIMAI solution tailored to MTCL pilot uses - this includes the collection of sensor data from the route, wafer saw and dispensing processes. The visual inspection of the output of these process steps, the augmented reality feedback to MTCL staff and the AI control of certain process input control.
Lead Partner	MTCL
Contributing Partners	CERTH, FINT, FORTH, EVT, VIS, YBQ, UTH, ENG, UNIMET, UPV, CARR, UAB
Relevant WPs	WP7
Relevant Deliverables (if any)	D7.8 & D7.9 Pilot evaluations 1st and 2nd versions
Completeness (%)	5%
Expected Delivery Date	End of the project (M36)
Type	Improved process knowledge and improved yeilds
Expected TRL by end of the project	TRL 6
Link (if applicable)	N/A
Target stakeholders	Technicians, Engineers and Managers
Foreseen IPR strategy (if any)	Preferential terms with technical providers
Sole owner or co-ownership	N/A
FTO - Freedom-to-Operate"	Yes
Individual or joint exploitation	Continued Joint exploitation to improve product for our use
Identified Risks	N/A

Business Value

The business value of the Microsemi demonstrator states on an improved product and process consistency in volume manufacturing, better understanding of processes and bottlenecks in mixed product manufacturing environment. Improved productivity and skills.

Innovation Value

Providing a digital twin of the factory and enhancing the production process for better cycle time and yields with the use of augmented reality.

Customer Value

Direct improvements to factory efficiency and yield.

2.2.24 OPTIMAI Pilots – Demo in TVES

Description	OPTIMAI developments will be tested at Televes antenna line in order to demonstrate its feasibility and to validate that it works in a real setup that can be extended to other manufacturing lines within Televes or in other manufacturers.
Lead Partner	TVES

Contributing Partners	CERTH, FINT, FORTH, EVT, VIS, YBQ, UTH, ENG, UNIMET, UPV, CARR, UAB
Relevant WPs	WP7
Relevant Deliverables (if any)	Televes pilot evaluation
Completeness (%)	5%
Expected Delivery Date	end of Project
Type	Documentation
Expected TRL by end of the project	TRL6
Link (if applicable)	NA
Target stakeholders	Operations Director
Foreseen IPR strategy (if any)	No
Sole owner or co-ownership	TBD
FTO - Freedom-to-Operate"	Yes
Individual or joint exploitation	Individual exploiting strategy
Identified Risks	NA

Business Value

Manufacturing line optimisation with regards defects reduction, quick setups and easier/reliable scheduling, leading to a significant cost reduction.

Innovation Value

OPTIMAI should provide a digital twin able to optimise our production with minimum cybersecurity risk.

Customer Value

Direct beneficiaries of the OPTIMAI solution tailored for TVES pilot is the manufacturing operation. The success of the solution delivered will be measured in terms of the promised benefits (optimisation).

2.3 Individual Exploitation Plan Updates

In the previous version of the present deliverable *D8.6* (M12) the individual exploitation plan of each Consortium member has been reported, following a common pattern made by the following details:

- **Partner profile**: a description of the company/organization, reporting attitude to innovation, research activities, experience in big distributed projects, and specific role in the consortium.
- **Identification of opportunities**: a description of the way OPTIMAI project results and outcomes are relevant to improve each partner business and activities, gaining a better positioning in the markets/areas of action or opening new possibilities in different ones. It can contain an explanation of which customers' needs will be fulfilled by the exploited results of the project.

- **Addressable Market**: Overview of the target audiences where OPTIMAI can be applied and how, identifying what kind of needs customers or stakeholders have or what kind of expectations the solution needs to fulfil.
- **Value propositions**: details about the specific approach and actions to use the value of the results of the project in each area of business.

During the Mid Phase (M13-M18) all partners have revised their plans. Overall, no significant changes emerged, for this reason the individual exploitation plans updated can be found in Annex II – Individual Exploitation Plan Update.

2.4 Exploitation Strategy at Consortium Level updates

As far as joint exploitation is concerned, possible scenarios have been investigated among partners in order to come up with a common organization model for the future exploitation of the OPTIMAI solution. A set of possible scenarios have been identified, including (a) the set-up of a New Legal Entity, by the partners of the consortium that will be responsible for the commercial exploitation of the project results, (b) the set-up of a Joint Venture, and (c) the possibility to pursue Multilateral collaboration agreements.

Scrutiny of such scenarios has indicated that significant risks are involved in the realization of those scenarios (beyond the self-evident risks of the exploitation potential itself). The resources which are necessary for the former scenarios (New Legal Entity and Joint Venture) may not be available by the consortium partners after the end of the project or the strategic vision of all partners are not in line as we have different mix of commercial and non-commercial public organizations. Regarding the latter scenario, the aforementioned resources-related issue combined with the fact that many of the involved stakeholders wish to actively participate into the marketing and exploitation planning, represent a valid option to investigate.

Furthermore, while defining the exploitation strategy at Consortium level it is mandatory to consider the different interests of each partner.

The Consortium is composed of several heterogeneous entities, the roles of every partner in the exploitation of the results will mainly depend on the type of entity. In particular, we can split the partners in four main types:

- Private sector companies (FINT, EVT, VIS, YBQ, ENG, UNIMET, CARR) are interested in the commercial exploitation of the project results, the know how that can be integrated entirely or partially into their already existing products or also define a new line of business starting from the experience in the OPTIMAI project. In most cases further internal research would be needed to reach the commercialization phase, including widening the stakeholders and analyse further specific manufacturing sectors.
- Academic Bodies (CERTH, FORTH, UTH, UPV, UAB) are planning to exploit knowledge, expertise and results produced in OPTIMAI in the form of an increased reputation (know-how) on the specific technological and manufacturing domains, which could lead to further internal and collaborative research on the topics, including participation to

relevant Horizon Europe initiatives and projects. They are committed also towards the dissemination of scientific relevance (publications).

- Target customers (KLEEMAN, TVES, MTCL) are immediately interested in the adoption of OPTIMAI framework for their daily operations: this is a set of final users that have already identified the need for a platform offering the features of OPTIMAI. After the end of the project, they will evaluate the actual impact of the solution in the scenarios executed, and eventually will invest if further fine-tuning/use cases.
- Legal consulting company (TRI) will exploit the experience and know-how gained with the legal and ethical requirements of the platform, in further collaborative research projects.

Different interests from the partners following the categorisation above, emerged also from the answers they provided to the questionnaire built to have the baseline to understand individual intentions over possible exploitation at Consortium level, and to depict the actual exploitation strategy. The answers provided by each partner are available in Annex III – Individual and Joint Exploitation Plan Questionnaire, while the questionnaire for the reader's convenience is reported in Table 2.4-1.

Table 2.4-1: Individual and joint exploitation plan questionnaire

1) Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done?
2) What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision?
3) How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast):
    a. Further Internal Research
    b. Collaborative Research (i.e. result as a starting asset for future collaborative research projects)
    c. Internal Product Development (results used in developing, creating and marketing a product/process)
    d. Internal Service Creation (results used in creating and providing a service)
    e. Licensing
    f. Assignment (results exploited by other organisations by the transfer of ownership)
    g. Joint Venture (result used as background of a joint venture)
    h. Spin-off (a separate company established in order to bring to the market technology resulting from the project)
    i. Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)

Reviewing the questionnaire, a full alignment with the three types of entity and their descriptions above has been encountered. For this reason, among the three models outlined in *D8.6 – Commercialisation and Exploitation Strategy – 1st version*, namely, New Legal Entity, Joint Venture, Multilateral collaboration agreements, the option that seems to fit better with OPTIMAI partners needs is the third, Multilateral collaboration agreements.

In fact, this model foresees flexible business agreements, with a series of partners collaborating in the delivery of products and services based on OPTIMAI, without a central structure or entity. Therefore, a global agreement is not strictly necessary: in fact, each partner becomes a 'link' in a supply chain and essentially establishes agreements with the other interested partners: clearly agreements between the involved parties are required but offer a high degree of flexibility. Typically, this partners' chain will be covered by all or most current OPTIMAI partners, who will also be free to establish other business agreements with third parties. The PROS and CONS for the chosen model identified in D8.6 are reported in Table 2.4-2.

Table 2.4-2: Evaluation of a Multilateral Collaboration Agreements model

PROS	CONS
• Little bureaucracy, • Relatively easy to set-up, • Maintains partners' flexibility, • All kinds of partners can participate, • Fits well with the Virtual Enterprise model, • Well suited to exploit modular assets in diverse environments.	• Risk of individual objectives clashing, • Weak global objectives, • Might favour some partner over others, • Changes in links might disrupt the chain.

Business relationships among partners in terms of the participation and contribution(s) to the OPTIMAI outcomes will be regulated in the scope of an exploitation agreement (EA) and a governance model to be selected and pursued under the hat of *T9.4 - Ethical and Legal monitoring*. All Consortium members will actively participate in the establishment, operation, support and sustainability of the project.

2.5 Exploitation Roadmap

The business plan is aimed to be the final and all-comprehensive outcome of *T8.6 - Exploitation plan and roadmap to market*. Figure 2-3 represents schematically the key steps needed to define the OPTIMAI Business Model, it remarks the activities/studies to be executed (or that have already been executed or at least drafted) within the project to achieve a meaningful and effective Business Model.

Figure 2-3 is not taking into account the actual technical development and the demonstrator validation of the solution, but only the effort undertaken within *WP8 - Dissemination, commercialization and exploitation strategies*, since it represents the exploitation roadmap towards a business model, but obviously the monitoring of other WPs is crucial and may lead to changes also on the exploitation strategy and features.

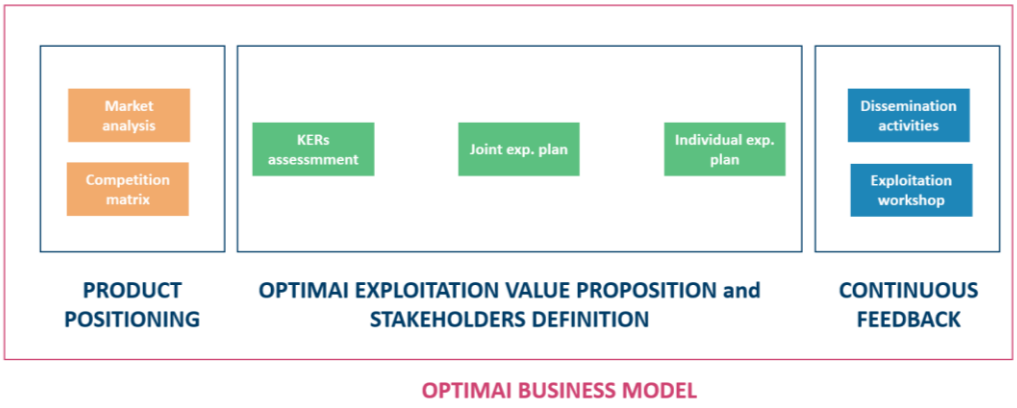

Figure 2-3: Key elements of the Roadmap towards the OPTIMAI Business Model

The major inputs that serve for the Business Model are:

- **Product Positioning** – as outcome of the market analysis and competition matrix, it is out of scope for the present deliverable and will be discussed in next deliverables related to T8.4.
- **OPTIMAI Exploitation Value Proposition** and **Stakeholders Definition** – will be discussed in the next paragraph.
- **Continuous feedback** – both external, considering all dissemination initiatives related to T8.1 and T8.2, and internal, considering the continuous monitoring of all project's tasks and exploitation-specific activities (workshops, etc.).

2.5.1 OPTIMAI Primary Stakeholders

The term stakeholder is used as a general term to describe individuals, groups, or organizations that have an interest in the project and can mobilise resources to affect its outcome in some way. According to PMI (Project Management Institute), a formal definition of a stakeholder is: *"Individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion" [4]*. In a broad sense, a stakeholder is the individual, entity, or group of people whose interest can be affected by the business or they have the power to give impact to business benefit. Every stakeholder is important for a business entity but some stakeholders exert more influence and are therefore considered more important than others. On the basis of importance, stakeholders of a business are usually categorized as primary stakeholders and secondary stakeholders:

- **Primary stakeholders**: stakeholders that hold a direct interest in a business or organization and its dealings are known as primary stakeholders. Examples of primary stakeholders include shareholders, employees, customers, suppliers, vendors and business partners. This group of people will have a direct impact due to the company's performance and is able to impact the company performance as well.
- **Secondary stakeholders**: stakeholders that do not hold direct interests in a business but can have a reasonable influence over a business's dealings are known as secondary stakeholders. An organization does not directly depend upon these stakeholders for survival of its immediate interests. Business competitors, trade unions, pressure groups

and state or local government organizations are some examples of secondary stakeholders. However, they have enough power to influence over company benefit. For example, the government or regulator can close down the company if we do not comply with the law and regulation.

Main potential stakeholders of the OPTIMAI solution have already been outlined in *D8.2 - Communication and dissemination strategy* and further explored in *D8.5 - Forum and information pack for key stakeholders*, among them[3] the two we would like to focus on are the Primary Stakeholders, providing tailored strategies and roadmaps, and in the next version of this deliverable also a Business Model:

1. **Smart Manufacturing actors**, as the key reference sector for OPTIMAI where main potential users/customers come from. The adoption of the OPTIMAI solution will enhance internal manufacturing processes, enhancing the product quality while optimising the material handling. The interest on investing in new technologies is to boost competitiveness and to offer appealing, sustainable job opportunities to the next generation of workers, engineers and researchers, therefore increasing their reputation with respect to competitors.
2. The **IT Industry/Technology providers**, they may integrate their services with the OPTIMAI platform or its MVPs, offering technical support and services, business support, training and other consulting services to stakeholders' enterprises making use of the project platform and tools.

The Value Proposition Canvas for the OPTIMAI primary stakeholders' main categories (from here on these two stakeholders will be also named as '*customers*') are represented in Figure 2-4 and Figure 2-5. They will be updated following the project evolution and will constitute the reference for the Business Model that will be presented in *D8.8 – OPTIMAI commercialization and exploitation strategy – 3rd version* (M36).

[3] Technology providers, End users, Enablers, Facilitators, Actors in Smart Manufacturing

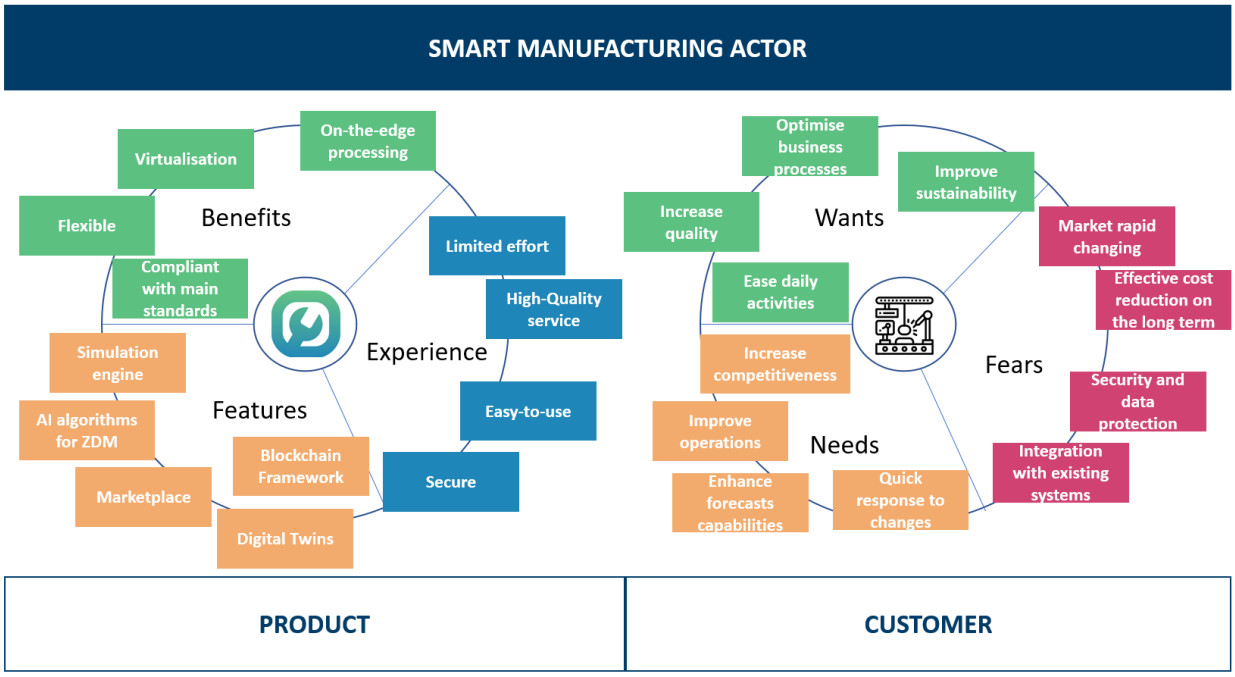

Figure 2-4: Value Proposition Canvas for Smart Manufacturing Actors

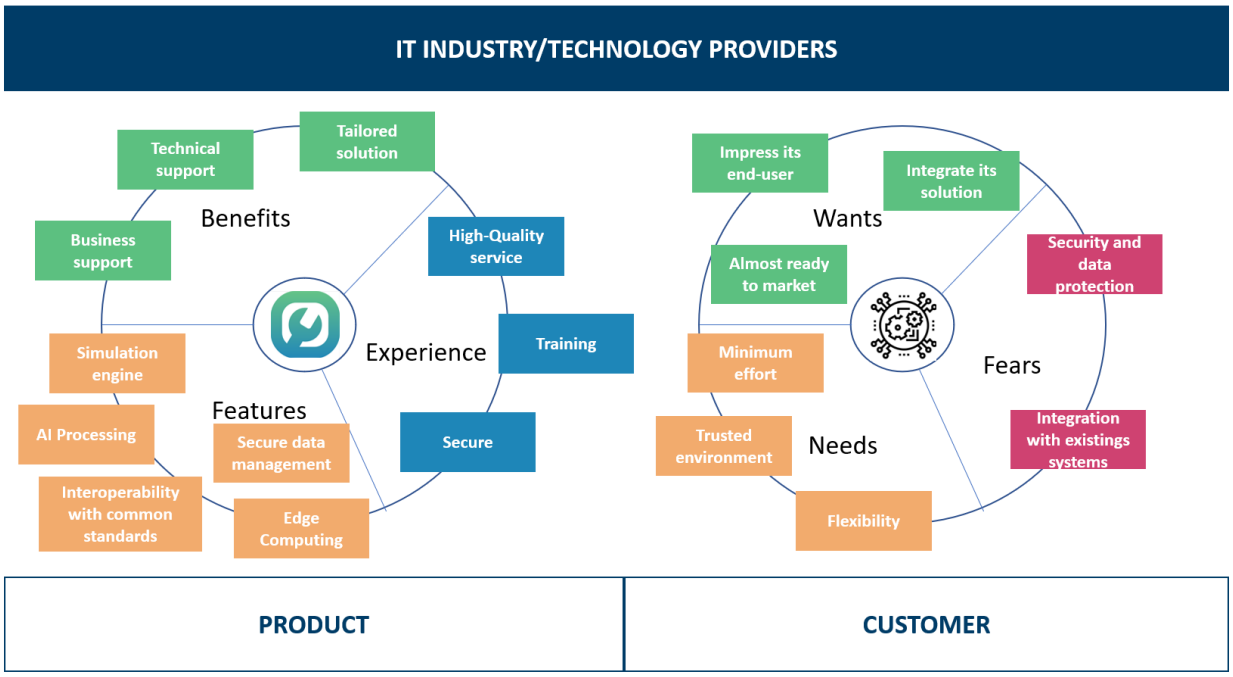

Figure 2-5: Value Proposition Canvas for IT Industry and Technological Providers

2.5.2 OPTIMAI Exploitation Value Proposition

Once the KERs have been cleared outlined, the individual and the joint exploitation plans have been agreed, the target customers have been identified, to reach the objectives predefined (i.e., to exploit the solution developed) it is crucial to settle an appropriate Business Model, but first a further mandatory step is the definition of a Value Proposition.

To access the Value Proposition, the whole exploitation process has been made into discussion, building the so called 'Exploitation Value Chain'. The Exploitation Value Chain is made by four consecutive calls-to-action:

1. **Design**: activities executed mainly within the first two years of the project in order to define a solid baseline to be used in the next phases.
2. **Development**: overall in-scope activities for the project lifetime, full alignment on them will be reached at M36.
3. **Go to Market:** set of actions to be executed once the technical solution is mature to efficiently disseminate and commercialise it.
4. **Maintenance:** post-sales activities to offer the best service to the customer.

The maximization of any of these steps will provide the organization with a competitive advantage over potential competitors. Each pace of the Value Chain is intended to answer the following questions:

1. What do we have?
2. Which are our objectives?
3. Who will get advantage from our solution?
4. Why should they choose OPTIMAI?
5. Who is responsible for the activity?
6. What is a feasible but effective timeline?

Figure 2-6 shows the OPTIMAI Exploitation Value Proposition.

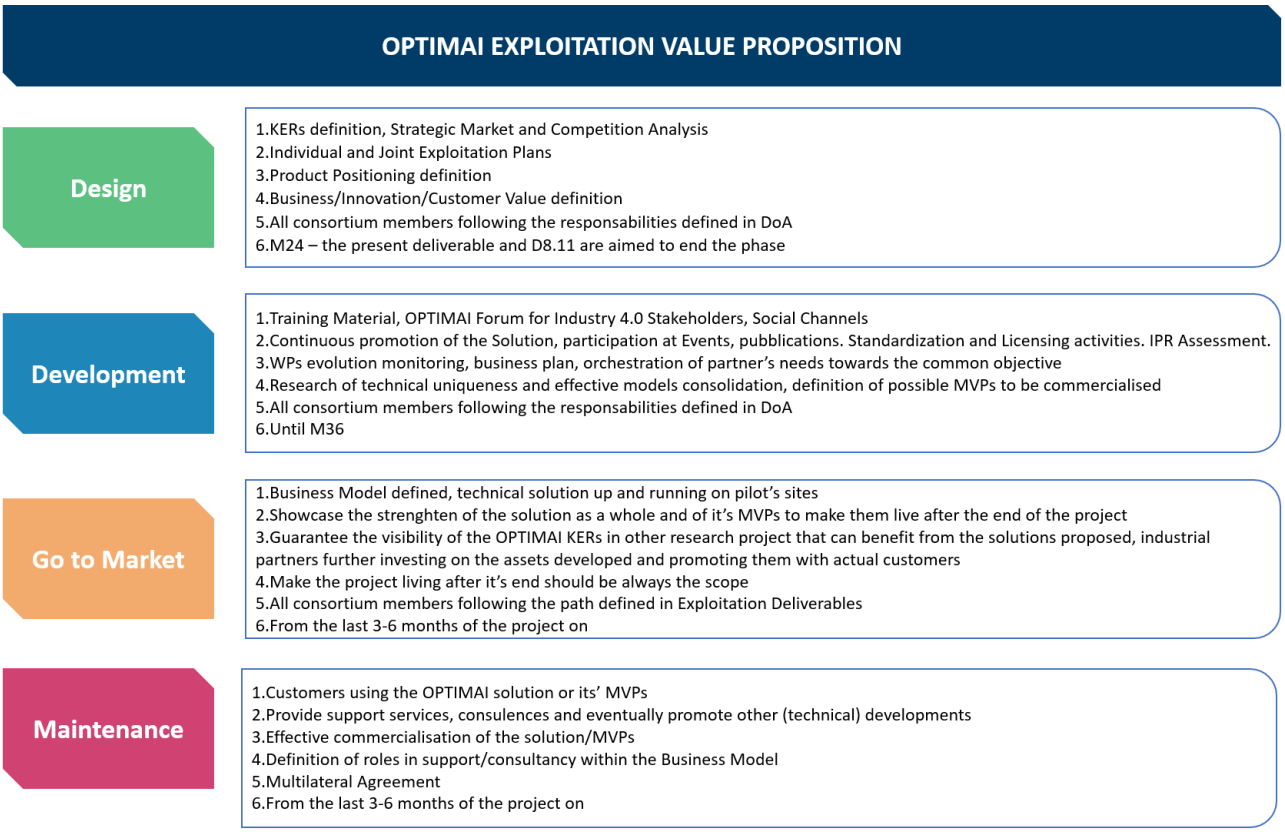

Figure 2-6: OPTIMAI Exploitation Value Proposition

2.5.3 Business Model Canvas

The Business Model Canvas [5] is a strategic management and lean start up template for developing new or documenting existing business models. It is a visual chart with elements describing product's value proposition, infrastructure, customers, and finances. The OPTIMAI Business Model Canvas is reported in Figure 2-7. Finally, this work will be further validated in the second reporting period (M19-M36) through an internal workshop for the definition of the final business model for the OPTIMAI KERs. The results of these activities will be reported in *D8.8-OPTIMAI commercialization and exploitation strategy – 3rd version*.

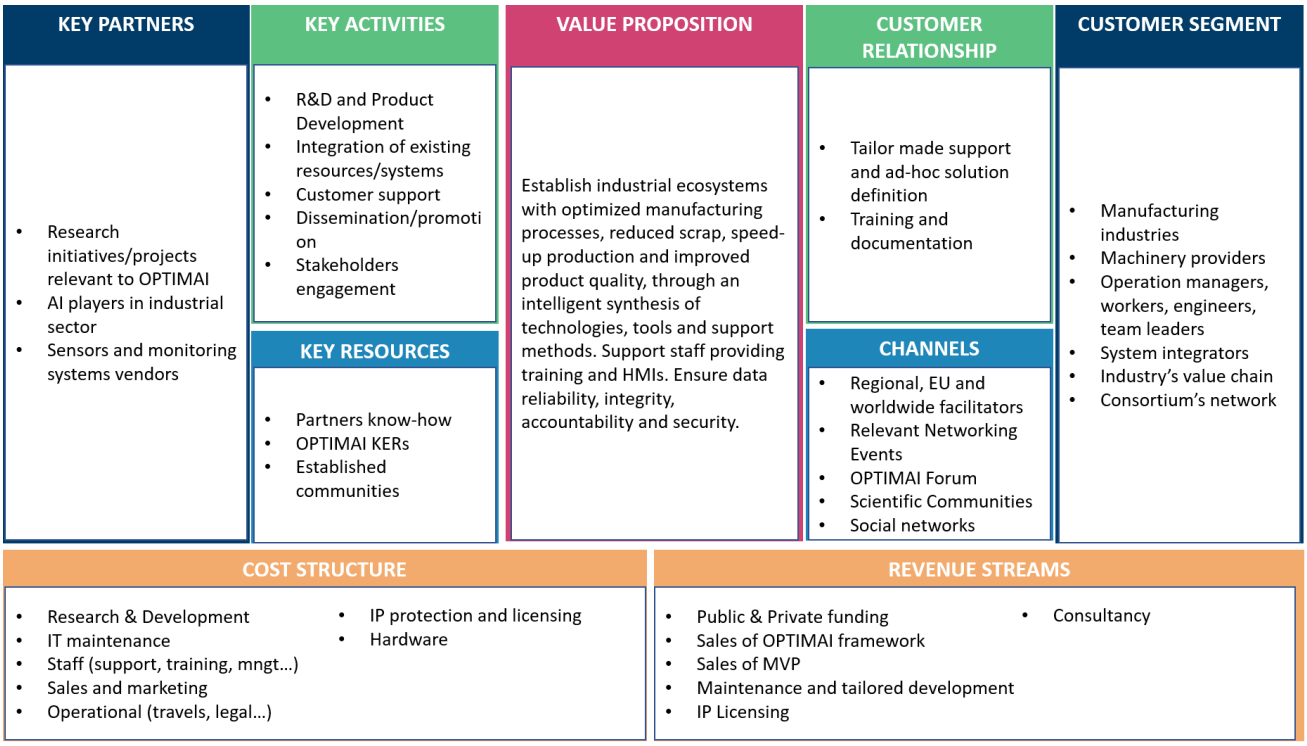

Figure 2-7: OPTIMAI Business Model Canvas

2.5.4 Next steps towards a concrete Business Model

The areas of interest to achieve the final Business Model have been already listed in Figure 2-6 under the Development, Market and Maintenance steps.

The four macro-categories to focus on are:

1. Outcomes from dissemination activities: the feedback received from the stakeholders will be valuable insights on their actual expectations mainly in terms of product and agreements.
2. Continuous monitoring of the technical WPs, to catch at best the features of the solution and translate them towards the appropriate market segment, including an enhanced vision on customer's needs.
3. Definition of possible MVPs i.e., a restricted version of the solution that may be offered to customers as a standalone solution, solving a specific issue.
4. Definition of IPRs and promotion of a draft agreement that could be used by project partners as a Template for future joint exploitation activities.

To ease the communication among the Consortium members and facilitate the sharing of ideas and fears related to exploitation's strategies and activities, in the next months, there will be a workshop entitled '*From the KERs towards a Product*'. Main objectives of the workshop will be:

- Consolidate the customers definitions and the Value Proposition Canvas;
- Define the MVPs and possible specific joint exploitation strategies;
- Discuss about customer-specific Business Models;
- Align the expectations and the outcomes achieved in the first part of the project with the plan and the activities to be executed in the second half in order to be as effective as possible.

3 Catalogue IPR and IPR Assessment

3.1 IP management overview/introduction

By their nature, EU research collaboration projects such as OPTIMAI require sharing of information between the project participants, seeing that the key principle behind it is developing new knowledge by using the existing knowledge of each partner. Defining the existing knowledge, i.e., the "background information", of the partners has a direct effect on the successful exploitation of the results and is one of the first IP management-related steps that were taken in the project. For OPTIMAI, this information is included in the OPTIMAI Consortium Agreement, particularly in the attachment 1, where all partners described their background brought to the project and specific limitations or conditions for exploitation.

Moreover, in the process of elaboration of an IPR catalogue it is important to define and assess the project results. In this regards, EC defines Results as "Any tangible or intangible output of the action, such as data, knowledge and information whatever their form or nature, whether or not they can be protected, which are generated in the action as well as any attached rights, including intellectual property rights". EC also defines a Key Exploitable Result (KER) as an identified main interesting result (as defined above) which has been selected and prioritised due to its high potential to be "exploited", that can be used and create impact, either by the project partners or by other stakeholders. The prioritization of the results is based on the degree of innovation, exploitability and impact.

Based on the statements above, results have to be defined in order to perform a selection of the key exploitable ones. Project results examples are presented in the next figure:

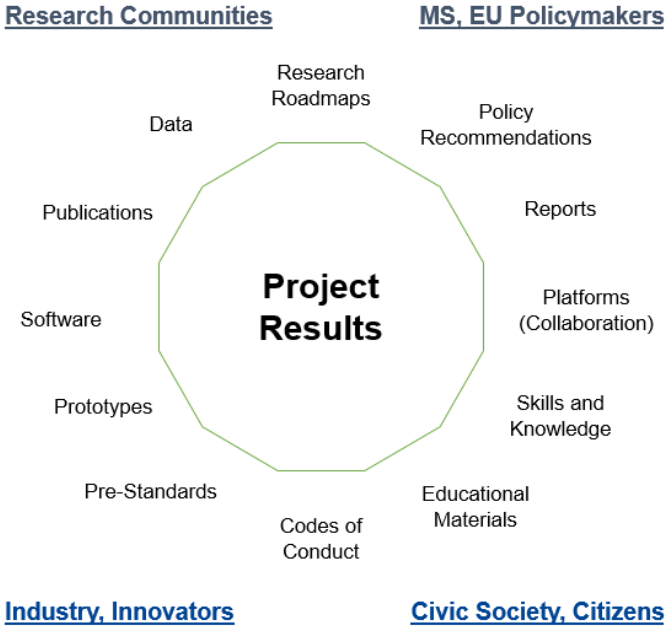

Figure 3-1: Project results examples

Other Project Results examples can be: hardware, framework, network, technology, process, agreement, service, guideline, methodology, documentation, publication, reference architecture, etc. All partners should have at least an individual result that is a project outcome for them, a benefit obtained from the project; this is also linked with the individual exploitation plan referred in section 2.3 of the deliverable.

Some of these key exploitable results are applicable for IPR. Intellectual Property Rights (IPRs) are legal rights that protect creations and/or inventions resulting from intellectual activity in the industrial or scientific field in this case. The most common IPRs include patents, copyrights, marks and trade secrets.

- Patents: any invention having a technical character, a novelty (not publicly known), that involves an "inventive step" and it is susceptible to industrial application.
- Copyrights: does not protect facts, ideas, systems, or methods of operation, but instead protects the way that these things are expressed; it protects fixed, tangible mediums of expression that can be reproduced.
- Licences: contracts with users, developers, distributors that depend on a licence that includes an authorization to use an IP protected product under certain agreed terms and conditions.
- Trade secrets: best IP protection. Secret not generally known among or readily accessible to persons that has commercial value and is subjected to measures in order to keep it as secret.

Intellectual property management is key to the successful implementation of collaborative projects and to maximising the impact of their results. Moreover, the protection of intellectual assets is essential to the competitiveness of most organisations, private or public, and to their attractiveness for investors.

3.2 IPR Catalogue

During the initial phase of the project an Exploitable Result repository was set to work as a live table to fill information about the results that will be obtained by partners with the intention of obtaining a first version of those that have a high degree of innovation, exploitability and impact (Key Exploitable Results); the ones that might be applicable to IPR.

In the Section 2.2 of this document there are listed the so far identified Exploitable Results from OPTIMAI. Some of them were identified as potential ones since the conception of the project, others have been better defined and new ones are added to the list as well. From this list, the following assets have been identified as feasible for IP by the partners:

Table 3.2-1: IPR catalogue of assets

Name	Lead Partner	Type	Foreseen IPR strategy (if any)	Sole owner or co-ownership
Integrated OPTIMAI platform	CERTH	Software, Hardware	Copyrighted	Co-ownership
Blockchain framework	CERTH	Framework	Copyrighted	Co-ownership
Industrial vision sensors with AI-processing and seemless process integration	EVT	Software, Hardware	Patents	EVT will be sole owner, but still TBD

However, as can be stated in the IPR repository table many of the assets definition in terms of IPR are still to be defined as the development of the assets evolves and materializes.

3.3 IPR Questionnaire

With the objective of having a common understanding among partners on the project results, KERs, FTO and IPR, a questionnaire will be shared. Its objective is to expand on the information of the repository table. Questions are the following:

- What tangible or intangible output(s) are you getting from the project?
- That tangible or intangible output is what we call result. Can the result be exploited or not?
- Are you the leader of the output (result) or you are a contributor of the result led by other partner?
- In regards to FTO, do you have the freedom to develop, test and market this result? How so? (e.g., the prior developments that will be used as a base for the development of the result were built in-house, you are proprietary, you own the licence of the solution or you use open-source tools and solutions, libraries from other owner, etc.)
- The result will be finalized in the project or will require further development?
- There is a similar result on the market?
- What is the innovativeness of the result?
- What is the impact of the result?
- What will be the IPR strategy to exploit the result? (Patent, copyrights, licences, trade secrets)
- Indicate target stakeholders within the project and external ones (target market)
- Sole owner or co-ownership?
- It will be an individual or joint exploitation?
- How will you exploit the result? (Licensing, start-up, join venture, outright sale)
- What are the foreseen risks that might affect the exploitation of the result?

Additional material has been prepared in relation to this (ppt format) to be shared with the partners.

3.4 IPR Assessment, Conclusions, Next steps

Project is advancing according to the plan. IPR, although it is a matter that should start to be addressed since the beginning of the project, it is more defined from the middle of the project to its end as the solutions and their actual scope are more defined. IPR strategy for the project have been focused on data gathering from all partners to: generate the IPR catalogue of the project (live table that is under continuous update), identify joint developments (joint results), form the basis to analyze in depth each exploitable result.

As next steps, more information on how to approach the identification of results, the FTO, targeted stakeholders and IPR strategy will be provided to the Consortium. Additionally to this, there will be a focus on the joint exploitable results and their IPR strategy.

4 Standardization activities

4.1 Overview

This section documents the industrial and technical standards that are applied in OPTIMAI. The information bases on a survey that has been done in February and May 2022. All project partners have been asked about industrial and technical standards they comply during their work, challenges when applying these standards and if they see any need to improve the standards. Also active membership in organizations was asked. The final question if any results of OPTIMAI may become part of a standard is investigated throughout the project and will be focussed in the final version of this deliverable. Table 4.1-1 lists all standards that have been reported until May 2022.

Table 4.1-1: Industrial and technical standards applied in OPTIMAI

Standard	Partner that work with the standard	Member of organization	OPTIMAI work packages
Smart data models	UPV, ENG, FINT		WP4: T4.2 WP3, T3.1
OPC UA/OPC UA companion specifications	CERTH, ENG, EVT, FINT	EVT: VDMA, OPC UA Vision	WP3, T3.1 WP4, T4.3: Defect detection& prediction
PROFINET	CERTH, EVT		WP3
TCP/IP	CERTH		WP4, T4.3
RabbitMQ	CERTH		WP5, T5.1 Instance Segmentation-Pose Estimation
Ethereum	CERTH		WP3,T3.5 Blockchain
IST/31 UK BSI National Committee on Immersive Technologies	YBQ		WP5-T5.2,T5.3; WP7-T7.3,T7.4,T7.5
QIF 3.0	UNIMET	UNIMET:DATAPIXEL	Tasks 2.3, 3.1, 3.6, 4.3, 6.3, 7.5
RAMI 4.0	FORTH		WP2
IIRA	FORTH		WP2
FIWARE foundation	ENG, FINT	ENG, FINT: FIWARE foundation	
Common industrie standards, such as ISO 45001, ISO 9001, ISO 14001	Several partners (e.g TVES)		All
GenICam	EVT	EVT:EMVA GeniCm	WP3, T3.1

MQTT	EVT, FINT		

4.2 Summaries of the Standards

This section summarizes the results of the survey for each of the standards that have been mentioned. The subsequent subsections debate the following questions for each of the standards.

4.2.1 Smart data models

4.2.1.1 Description of the standard

Since the early days of FIWARE, a standardization effort has been done to create official FIWARE Data Models in multiple application domains such as smart cities or smart sensoring. These data models were designed following a set of guidelines defined by the community. However, they are now deprecated and now the community is encouraging the use of the Smart Data Models.

The FIWARE Foundation IUDX, TM Forum and OASC and other entities to join, are leading a joint collaboration program to support the adoption of a reference architecture and compatible common data models that underpin a digital market of interoperable and replicable smart solutions in multiple sectors, starting with smart cities.

Instead of a classic standardization approach, this initiative uses an open de-facto standardization which is much faster than the classic one. The usual review period for a standard is four years (this, in terms of the data market, is an eternity). However, the agile methodology allows quick reviews, avoiding the creation of theoretical standards that are never used in practice.

Very briefly, the Data Models Lifecycle has three phases:

- First of all, data models are incubated. During the incubation period, they are elaborated by the users.
- Secondly, during the harmonization, the data models are accepted but they are in progress to complete some of the mandatory elements.
- Lastly, the data models are made official.

4.2.1.2 Reasons for the standard

The inclusion of OPTIMAI data models in the Smart Data Model Initiative would contribute to the creation of a global digital single market of interoperable and replicable (portable) smart solutions. In this specific case, OPTIMAI would contribute to the creation of a smart Manufacturing domain data model.

4.2.1.3 Challenges

The challenges are that there are not yet too many models available.

4.2.1.4 What could be improved

The domain repository for smart data models related with Manufacturing have just started at the beginning of 2022. For the moment it only includes 3 entity types. So, OPTIMAI can provide multiple model entities that have not yet been included or considered.

4.2.2 OPC UA

4.2.2.1 Description of the standard

OPC Unified Architecture (OPC UA) is a cross-platform, open-source, IEC62541 standard for data exchange from sensors to cloud applications developed by the OPC Foundation. Among distinguishing characteristics, we have: extensible data model with rich ecosystem of modelling tools, standardized data models freely available for over 60 types of industrial equipment, published by the OPC Foundation via Companion Specifications, extensible security profiles, including authentication, authorization, encryption and checksums, support for both client-server and publish-subscribe communication patterns.

4.2.2.2 Reasons for the standard

The evaluation of this standard is work in progress in order to identify which industrial partners could benefit of it according to the operational equipment they use.

The following benefits have been mentioned: Devices can be discovered in the network. Clients can determine whether OPC Servers are available on local PCs and/or networks.

All data is represented hierarchically (such as folders and files), allowing OPC Clients to discover and use simple and complicated structures, so the address space is comprehensive. Data is available on-demand: based on access rights, information and data can be read or written.

OPC UA provides synchronous and asynchronous communication. Asynchronous communication can be done via subscriptions to track data/information and provide exception reports when values change based on a client's specifications.

In terms of security, OPC UA is firewall-friendly, and it addresses security concerns with a set of controls.

4.2.2.3 Challenges

The following challenges have been mentioned for OPC UA: Complicated configuration: it has been considered for being inflexible and difficult to implement when dealing with a variety of data structures. Also, there are device-specific constraints, concerning the lack of support for technologies such as Electronic Signature, Enhanced Failover, and historical data sources.

4.2.2.4 What could be improved

The standard could improve with standardized data and processes to facilitate implementation in different actors. On the other hand, there exist the so-called companion specifications, that exactly are used for this.

4.2.3 Profinet

4.2.3.1 Description of the standard

PROFINET is an industry technical standard for data transmission over Industrial Ethernet based on international standards. It is designed to transfer data among controllers and devices in industrial systems, with a particular facility in data delivery under time limits. It is the most well-adopted Industrial Ethernet solution.

4.2.3.2 Reasons for the standard

The standard is suggested to be used in project due to its flexible network topology. It is worldwide available, most PLCs implement it as a default protocol. Functional safety is deeply integrated, and all in all it allows uniform integration on fieldbus system. The standard rather be used on field level communication instead of accessing higher levels of the environment.

4.2.4 TCP/IP

4.2.4.1 Description of the standard

The Transmission Control Protocol/Internet Protocol (TCP/IP) is a set of communication protocols used to send and receive data over the Internet. TCP/IP is a two-layer network protocol. Data is taken apart into smaller packets by the upper layer Transmission Control Protocol, which is then transferred across the Internet and received by a TCP layer, which reunites the packets into the original data. Each packet's address is handled by the bottom layer Internet Protocol, ensuring that it reaches its intended destination.

4.2.4.2 Reasons for the standard

TCP is used in the TCP IP model and allows the data transmission between applications and devices, that all share a network. Its aim is to separate a message into smaller data packets so that it reaches its intended destination successfully and as rapidly as possible. A significant advantage of TCP/IP is that is able to recover from the malfunction of any network devices, in an automatic way.

4.2.4.3 Challenges

TCP has been designed to efficiently transfer huge amounts of data across a long-lived point-to-point connection with no strict latency requirements. Because most IoT connectivity includes only a tiny amount of data, the cost of establishing a connection is restrictive. TCP is not a generic product. As a result, different protocols cannot be replaced in an easy way in TCP/IP model. It cannot, for example, define a Bluetooth connection.

TCP/IP was created to serve the usage in wide-area networks (WAN). It is suboptimal when is used in tiny networks such as LANs (Local Area Networks) and PANs (Personal Area Networks).

4.2.5 RabbitMQ

4.2.5.1 Description of the standard

RabbitMQ, often known as a message broker or queue manager, is a message-queuing software. It is the part of software that defines the connection of the queues to specific programs in order to be sent a message or a series of messages. The messages are stored in the queue-manager software until a receiving application connects and removes a message from the queue. The message is subsequently managed by the receiving application.

4.2.5.2 Reasons for the standard

Message queueing helps web servers to react to requests rapidly rather than having to perform resource-intensive procedures on the fly, which can cause delays. Message queueing is also useful for distributing a message to several recipients or balancing workloads across workers.

4.2.5.3 Challenges

The following challenges have been mentioned concerning RabbitMQ: Problems with long queues. The use of RAM is heavily load when there are many messages in a queue. The system will need to page out messages to the hard disk to free up RAM. An unlimited prefetch value, where one client receives all messages is also a challenge. This can lead the client running out of memory.

4.2.5.4 What could be improved

The queue needs to be kept short. Queues that are not used, need to be deleted. An improvement could be to limit the queue size with TTL (Time-to-Live).

4.2.6 Ethereum

4.2.6.1 Description of the standard

Ethereum is a distributed computing platform based on blockchain that can be used to create and run decentralized applications or smart contracts. The Ethereum Virtual Machine (EVM) is at the heart of Ethereum, and it can execute codes of any algorithmic complexity. In addition, it offers a peer-to-peer protocol for the blockchain.

4.2.6.2 Reasons for the standard

In OPTIMAI a private Ethereum is used. So the access is limited. The standard provides a role-based access control. Smart Contracts and Proof of authority can be used.

4.2.6.3 Challenges

The challenges in Ethereum Platform are i) gas fee price and ii) use a lot electricity with the Proof of Work consensus mechanism.

4.2.6.4 What could be improved

Private Ethereum has not gas fee and we will use Proof of Authority consensus mechanism so there will be not so much use of electricity.

4.2.7 IST/31 UK BSI National Committee on Immersive Technologies

4.2.7.1 Description of the standard

Under the direction of the Standards Policy and Strategy Committee, IST/31 is responsible for developing standards for immersive technologies (AR/MR/VR and XR), and for contributing to the work of ISO/IEC JTC 1/SC 24 developers of such standards as: Augmented reality continuum presentation and interchange, Augmented reality continuum concepts and reference model and lastly, all matters of health, safety, security and usability of these technologies.

4.2.7.2 Reasons for the standard

The OPTIMAI partner Youbiquo has been involved by BSI as domain experts in AR technologies as one of the few companies across Europe manufacturing AR glasses.

4.2.7.3 Challenges

The standard is under development. Major challenges are related to the definition rules in compliance with de facto standards yet adopted by major AR devices manufacturers, checking compliance with national law for employee's safety.

4.2.7.4 What could be improved

The standard will be completely defined in October 2023. Thus, there will be time to refine proposal. First draft is expected to be submitted for review within 2022.

4.2.8 QIF 3.0

4.2.8.1 Description of the standard

QIF 3.0 is a standard which supports Digital Thread concepts in engineering applications ranging from product design through manufacturing to quality inspection (metrology). Based on XML, QIF contains a Library of XML Schema ensuring both data integrity and data interoperability in Model Based Enterprise implementation. Critical to the Industrial Revolution 4.0. It can be easily integrated with Web/Internet applications.

4.2.8.2 Reasons for the standard

The data relevant to each partner must be intelligently organized and communicated. In OPTIMAI, QIF is used to communicate the results from the measurements during quality control and defect detection processes as it seamlessly defines, organizes, and associates quality information. QIF is a fully digital standard for metrology information.

4.2.8.3 Challenges

Partners involved with outputs/inputs in concordance with QIF must be familiar to QIF ontology, structure and their software components must be able to read XML files.

4.2.8.4 What could be improved

Continuous discussion is held by the committee (DATAPIXEL is member) for the seek of improvements, but the topics are not relevant for OPTIMAI at this point.

4.2.9 RAMI 4.0

4.2.9.1 Description of the standard

The Reference Architectural Model Industry (RAMI) 4.0 is a framework for defining a common picture, terms and rules for describing requirements and structures regarding different smart factory use cases of I4.0. RAMI 4.0 breaks down the most critical elements found in the Industry 4.0 environment into a three-dimensional coordinate system, whose axes correspond to: (i) the hierarchy levels of a connected manufacturing system; (ii) lifecycle of systems and products, including both development and maintenance; and (iii) different perspectives (or I4.0 components) in a smart factory.

4.2.9.2 Reasons for the standard

The alignment to the aforementioned standards delivers a foundation for implementing the OPTIMAI framework in accordance with the RAMI 4.0 and IIRA specifications. Through this process, specific cross-cutting system aspects, such as inter-communication of components, integration and interoperability, can be addressed in a more harmonised manner, applying the principles reported in the documentation of the two reference architectures (for more information, see D2.4).

4.2.9.3 Challenges

RAMI 4.0 is a generalised framework which does not provide implementation guidelines.

4.2.9.4 What could be improved

OPTIMAI can showcase a pragmatic implementation of RAMI 4.0 in the context of zero-defect manufacturing and zero-waste production planning.

4.2.10 IIRA

4.2.10.1 Description of the standard

The Industrial Internet Reference Architecture (IIRA) establishes a common reference frame for the development of Industrial Internet of Things (IIoT) solutions targeted at modern smart factories in different industrial verticals.

4.2.10.2 Reasons for the standard

The alignment to the aforementioned standards delivers a foundation for implementing the OPTIMAI framework in accordance with the RAMI 4.0 and IIRA specifications. Through this process, specific cross-cutting system aspects, such as inter-communication of components, integration and interoperability, can be addressed in a more harmonised manner, applying the principles reported in the documentation of the two reference architectures (for more information, see D2.4).

4.2.10.3 Challenges

No challenges have been mentioned.

4.2.11 GenICam

4.2.11.1 Description of the standard

The goal of GenICamTM (Generic Interface for Cameras) is to provide a generic programming interface for all kinds of devices (mainly cameras), no matter what interface technology (GigE Vision, USB3 Vision, CoaXPress, Camera Link HS, Camera Link etc.) they are using or what features they are implementing. The result is that the application programming interface (API) will be identical regardless of interface technology.

4.2.11.2 Reasons for the standard

Leading industrial vision camera and software manufacturers cooperated to develop this standard. It is possible to develop vision applications much quicker and to reuse source code for other projects with different cameras and sensors, and even to use one API for different camera interfaces.

4.2.11.3 Challenges

GenICam consists of many sub protocols, that all have a big complexity. The aim is nothing else than providing a model for all use cases of image acquisition of industrial vision.

4.2.12 MQTT

4.2.12.1 Description of the standard

MQTT is a lightweight publish-subscribe network protocol for the scope of sending and receiving messages. Although MQTT is mostly used in combination with TCP/IP, it can be used with any network protocol that enables ordered, lossless, bidirectional communications. It serves remote communications when there are limitations in the resources or in the network capacity. The protocol is an ISO recommendation (ISO/IEC 20922) and an open OASIS standard.

4.2.12.2 Reasons for the standard

MQTT runs on top of the TCP/IP network stack and is designed for low-bandwidth, high-latency, and unreliable networks. Thanks to the properties of MQTT, it is considered to be adequate for transferring large amounts of sensor data to analytics platforms and cloud applications.

4.2.12.3 Challenges

MQTT doesn't cover the encryption method for security. MQTT is mostly unencrypted, despite the fact that it uses Transport Layer Security/Secure Sockets Layer (TLS/SSL). Creating a worldwide scalable network using the MQTT protocol is more challenging than with other protocols due to the single broker architecture.

4.2.12.4 What could be improved

For IoT and sensor networks some possible improvements have been mentioned. With Software Defined Authorization (SDA) the username/password login can be replaced using Single-Packet Authorization (SPA). SPA "hide" the receiving device so that hackers cannot see it. When a device is unable to use encryption, having an SDA allows for device concealing and prevents a hacker from collecting the username or password.

4.3 Results of OPTIMAI that may lead to new standards

4.3.1 Blockchain framework

OPTIMAI blockchain framework can contribute to the extension of industrial process standardization in terms of data traceability and integrity in shop floor sensors networks. We want to create a generic prototype that it can be applied to a variety of factories and industrial sectors.

With blockchain all the critical information that will be collected from the sensors, will be stored, the firmware will be validated, AI models will be verified and there is going to be access control.

UPV: The inclusion of OPTIMAI data models in the Smart Data Model Initiative would contribute to the creation of a global digital single market of interoperable and replicable (portable) smart solutions. In this specific case, OPTIMAI would contribute to the creation of a Smart Manufacturing domain data model.

4.3.2 Hand gesture recognition for IST/31

Youbiquo mentioned the hand gesture recognition definition activities could serve as part of user experience and usability section of the IST/31 standard.

4.3.3 Smart Data Models

Partners have decided to aim to include data models that will be developed in OPTIMAI into the Smart Data Model Initiative. This would contribute to the creation of a global digital single market of interoperable and replicable (portable) smart solutions. In the specific case, OPTIMAI will contribute to the creation of a smart manufacturing domain data model.

5 Conclusions

The current deliverable is the second version out of three of the OPTIMAI Commercialization and Exploitation Strategy. It updates the previously defined KERs and individual/joint exploitation plans and provides the up-to-date status of the overall exploitation roadmap including the primary stakeholders' definition, the OPTIMAI exploitation value proposition and the business model canvas. The document also includes the IPR assessment and the activities around possible standardization opportunities.

The tools set up in the first part of the project will be maintained also in the second half of the OPTIMAI project lifetime and further workshop and focus groups with possible stakeholders are already on the roadmap. The outcomes of these activities as well as the final version of the business plan will be reported at M36 (December 2023) in *D8.8 - OPTIMAI commercialization and exploitation strategy – 3rd version.*

Annex I - KERs Repository Template

Description	Please insert the description of the asset
Lead Partner	Please indicate the leading partner
Contributing Partners	Please indicate the partners contributing to the asset
Relevant WPs	Please indicate the WPs relevant for the asset
Relevant Deliverables (if any)	Please indicate the deliverables relevant for the asset
Completeness (%)	Please state the percentage of completion at the time of writing
Expected Delivery Date	Please indicate the expected delivery date
Type	Software, Hardware, Framework, Service, Guideline, Methodology, Documentation, Reference Architecture, etc…
Expected TRL by end of the project	Please indicate the expected TRL reached by the end of the project
Link (if applicable)	Please insert the link to the asset
Target stakeholders	Please indicate the target stakeholders of the asset
Foreseen IPR strategy (if any)	Please indicate the foreseen IPR strategy (Copyrighted, Service, Licensed, None) if applicable
Sole owner or co-ownership	Please indicate whether it will be a sole owner, co-ownership
"FTO - Freedom-to-Operate"	Please indicate the FTO or right to use for the asset (freedom to test, market, sell the product or service in a specific area)
Individual or joint exploitation	Please state if the asset will be exploited individually or jointly or use this column to state a possible joint exploitable result.
Identified Risks	Description of the risks identified so far for the success of the KER.

Annex II – Individual Exploitation Plan Update

Centre for Research and Technology Hellas - Information Technologies Institute (CERTH-ITI)

Partner Profile

CERTH as a research organization is primarily interested in promoting science and generating new knowledge. CERTH has extensive experience in large-scale research projects particularly in Industry 4.0. As the coordinator of the project, it leads WP1 for project management and WP6 for "Decision support and system integration" while having horizontal contribution in all other work packages. As a computer science research centre, CERTH is mainly involved in the development of AI methodologies for zero defect manufacturing and decision support. CERTH is also the main contributor in the blockchain framework that will be developed for OPTIMAI end-users. CERTH is a non-profit organization, thus it cannot directly commercialize the developed technology but its main exploitation route, is the gained expertise and knowhow that is transferred in other research initiatives and disseminated in high impact scientific publications. This way CERTH can enhance its track record in research and innovation and create new synergies with public and private organizations. An alternative way of exploitation is through spin-off companies involving the main scientific personnel working the project that can commercialize research results either directly or as part of a joint venture.

Identification of opportunities

An important opportunity for CERTH in order to improve its positioning with respect to other research organizations, can be pinpointed in the blockchain platform that is currently developed. This platform will enable the secure connection of Web / Cloud Platforms with a private Ethereum Blockchain, allowing for efficient permission management for collected data. The blockchain can be used and extended in OPTIMAI to enable the immutable recording of: i) AI system choices in the context of Trustworthy AI; ii) operators actions allowing for traceability of upstream causes of particular production outputs.

AI analytics algorithms for zero defect manufacturing is another opportunity for CERTH as it will enhance its research portfolio for the detection and prediction of defects thus enabling their prevention and containment before they are propagated in the next production phases. Through its involvement in different pilot sites CERTH will create complementary AI methods for zero defect manufacturing thus expanding its AI portfolio for Industry 4.0 and facilitating the delivery of AI solutions for different industrial sectors.

CERTH is also involved in the interaction and visualization of results to the operator through AR gear and the proposed Decision Support framework. This technology can be used to improve workers productivity by carrying out equipment calibration and inspection tasks faster and in a more efficient way. This can lead to new ways of interaction between workers and production equipment that can be expanded to other industries as well.

Addressable Market

Target audiences for CERTH can be divided in two categories. The first one is the scientific and research community that will be reached through high impact scientific publications with the goal being to enhance CERTH scientific profile and publications track record. The second one are industries and R&D industrial groups that can use OPTIMAI technology in their shopfloors and manufacturing processes. Of course, as OPTIMAI focusses on specific industries, it is closer to the markets of microelectronics, antennas and lift manufacturing but the solutions under development are designed so that they can be generalized in other sectors as well.

Value propositions

The pilot demonstrations of the project will verify the value of the results, allowing end-users to evaluate the developed technology and provide their feedback. Prior to the demonstrators, each technology will be individually developed and tested using offline data collected from each factory. Concretely for the blockchain framework, the first step is to identify the actions and events that should be recorded in the ledger and then proceed with basic test net implementations that will evolve as project progresses. Eventually the blockchain framework with be connected to the OPTIMAI middleware to record and verify ongoing transactions. The basic value proposition for end-users is to enable full traceability over specific courses of actions that lead to particular production outputs that will also facilitate root cause analysis for critical events in the shopfloor, like the cause of a defect that has appeared or the malfunction of a machine.

Regarding AI analysis, its value proposition can be summarized in the minimization of defects and production downtime. The first step to this end is the in-lab study of defective parts in order to understand the type of defects and determine the most appropriate sensors. Afterwards, AI models will be trained for defect detection and prediction while appropriate sensors will be integrated in the shopfloor and connected to the OPTIMAI middleware. Having established this testing infrastructure, the AI models will be fine-tuned and we will proceed to demonstrators' phase where the OPTIMAI AI solutions will be verified in operational environment by the project end-users. The industry partners of the project are planned to be the early adopters of the developed technology, but other industries will be contacted through the outreaching activities of WP8.

Finally, CERTH proposes new ways for the interaction of operators in the shopfloor and production equipment. Concretely, computer vision techniques will be developed to understand operators' actions and intentions and then send appropriate actuation signals that will speed up and facilitate production setup tasks. At the same time a Decision Support framework is developed to forward AI results and provide suggestions to workers. To accomplish this, the first step is to document the operators' actions that should identified and generate training datasets according to defined gestures and signals. Afterwards, actuators will be interconnected in laboratory with the outputs of computer vision modules in order to ensure high precision and recall before actual deployment. Analysis will be performed on the video signal of the AR glasses, having a user-centric viewpoint. Decision support outputs will be visualized in the AG glasses and end-to-end tests will be carried out in the laboratory. The next step is to train end-users in these new ways of interaction and perform small scale pre-trial tests, before proceeding to the

final pilot demonstrators. The value proposition of CERTH is to increase productivity of workers by enhancing their situational awareness, providing a complete view of a particular process, and relieving them of menial tasks for setup and calibration that can be automated through the actuation network.

Future Intelligence Limited (FINT)

Partner Profile

Future Intelligence (FINT) is a leading and highly innovative Group of Companies specialising in Information and Communication technologies (ICT). The Group was initially established in Greece in 2009, is privately held and its main facilities are located in Greece, the United Kingdom and Cyprus. FINT provides highly demanding solutions and business services covering a number of activities, in the fields of long-range communications (WiMAX, LTE, 5G), short-range communications (WSN, M2M, IoT), and Future Internet (distributed cloud environments, artificial intelligence).

FINT is one of the leading IoT devices manufacturers in Europe. The company's objective is to build an IoT-enabled ecosystem which can expand horizontally and vertically providing a playground for vendors, OEMs and software engineers. The main platform that FINT provides is commercialised under the name FINoT®.

Current commercial and research activities include next generation networks (network virtualisation), sensor adaptation and data interpretation techniques, data mining and data provision through cloud-based applications, distributed computing techniques (EDGE computing) and big data analytics.

In addition to contributing to breakthrough and innovative scientific research through its RnD facilities (FINT Labs) in Greece (Athens: IoT manufacturing, Heraklion: Cloud Infrastructure and services), the United Kingdom (London: PCP, FPGAs, Heterogeneous Processing, Intelligent Surveillance), and in Cyprus (Limassol: AI, Blockchain, etc). Related to the above fields, the focus is to pitch in with other players in order to produce innovative and original products and services.

The company itself and its core personnel have participated in key roles in more than 50 EC co-funded R&D projects (FP6, FP7, INTERREG-MED, SEE, LIFE, PRIMA, H2020) in the domains of ICT, TRANSPORT, HEALTH, SECURITY, ENVIRONMENT, AGRICULTURE and DT.

Identification of opportunities

FINT has significant experience in Industrial automation projects. Through introduction of FINoT platform to the project, several developments of OPTIMAI had been identified as main commercialisation opportunities for the company. Specifically, FINT provides as a commercial solution a middleware service that can incorporated knowledge, data, algorithms from heterogeneous sources and can be used from its clients using it in Smart Cities, Smart Agriculture, Smart Infrastructure and Industrial Automation for Manufacturing domain. Moreover, FINT is one of the first companies in Europe which provided a marketplace for services and data sharing using a complete FIWARE-based platform along with a Marketplace creator for

virtualisation function deployment and operation at FPGAs accelerating platform. The work that FINT undertook in OPTIMAI will definitely help to further develop its solutions and show case its capabilities to industrial parties.

Addressable Market

Currently, the Core FINoT Platform – which will be the foundation upon which the OPTIMAI middleware platform will be built – is commercially used in the domains of smart cities and smart infrastructures. Through the expansion and enhancement of the platform to satisfy the needs of the OPTIMAI project, FINT will be in an advantageous position of being able to bring this innovative technology into the industrial domain, a market which the company have strategically aimed to penetrate.

The marketplace will also expand the company's know-how and expertise in the software domain, as the already market available company's solutions in the smart cities/infrastructure domains.

Value propositions

FINT is following OPTIMAI project activities, trying to establish three concurrent exploitation channels: (a) Establish license-based collaborations with other participants by providing parts of FINoT platform; (b) License FINT's developments in terms of middleware and marketplace to other partners of the consortium as well as to other parties outside of it; (c) Participate in joint ventures with other partners, promoting common developments.

Foundation for Research and Technology Hellas (FORTH)

Partner Profile

The Foundation for Research and Technology-Hellas (FORTH) is one of the larger Research Centres in Greece, employing highly qualified personnel and an internationally acknowledged reputation as one of the top research institutions in Europe. In particular, FORTH's Institute of Computer Science (ICS) is focused on: (i) conducting basic and applied research; (ii) developing applications and products; (iii) providing services; and (iv) pursuing and maintaining leadership both nationally and internationally, in the fields of Information and Communication Technologies (ICT).

ICS-FORTH is represented in OPTIMAI by The Human-Computer Interaction (HCI) Laboratory, an internationally recognised centre of excellence, conducting research regarding critical domains such as Human-Computer Interaction, Universal Access, Computational Vision, Artificial Intelligence, Semantic-based Knowledge Systems, Robotics, Networks and Telecommunications, Distributed Systems, Microelectronics, etc. The activities of the Laboratory include among others the design of human-centric smart environments, the development of ambient intelligence technologies, and the assessment of those technologies' impact on both the individual and societal levels. The Laboratory has extensive expertise in the implementation of large-scale National and EU-Funded research and innovation activities, with a well-known profile, particularly regarding the technical management of international project networks and activities

involving academic and industry partners. In OPTIMAI specifically, regarding the system implementation, ICS-FORTH is in charge of both the integrated AR environment development for the on-the-fly production (re)-configuration; as well as Graphical User Interfaces (GUIs) and HCI modules.

Activities of ICS-FORTH address important research and development areas, encompassing new perspectives, emerging fields of research and technological challenges. In its continuing efforts to exploit its research activities and results, the Institute contributes significantly to the diffusion of modern ICT solutions in both the public and private sectors, acting as a catalyst for the creation of an Information Society acceptable by all citizens. As such, ICS-FORTH has an extensive track record of commercially relevant research, which has notably led to several patents, successful start-ups, and important technologies used by ICS-FORTH partners worldwide.

Identification of opportunities

FORTH identifies the Augmented Reality framework and applications it will develop in the context of Task 5.2 (e.g., defect detection analysis; remote manipulation via gesture-driven input; etc.) as the component with the highest exploitation potential out of its contributions to the project. The components for rendering and AR interaction are seen as relevant for both (i) improving internal ICS-FORTH research and training activities, capitalizing on the gained experience toward forming future collaborations within the HORIZON framework promoting the group's speciality with AR using the proven track record of applying these tools in manufacturing domain in the context of OPTIMAI; and (ii) seeking to diffuse products of OPTIMAI cutting-edge research to various vertical domains and potentially interested buyers (see Section below). The following assets will be examined more closely throughout the project to assess exploitation possibilities:

On-the-fly reconfiguration of production equipment: The unique contribution of this module lies in the combination of a wearable visualisation solution for defect inspection and analysis with cutting-edge AI approaches for fault detection and defect prediction. The added capacity for operators to reconfigure equipment parameters using gestures is expected to be of significant interest to the target audience, particularly in cases where human presence is deemed too dangerous for enabling manual operations. This will be possible through an integration of sophisticated computer vision algorithms used for recognising and detecting gestures, which (as an independent module) may also find application in other domains, such as accessibility (e.g. sign language interpretation) and other interesting natural interaction use cases (e.g., in hands-free virtual reality scenarios).

Addressable Market

FORTH's target audience includes research and academia, who are expected to benefit from the contribution of knowledge and evidence regarding the implemented OPTIMAI processes, the introduction of new instruments (e.g., AR) and computing systems in manufacturing and overall advances proposed to the current state of the art. Furthermore, FORTH's solutions will target major national/international manufacturing companies, who may exploit or use the proposed developed products in their manufacturing lines.

Finally, several vertical domains may be identified throughout the project who may have an interest in the proposed AR solution. Initial market research has shown AR tools to be particularly sought after by buyers in the manufacturing industry, but also first responder organisations and disciplines, cultural heritage organisations, the entertainment industry, etc. The potential penetration of the proposed tools in the aforementioned markets will be examined throughout the project.

Value propositions

ICS-FORTH technical contributions to the OPTIMAI project are of significant exploitation interest to the HCI Laboratory. Therefore, ICS-FORTH has structured its exploitation plan on two major pillars.

Of particular importance to ICS-FORTH is the capacity to exploit knowledge generated from its own (as well as other joint research) activities in the project, toward the benefit of improving ICS-FORTH's scientists' and developers' background and processes. Particularly, the knowledge gained from the integration of the solutions and exploitable assets in real, operational factory shop floor environments is expected to significantly enhance the understanding and technical know-how of ICS-FORTH personnel, particularly the people directly involved in project activities, which will allow them to both gain experience in co-creating and approbating of the proposed, as well as future similar products, with a direct consequence being the application of that knowledge toward future collaborative Research and Development (R&D) activities.

The second pillar of FORTH's exploitation strategy lies in the publication of its results in high-profile, high-impact venues for dissemination, such as high impact factor journals and premiere international conferences. Targeting the research and academia group, FORTH expects to benefit from the usage of the scientific discoveries, measured using the relative rate of citation index of its project-related publications.

EVT Eye Vision Technology GmbH (EVT)

Partner Profile

EVT develops hardware and software for machine vision solutions. Standard Software (ready to use) for integrators and OEM customers as well as specialized sensors and light systems to realize solutions for special markets. EVT was established in 2007 with a clear focus on standard products for the machine vision market. EVT is a Manufacturer of machine vision software for VisionSensors, SmartCameras and PC Systems. EVT's main product is the EyeVison software, the one software for all Hardware Platforms.

The early beginnings last back to 1999 where Michael Beising, a student at KIT (Karlsruhe Institute of Technology) with the clear idea to create "easy to use" software for machine vision solutions first developed the software. The idea was to enable even a layman to create complex machine vision solutions, using a fast time-to-market approach.

A few years later, based on the needs of customers, EVT also started to develop specialised hardware for machine vision solutions. This is mainly hardware that can't be found on the

market, or that enables the market access for the EyeVision Software based on suitable hardware for this target markets.

In the meantime, the software has been sold either as a stand-alone solution or integrated in embedded systems in original equipment manufacturer (OEM) machines.

Today the focus is on enabling the power of the new technologies to the customers, such as 3D, Thermal, Hyperspectral imaging, but also the latest Deep Learning technologies.

EVT's role in OPTIMAI:

EVT contributes in activities related to hardware and software development as well as for machine vision solutions. EVT brings their expertise in vision sensors into the Task 3.1 Multisensorial data acquisition and actuation network where it plans to develop components that can be used in the specific scenarios.

This implies the development of software components (cloud/edge architecture specific middleware) and the integration of developed HW and SW components into edge devices (IoT-enabled). EVT will also contribute to the development of the DSF, within OPTIMAI holistic platform. Furthermore, EVT will participate in the demonstration activities supporting the planning, preparation and deployment of adaptive sensorial network technologies in the pilots.

Identification of opportunities

The major strategic goal is to extend the exploitation of their know-how in manufacturing processes. For that, EVT intends to transit the nowadays resource-based, hardware-oriented business models to more skill-based, service-oriented models.

EVT as an industrial partner mainly targets on a broad dissemination and communication of its individual results to their customers. The stakeholders for the dissemination activities involve all customer groups of EVT. Major efforts will be spent to reach the automotive end users and their direct suppliers. EVT will use all dissemination channels available (a) the website and other online platforms (e.g. LinkedIn, YouTube channel), (b) the EVT'S quarterly newsletters, and (c) direct customer contacts at different exhibitions in Europa but also world wide.

Addressable Market

EVT has a broad customer base worldwide. Especially in Germany automotive industries and their direct suppliers have a high demand for direct integration of the systems into their middleware. OPC UA and MQTT are requested but very often only partially realized. EVT sees a big opportunity to help a lot of medium sized customers to transform into a more efficient production process based on the techniques from OPTIMAI.

Value propositions

Results will contribute to improve the development of EVT's standard products. EVT will integrate the gained technology to the products to have an easier way to the markets like semiconductor, automotive, food and pharma and battery industry. EVT will investigate the overall results of the OPTIMAI project and expects to gain from the new relations with project partners.

Visual Components Oy (VIS)

Partner Profile

Visual Components (VIS) is recognized as a global leader in the manufacturing simulation industry and a trusted technology partner to many leading brands in industrial automation. Founded in 1999, Visual Components has been focused on developing innovative 3D simulation and visualization solutions to make factory design and simulation technology easier to use and more accessible to manufacturing organizations of all sizes.

The 3D factory simulation and visualization suite offered by Visual Components consists of innovative tools, which set the standard for modern simulation. The simulation suite gives machine builders, system integrators, and manufacturers worldwide a simple, quick, and highly cost-effective way to build and simulate their total process solutions. With solutions for sales, manufacturing planning and optimization, offline programming, and virtual commissioning, Visual Components software is trusted by hundreds of organizations worldwide to support critical planning and decision-making processes and to build the digital twins of their production facilities.

Visual Components is actively involved in research and innovation activities, participating in several research projects in European and national initiatives, and further developing its simulation solutions. The solutions developed within the projects are targeted to be released as commercial solutions after the end of the projects.

Identification of opportunities

Providing solutions for machine builders, systems integrators, and end-users within the different verticals is the target of Visual Components. The research and development targets of OPTIMAI project targeting developing solutions for creating the digital twin of the manufacturing systems through the system virtualization is aligned with the objectives of Visual Components.

The project is intended to extend the virtualization capabilities of Visual Components 4.0, by extending the interfaces for modelling the manufacturing process. This will facilitate the development of virtual replicas of the manufacturing processes. The capabilities for sensor modelling and virtualization will be enhanced to cover the OPTIMAI's use cases requirements. Machine builders and system integrators will get advantage from the capabilities once introduced in the commercial solutions as the development of virtual production environments will be faster and more reliable. In addition, the extension of the simulation engine to be developed within OPTIMAI will increase productivity for end-users and facilitate the systems integration for integrators.

Addressable Market

Although the use cases covered in OPTIMAI belong to two specific verticals, elevation equipment, and electronics, mainly focusing on two domains of consumer electronics (antennas and PCBs), the solutions developed during the OPTIMAI project are intended to be extended to different domains, and in various verticals such as automotive, aerospace, etc.

The solutions developed within OPTIMAI, in addition, to being part of the commercial offer after the end of the project, will also be available in the education and research products to open access to the educational community for the new professionals and research purposes.

Value propositions

After completing the project, Visual Components targets commercializing the developments within OPTIMAI, including them into the commercial offer. During the project, the potential of the different solutions developed and how they should be commercialized to maximize the income will be studied. In contrast, the go-to-market strategy will be developed.

An initial study allows us to predict an increase of 15% in sales after the first year of commercialization, increasing up to 35% during the following two years. This go-to-market study is focused on the commercialization of the solutions as a plug-in, extensions in the product functionalities, and the offering of related software services and consulting for the different domains where we foresee its utilization.

Youbiquo (YBQ)

Partner Profile

Youbiquo is a B2B product company focused on the design and development of wearable devices for enterprises who want to benefit of Augmented Reality and Artificial Intelligence wearable electronics in the Public Safety & Disaster Relief (PPDR) and Industry 4.0 ecosystems.

Youbiquo since 2015 provides prototypes to various customers in the B2B market.

The company currently has investment programs of Research and Development funded by Italian Ministry of Industry (**MISE**), Italian Ministry of Research (**MIUR**) and **Campania Region** in partnership with large companies. Currently, Youbiquo is involved in several European projects within the Horizon 2020 program together with international research centers and companies as Thales and Microchip.

The company has been awarded with two “Seal of Excellence” certificates by the EU Commission and has been granted for several R&D Programs by the European Community.

Youbiquo also provides consulting services for the design and prototype of wearable electronic and IoT devices, equipped with software applications. Smart features on board of our wearable/IoT devices are driven by Augmented Reality and Machine Learning technologies – i.e., understanding of Natural Language and Object Detection and Tracking.

The team consists of 15 employees skilled in software development, electronics design and prototyping, and mechanical product design. Governance is guaranteed by a board of two experienced founders.

The company boosts collaborations with Universities and Research Centres and has taken part to several international acceleration programs in which it was selected.

Identification of opportunities

The introduction of AR in the enterprise was mainly focused on marketing and engineering activities since 2017; later, maintenance was the main focus of use case in Industry; more recently, the introduction on assembly lines was tested, but limitation in precision of superimposing virtual content in Augmented Reality to real world rose up, as well as ability to measure and recognise objects in the field of view. These limitations showcased by all commercial AR headsets have to be overcame to widely apply AR technologies on assembly lines and, further, on quality inspection procedures. We have focused our research on the following Quality Assurance problems and limitations: a) Detect defect on production line too late; b) Fixed detection points on production lines; c) High cost of fixed cameras.

Within OPTIMAI project we are building up a brand-new model of AR Smart Glass - integrating advanced metrology sensors and proprietary IP technologies to perform AR combined with high precision measurements of objects and close environment with the aim of increasing worker performances, effectiveness and safety in quality inspection activities. These advanced features are not yet available on AR devices on the market and will allow to foster market opportunities and positioning of the company in AR devices market.

Addressable Market

The global AR market is projected to reach USD 344,325 million by 2026, from USD 25,248 million in 2019 and is anticipated to register a CAGR of 42.5% between 2020 and 2026. The largest market segment based on component is the hardware, that will reach USD 2,02,929 million by 2026, from USD 14,195 million in 2019 and is anticipated to register a CAGR of 43.4% between 2020 and 2026. The largest market segment from the display point of view is the Head Mounted Display, that will reach USD 2,45,091 million by 2026, from USD 16,929 million in 2019 and is anticipated to register a CAGR of 43.7% between 2020 and 2026.

The largest market segment from the application point of view is the smart manufacturing industry that will reach USD 96,013 million by 2026, from USD 7,510 million in 2019 and is anticipated to register a CAGR of 47.2% between 2020 and 2026.By application, healthcare will be a key growth market segment. It is anticipated to register a CAGR of 47.2% between 2020 and 2026. By region, the Asia Pacific market segment is anticipated to register a CAGR of 46.5% between 2020 and 2026.

Our 2020 device Talens Holo is especially focused on Enterprise maintenance and assembly, allowing Operation specialists to assist remotely on-field operators in assistance and repair operations. This activity increased in importance during the Covid-19 pandemic, for the limited possibilities of local operation.

The planned release of AR Smart Glass for OPTIMAI project, thanks to advanced measurements features, will cover use cases in Quality inspection along production lines, reducing the time to detect and time to resolve, increasing productivity in manufacturing, ensuring increased precision at millimetric scale to operate with AR superimposing digital content to real world within Field of View; the device could be also applied to other vertical industries and sector, such as Medical Surgery, Construction and Manufacturing. Large and Mid sized manufacturing

industries are the main target customers; hospitals and the surgery sector are a second vertical interested to the innovation.

The use of wearable smart cameras of which the AR smart Glasses are equipped will allow advanced features to be available also in a future work environment where robot and humans will collaborate, in order to increase safety in human-robot interaction.

Value propositions

AR Smart Glass combines AR with Machine Learning and Computer Vision through depth camera to allow precise measurement for quality assurance activities and zero-defect inspection in smart manufacturing.

The outcome of the project – AR Smart Glass prototypes allowing advanced and intuitive mixed reality interaction with virtual objects and content and, optionally, precise measuring of close objects - will be the background to build up and industrialise two models of AR Smart Glass devices, one focused on Quality inspection and another model customised for the healthcare and surgery use case. Actions will be taken to protect intellectual properties related to UX and gesture interactions detection and tracking algorithms combined with AI cameras. These actions will allow the commercialisation of software libraries independently from the AR Smart Glass sales. At the end of the project, a Marketing Plan and a Business Plan will be defined to exploit either the device and the software libraries offering in the Industry and in Medical sectors.

University of Thessaly (UTH)

Partner Profile

The UTH team is comprised of key individual researchers whose field of expertise is AI along with the development of AI models and methodologies. They also focus on other efficient AI techniques such as deep learning and fuzzy cognitive maps. They possess an extensive experience in AI algorithms and tools, intelligent decision support systems as well as in Learning Analytics and Big Data, which constitute significant components in all stages of the OPTIMAI project.

The research group behind UTH offers its valuable expertise in working with dynamical models for decision support systems, based on fuzzy cognitive maps, artificial intelligence methods and tools, machine learning, deep learning and data mining, to develop certain software components for the identification of defective products using artificial intelligence. Additionally, our organization exhibits long, solid experience in the AI framework in several European projects so far, constituting overall an ideal partner who can help OPTIMAI successfully deliver its outcomes.

Identification of opportunities

As part of the Integrated OPTIMAI Solution, AI methodologies for defect detection and prediction is one of the most important exploitable results that OPTIMAI will provide, regarding the optimal decisions for zero-defect manufacturing, optimal production planning and rapid and efficient re-configuration of industrial equipment. These results are intended to be effectively converted from pilot applications into commercial products with reasonable costs and configuration effort.

In this direction, UTH has established an individual exploitation plan, in which new competences in the field of AI models for defect detection, as included in the DSS system, will be developed through the implementation of the AI framework. More specifically, Artificial Intelligence methodologies will be developed for zero defect manufacturing through the analysis of multisensorial quality inspection data, the detection of defects and the identification of defects' causes upstream in the manufacturing process. In turn, AI-enabled quality inspection will provide feedback and readjust production parameters to improve quality and optimize production.

Hence, UTH's exploitation plan is first to protect the knowledge created in the course of the project, in the form of the innovative developed software, by licencing the final production application, which can address the challenge of AI models for Zero-Defect Manufacturing. UTH has the opportunity to own the foreground it generates which is defined by the Knowledge and Intellectual Property Rights within OPTIMAI, to manufacture and sell the produced software within a defined market area.

Moreover, an Indirect exploitation can be realised by working with relevant project partners to develop application demonstrators partly based on UTH's research output, which is the development of AI methodologies for defect detection and prediction. UTH can break into the "intelligent" market with the demonstration of the AI Production Monitoring Component which offers certain capabilities such as profiling, indexing and repurposing defective parts and is related to OPTIMAI's objective of developing AI models and algorithms for quality inspection. In particular, the produced component will be utilized as a site use case for KLEEMAN, Microsemi and TELEVES end-users for quality control and defect detection in the manufacturing process. This exploitation attempt will increase UTH's wider outreach opportunities both in Europe and globally.

Addressable Market

There is a strong consensus that target customers that belong to manufacturing industries have the need to achieve zero-defect manufacturing, reduction of risk, a clear overview of the cost of operations in real-time, and overall performance optimisation within the manufacturing process. In this direction, OPTIMAI can offer a unique solution through the integrated results that delivers for quality control, early defect detection and prediction for zero-defect manufacturing.

To begin with, the OPTIMAI solution could be put in the market in the form of an integrated solution or in the form of individual of Result(s) to be sold:

1. directly to enterprises (end-users) belonging to the **industrial manufacturing sector**,
2. to companies that implement **quality inspection** and **monitoring systems** and/or communities in the field of **maintenance management**, as part of the smart manufacturing sector,
3. to technology providers such as **software industries, ICT research communities, engineers** and the **scientific community**.

As regards UTH, its direct target audience includes research teams and other R&D industrial groups, which can exploit directly and indirectly the project's results. The developed AI methodology will help these target groups to further understand and expand the relevant machine-intelligence research that has a direct impact on society and industry. They will also benefit from a possible dynamic collaboration with UTH and from the exploitation of the produced AI models and algorithms in the field of quality inspection and monitoring in manufacturing.

Moreover, UTH can offer highly innovative insights into how either external manufacturers or industrial partners can scale AI, with important implications for defect detection in the manufacturing process. These companies will be able to integrate AI into their firms, leveraging AI in the form of new capabilities and improving the overall manufacturing process. AI capabilities can play an important role in monitoring product flows, defected products, and maintenance processes. Overall, the effects of the produced AI methodology go beyond incremental process improvement and include fundamentally new ways of operating and growing a business.

Value propositions

UTH's production AI framework:

- Delivers a holistic and innovative solution for zero-defect manufacturing, predictive maintenance, optimal production planning, automated quality control and production monitoring.
- Utilizes state-of-the art AI techniques and algorithms for early detection of deterioration in production and prediction of upcoming defects.
- Reduces production costs, energy & material consumption.
- Increases overall quality and customer satisfaction.

Engineering Ingegneria Informatica S.p.A (ENG)

Partner Profile

Engineering (ENG) is Italy's largest systems integration company. With approximately 12,000 professionals in 40+ locations (in Italy, Belgium, Germany, Norway, Serbia, Spain, Switzerland, Sweden, Argentina, Brazil, Mexico and the USA), the Engineering Group designs, develops, and manages innovative solutions for the areas of business where digitalisation generates major change, such as digital finance, smart government & e-health, augmented cities, digital industry, smart energy & utilities, and digital media & communication. The greater performance of Engineering in the Industry and Services segment is due to the ability to combine twenty years' experience with the potential offered by technologies such as Cloud, Artificial Intelligence, Digital Twin, Digital Enabler, IoT, Cybersecurity, and Big Data.

The R&D lab, founded in 1987, with 250 researchers has participated in more than 100 EU funded projects and gained international research awards.

Engineering has also a long-standing expertise in Industry and a strong focus on R&I projects, where it has shown the capacity of exploiting research results. In fact, ENG is also very active in many key international initiatives and activities including NESSI (Networked European Software and Service Initiative), founding partner of the Future Internet PPP initiative, FIWARE. ENG is corporate member of OW2 Consortium and Eclipse Foundation. It is also involved in other related projects where it has the opportunity to network and interact with major research and business players.

Identification of opportunities

Engineering is strongly interested in committing to joint initiatives with other project partners, to further exploit the OPTIMAI results in the future. ENG's commitment pertains to all relevant Exploitable results which fit into the common exploitation strategy, where it can provide its expertise - both internally and externally to the project - as well as utilizing its market leadership and innovation management capability.

Additionally, Engineering operates within strong strategic networks and initiatives, comprising leading industries, Future Internet initiatives, etc. where it can further disseminate and promote OPTIMAI.

Addressable Market

ENG expects to increase its capability of **offering innovative solutions** to its clients, especially in the **manufacturing domain**, by utilizing OPTIMAI results and possibly expanding its current services portfolio.

Moreover, ENG will promote project results through several communities in which it is involved such as FIWARE, BDVA/DAIRO, IDSA, Digital Factory Alliance to increase the visibility and the awareness of the project through the technical community.

Internally ENG's R&D department will transfer technologies and knowledge acquired from its involvement in the project to ENG's own **Industry & Services business unit.**

Value propositions

ENG will use the project outcomes in order to identify and address the new and emerging key clients' needs and to strengthen its presence in the industry sector. In addition to that, ENG is also interested in the potential **re-use and adaptation** of some innovative technologies being researched and developed in the project.

As a founding member, ENG will spread OPTIMAI platform and services through the **Digital Factory Alliance**, a global initiative with a factory focused mission able to reach manufacturing companies all over Europe.

Internally, ENG will exploit OPTIMAI results through its own **innovation pipeline**, where research results are presented internally to relevant **business units** for further development and possible integration in the business portfolio.

Furthermore, ENG will promote and exploit OPTIMAI project and outcomes through dedicated commercial activities supported by corporate **marketing** and **communication units**.

Unimetrik S.A. (UNIMET)

Partner Profile

Unimetrik is a Metrology Service company and a Calibration Laboratory, oriented to offer solutions for the industry related to Calibration, Measurement and Metrology Engineering; certified in: 1) ISO 10012, which specifies generic requirements and provides guidance for the management of measurement processes and metrological confirmation of the measuring equipment used to support and demonstrate compliance with metrology requirements. 2) ENAC: Dimension, Temperature and Torc Certification. Utilising the latest technology and with highly qualified staff, Unimetrik, our ENAC-accredited laboratory, is able to guarantee maximum service rigour and reliability.

In Unimetrik, innovating is the way to improve the services that we offer to our customers, as innovation and research allow us to find solutions to existing or potential problems in the industry. Thus, we place special emphasis on innovation and R&D activities to research new processes, new methodologies and tools relating to 3D Vision, optics, electronics, metrology and software engineering. In this sense, Unimetrik have collaborated in European R&D projects such as, EASYTRACK, MT CHECK, e-Calibra and ADALAM, this last as the project coordinator.

Unimetrik will bring to the project its expertise in metrology, calibration and dimensional quality control assurance, making available their advanced facilities with the most accurate systems for verification of parts/tools and advanced metrology software, for a characterization and evaluation of measurement solutions as well as its calibration and certification. This involves the identification of error sources, their effects on the machine, measurement processes, and the development of specialized calibration artifacts and methodologies. Additionally, Unimetrik will lead the task related to IPR protection for the exploitable assets that result from the project.

Identification of opportunities

UNIMET will use the results of the project to expand its catalogue of solutions by adding the measurement, verification and calibration methodologies and processes developed in the OPTIMAI along with more use cases where our technology is applicable. Moreover, the experience and know-how gained work for updating and improving the already existing products, services and techniques. Quality control and ZDM are important paradigms for most clients so this project will improve UNIMET position in the Metrological Engineering market in Spain and Europe.

Addressable Market

UNIMET is acknowledged by the principal aeronautic groups in Spain and it is exporting its technology to countries such as USA, Germany, Brazil and the Czech Republic. These form part of the target markets in where Unimetrik would like to continue expanding, as well as in other

countries of Europe; mainly in the fields of industrial manufacturing such as automotive, aeronautics, constructions, utility, electronics, etc. On the other hand, effective quality control processes are highly important and demanded in the new manufacturing paradigm of Industry 4.0 as they provide key information, real time corrections, more productivity and reduced production times. In this sense, by increasing our knowledge, experience and developments in projects such as OPTIMAI help us to cover more and more end users' needs, from different manufacturing production lines.

Value propositions

As commented, project results will contribute to improve the developments of UNIMETRIK standard products. UNIMET will focus on delivering the OPTIMAI's results to its industrial clients, showing them how the solution could apply or improve their operations, based on their particular manufacturing process characteristics. Indirect exploitation may be realised by assuming UNIMET as a reference in the industrial IT world. Our project results dissemination plan is focused on UNIMET participation in industry-related conferences, and similar events, located both in Europe as well as in other continents. Most of these events are focused on metrology, quality and other industrial sectors as metal and mechatronics, interested in quality control and precision manufacturing. Additionally, UNIMET will disseminate OPTIMAI results in its website and in events such as EMO, CONTROL, METROMEET, Measurement World & CIM International Metrology Congress, FabTech, EXPOMAQ, IMTS.

Universitat Politècnica de València (UPV)

Partner Profile

Universitat Politècnica de València (UPV) is a dynamic, innovative, public institution, dedicated to research and teaching that keeps strong ties with the social environment in which its activities are performed and, simultaneously, has an important presence abroad. Today, over 39,000 members integrate its academic community: 35,000 of these are students, 2,387 are teachers and 1,593 belong to the administration. UPV includes 15 faculty centres: ten schools, three faculties, and two higher polytechnic schools (Alcoy and Gandia), and five associated institutions.

The UPV is a non-profit academic and research-oriented institution, whose main objectives are two-fold: i) to provide the whole of society with a continuously updated high quality superior education and ii) to promote high-quality research as an outstanding aspect to obtain recognition from society, the business sector and finally from students.

Identification of opportunities

Currently, many universities' educational programmes are outdated. This is because in recent years there have been great advances in technology, and it takes time to transfer these advances to the university academic and formative curricula. Consequently, in many educational programme technology is ahead of what is taught in the classroom. Furthermore, on many occasions the knowledge that is transmitted is largely theoretical and with few final applications. The updating of subjects with practical and current applications of cutting-edge technologies

allows students to stand out when they enter the highly specialized and competitive labour market.

As explained previously, the UPV is a non-profit academic and research-oriented institution whose main clients are its students. The UPV provides a response to the need of providing to its students with a high-level education that is as up to date as possible with current market demands. The participation of the UPV in OPTIMAI allows the university to validate its research results and its developed solutions in a real industrial environment with final users. This knowledge is translated to the academic curriculum by the professors and researchers who participate in the project, translating in the lectures the real needs of industry and thus going beyond a purely theoretical framework. The knowledge gained will be made available to students, and the whole society, through courses, master's, and doctoral programmes.

Addressable Market

Education is one of the main assets of society and must play an active and proactive role. It is a service that must be permanently updated to the diverse requirements of society, responding to the needs of the business and economic environment of the country and the region. Thus, universities aim to design high-quality academic programmes and provide greater benefits that add value to the different target audiences, in order to attract and retain their customers, the students.

Zapata (2007) states that educational institutions have been growing for many years, thanks to the inertia of an uncompetitive market. The situation they face today, both in Colombia and in the rest of the world, is very different. The strong and intense competition they have to face forces to respond to a demanding demand, with innovative proposals, adjusted to the needs of the market to which their educational offers are directed. Therefore, there are a number of changes and challenges that Higher Education Institutions have to face.

On this line, Pérez (2002) considers in his research that the market for the generation and dissemination of knowledge is currently highly competitive, the criteria for selecting alternatives are very subjective, and the culture of the right to choose on the basis of relevant information is very strong. It is evident that the situation is different from 20 years ago, when there was not so much education on offer at the higher education level, changes in the market structure can be observed, and universities must adapt to these changes, offering effective responses to the needs and desires of their target market. On the other hand, Carmelo and Puelles (2007) state that if the university does not project a quality academic image, it will not be able to obtain resources from the productive sector or other possible sources of funding.

Hence, in recent years, universities have made a great effort to project a strong image and offer an appropriate educational programme, at a price that students and their families are willing and able to pay, in a reasonably attractive location. All these aspects are communicated to prospective students in an accurate, interesting and timely manner. Universities know very well what the consumers of higher education programs need and want, since they have concrete and specific demands, being aware that they have more and more information on the variables currently provided by the educational market. Currently, there is a struggle to capture very

strong markets with costs for all tastes. An "average" service at a low price is not enough, as stated by Ramírez (2009).

Value propositions

UPV as a non-profit public university aims to engage students. One important channel for UPV is to reach out to potential students and general society with a presence in the media channels and social media. The research results from the project will flow into the academic curricula by endorsing solutions and paradigms related to OPTIMAI research in teaching programs. The knowledge acquired will be made available to society through courses, master's, seminars and doctorate plans. Specifically, Component-based Software Development and modern Distributed Systems lectures can be given during postgraduate semester programs to inspire students towards the design of OPTIMAI solutions while advanced research concepts can be incorporated into respective doctoral courses. These lectures will allow both, to generate fruitful debates and interesting ideas as well as allow the student to know areas and opportunities in it in which to actively participate in the UPV, in addition to putting researchers and potential talents in contact for innovation projects.

Another area in which it will be impacted significantly will be the scientific community, through conferences, workshops and international journals related to the research areas addressed by OPTIMAI. Thus, UPV plans the exploitation of OPTIMAI results to further increase their standings and ranking in the academic area through participation in key scientific conferences and journals.

Participation in the project will generate localized knowledge for the university in both technological (AI, advanced IoT systems, digital twins) and business areas (better diagnosis, thanks to the application of AI and always under the supervision of expert personnel). In this way, the university's competitiveness is increased, thus facilitating the export of knowledge as a service (either through new competitive projects, creation of courses and masters, sale of services, etc.).

Finally, in the field of research, new projects generate subsequent ones in which knowledge is consolidated, updated and improved, providing feedback on the return chain in the social field in a way analogous to the economic field (the first more for universities and research centres, the second for companies).

Carr Communications Ltd (CARR)

Partner Profile

Carr Communications is predominantly a service-based company that focuses on PR, Communications Management and Human-Resource Training. This results in a slight difference in exploitation strategy from the partners that have concrete products developed through the project. CARR will be using the OPTIMAI exploitable results to improve on their current services and expand them to the manufacturing market. This will be done by using the knowledge gained from our participation in the OPTIMAI project, as well as the networks developed in the manufacturing and production process design sectors. In the following section, we will briefly

explore the products and services that CARR plans to take to market using OPTIMAI exploitable results.

Identification of opportunities

Market R&D: An important service that CARR provides is market research on PR, Communications and Stakeholder Engagement Strategies. By exploiting the new networks and connections created by our experience working on a manufacturing-oriented project, we expect to increase our yearly work in Research and Stakeholder Engagement. This will be achieved by using our experience in the sector, as well as our communications strategies to reach new clients in the industrial domain.

Training Programmes: Similarly, CARR will be incorporating best practices learned from our experiences in OPTIMAI to update the content in our personnel training programmes and increase their relevance to the manufacturing industry. These training programmes are often booked by both public and private sector clients for large groups to improve the overall capabilities of the team.

Communications Strategy: In addition to these services, CARR provides a number of Communications Service and Strategy Workshops. We will be using our experiences to develop updated programmes aimed at the industrial sector, with workshops focusing on Industrial Communications Strategies and the Practical Application of Behavioural Economics in Manufacturing. In addition to this, we also provide communications services such as Communications Strategy, Media Strategy, and Crisis Communications services.

Event Management Service: CARR also provides an Event Management service, which could be marketed to the industrial sector for exhibitions, demo sessions, conferences, brokerage events or trade fairs.

Design Services: An additional avenue for possible future exploitation is in the design of products through CARR's graphic design department. Currently CARR produces various design services including general Branding and Promotional Materials. In addition, website design and other creative digital services are also provided. Using the experience in producing these as part of the project,

CARR can use their experience to target the manufacturing sector and leverage the strategies and best practices learnt in OPTIMAI.

Participation in New Research and Innovation Projects: A major route for the post-project exploitation of results will be the participation in new EU funded research and innovation projects. CARR has several pieces of intellectual property developed as part of the project, as well as extensive experience in communications, dissemination and exploitation strategies. By using this experience and the contacts developed throughout the life of the project, CARR will approach potential partners and begin drafting project proposals on similar topics to OPTIMAI.

Impact Evaluation & Assessment: Finally, CARR provides a service in which it conducts analysis of the impact achieved by a communications and dissemination strategy. This allows

organisations and projects to identify the gains from various marketing and communications strategies and then refine them to maximise their effectiveness. This is a service which could be applied to a number of the products and services listed above.

Addressable Market

Target audiences include:

- manufacturing companies
- industrial projects
- industrial research groups
- regulators
- policy makers
- researchers, academics, students

Value propositions

Expansion of existing services: opportunity to expand our market offerings in communication and dissemination services to a number of key manufacturing areas. In addition, the knowledge of CARR's involvement in OPTIMAI will be important as CARR seek to expand their market penetration in these activities.

Future R&D opportunities: Furthermore, CARR sees the potential to be involved in future related R&D projects through their involvement in the OPTIMAI project. Working relationships developed with project partners and wider networks may lead to future collaboration and continuation of the results achieved in the OPTIMAI project.

Potential for a Spin off/ Start-up business: The IP developed in OPTIMAI could be utilised (in an agreed way) to facilitate the development of new businesses, and CARR could be part of such developments.

Universitat Autònoma de Barcelona Institute of Law and Technology (UAB-IDT)

Partner Profile

The UAB Institute of Law and Technology (UAB), housed at the Faculty of Law, is a research centre promoting cutting-edge research on Law and Technology from an interdisciplinary perspective (http://idt.uab.cat).

The areas of research include Law and Artificial Intelligence, legal culture and judicial studies, alternative dispute resolution (ADR) and online dispute resolution (ODR), legal ontologies, the Semantic Web, Data Protection, Ethics and regulations for the Web of Data. The UAB team role entails: (i) setting the normative requirements for the project approach; (ii) building the regulative model for the technologies and platform deployed in the project and the workflow of data; (iii) carrying out the knowledge acquisition process; (iv) fleshing out the governance and ethical principles for the whole system; (v) guiding Consortium partners in data protection issues to promote data protection compliance with the GDPR: (vi) linking the project with the monitoring tasks of the project's Ethics Board all along lifecycle of the project; and (vii) providing interoperability among different European countries through semantics. UAB researchers are

also able to contribute significantly to the organization of specialized Workshops, and the dissemination of the project findings and results through scientific publications and presentations in the main Data Protection and Law & Technology Conferences and Workshops (EDPD, EDPP, IVR, Jurix, ICAIL, AICOL).

The UAB has contributed to large projects in FP7 and H2020 programmes. As Ethical and Legal partner: CAPER (2011-2014) with GA 261712; TAKEDOWN (2016-2019) with GA 700688; SPIRIT (2019-2021) with GA 786993; and ITFLOWS (2020-2023) with GA 882986.

The UAB's role in OPTIMAI project is mainly focused on the Legal and Ethical framework (WP9). The main objectives of this WP are: (a) to identify the EU ethical and legal framework applicable to the project with the aim of ensuring that the innovation brought by OPTIMAI is lawful, ethical and social desirable; (b) to identify the potential risks posed by the foreseen research activities from an ethical, legal and social perspective; (c) to provide the OPTIMAI regulatory model; (d) to set up a monitoring and enforcement strategy to ensure that the outcomes of the project comply with the legal and ethical requirements and societal values previously identified for OPTIMAI; and (e) to provide continuous legal and ethical advice and support to the OPTIMAI Consortium.

Identification of opportunities

The UAB enrolment into the H2020 programme was mainly focused on "fight against organized crime and terrorism" topic. Therefore, the UAB participation in OPTIMAI has largely contributed to include "Industry 4.0" field in our catalogue of expertise. The inclusion of the "Industry 4.0" particularities to our know-how opens a new opportunity to be part of new consortium in the Horizon 21 programme in industry related calls.

Addressable Market

Our target is two-fold. Firstly, the UAB as higher education establishment, public body and non-profit organization focuses on the academic field, then, we expect to publish in outstanding peer-reviewed journals and relevant academic events. Secondly, the know-how acquired will enable our participation in consortiums related to the industry field.

Value propositions

The know-how acquired through the OPTIMAI project will include improve the methodology used to develop ethical and legal strategies and to monitor activities from a legal and ethical perspective. This improvement in our methodology will be disseminated through the OPTIMAI project and our institution dissemination and communication channels and, also, through the academic publications produced. In addition, we are also gathering relevant events and fairs related to industry in order to create a strategy to promote our expertise and methodology. The main idea is to use this knowledge to achieve a better position for the Horizon 21 programme.

Trilateral Research Ltd (TRI)

Partner Profile

Trilateral Research (TRI) is an Ireland-based SME. It specialises in research and the provision of policy, regulatory and certification advice and recommendations for new technologies, processes, policies and systems. Trilateral has a long record of successful project involvement on the privacy, social, ethical, and legal impacts of new data practices and innovation. We have expertise in assessing impacts and risks, and evaluating systems to suggest solutions to enhance innovation whilst ensuring responsible practices. We have been working with the new General Data Protection Regulation (GDPR) since the first drafts in 2011, and we have GDPR certified research analysts experienced in Data Protection Impact Assessments and helping to support the implementation of the GDPR. We regularly work with a variety of stakeholders ranging from technical specialists, policy-makers and citizen groups in order to contextualise this work. In addition, Trilateral designs, develops and evaluates data analytics tools with a special focus on transforming data into actionable information for industrial, institutional and policy stakeholders. This technical competence informs our privacy and data protection work, to ensure a complementarity between social science and technical expertise across all our activities. Trilateral leads the privacy and ethical impact assessment work for multiple H2020 projects (e.g., HEROES, DARLENE, PestNU, TechEthos, TRIPS).

Name and Description of the Department(s) contributing to the execution of the Project:

The policy, ethics and emerging Technologies (POET) team focuses on assessing the ethical, legal and social impact of new technologies providing guidance for policy-makers while identifying new promising technology trends. POET team consists of social scientists, ethical and legal experts. The team's research impacts on a wide variety of disciplines, all focused on enhancing societal well-being, including (but not limited to) new and emerging technology, ethics of technology, responsible research and innovation (RRI) and human rights. POET team works with stakeholders at national, European and international levels having an expertise on primary applied research, impact assessments (ethical, socio-economic, privacy, and human rights) and stakeholder engagement. POET team has over 15 years' experience of leading and participating in European and nationally funded research projects.

Identification of opportunities

A description of the way OPTIMAI project results and outcomes are relevant to improve each partner business and activities, gaining a better positioning in the markets/areas of action or opening new possibilities in different ones.

- An **integrated impact assessment methodology** encompassing ethical, legal (including human rights and privacy) and societal aspects that focusses on the entire lifecycle of the research and innovation process, including TRI Risk Touch Point Table™ (D7.3; D9.2; D9.3; D9.4; D9.9).
- The Trilateral's integrated impact assessment methodology follows the ensuing path:

    a) identification of the ethical and legal framework together with mapping ethical and legal requirements.
    b) mapping ethical, legal, and societal aspects of the research and innovation (R&I) process and its outcomes, thus for two layers: (1) R&I activities; (2) R&I outcomes

– technology. Such aspects are identified in collaboration with internal and external stakeholders, including tech developers, end-users, Ethics Board (EB) and other relevant stakeholders

c) requirements, ethical, legal and societal (ELS) aspects, principles and values are translated into specific solutions, actions and mitigations measures via dialogue sessions with relevant stakeholders.
d) tech developments are assessed, monitored, and re-evaluated following the R&I process in an iterative and agile way.
e) the final integrated impact assessment providing recommendations for potential use of the project's results.

Addressable Market

Target audiences for Scientific Partners are, i.e., research teams, students, general public, R&D industrial groups, etc, for industrial partners It can be internal (the own organization), external (potential customers) or a mixture of both. Where OPTIMAI can be applied and how, identifying what kind of needs customers have or what kind of expectations the solution needs to fulfil.

Scope: (connect result with the scope)

- Manufacturing technology is developed to strengthening competitiveness and growth of companies, improve quality, optimize production, boost productivity and environmental sustainability. However, technology may also (even with best intentions) lead to breach of legal compliance, ethical and societal values, particularly in the context of corporate social responsibility (CSR), sustainability and employees' rights.
- Manufacturing technology needs to be assessed in terms of its impact on society and environment (ethical, legal, societal and environmental aspects of tech).

Customers (problem owners – they make our results sustainable):

- **Private sector: Private actors (tech companies)** developing tech supporting manufacturing may conduct impact assessment internally or engage external advisors. Not always a top priority, no means, etc. **The impact assessment is rarely independent** when conducted internally by tech developers. At the same time, it should be outsourced from the tech developing partners, to guarantee independent review. This may lead to lack of trust from potential clients, breach of legal compliance, ethical and societal values.
- **Private sector: Private actors (manufacturing companies) have limited or no support regarding ethical, legal and societal aspects of tech solutions**. Occasional data protection officers, legal/CSR advisors, HR officers are often disconnected from research and innovation (R&I). This may lead to negative consequences for manufacturing companies such as lack of trust from employees, breach of legal compliance, ethical and societal values, risk to reputation among partners and clients.

Impact assessment methods:

- **Most current technology and impact assessment methods** either engage in ex-ante assessment (based on hypothetical design) or ex-post assessment (based on the finalised prototype), which makes them either **not extensive and specific enough, or associated with large costs to redesign and redevelop an existing solution to comply with the ethical and legal requirements.**

- **Impact assessment often focuses on only one type of consequences**, e.g., privacy, health, or societal aspects and it is not balanced with severity, likelihood and occurrence. Rarely does such impact assessment focuses on technology assessment, no understanding of specificities of tech.
- **The integrated impact assessment is hardly part in a design process**, going beyond abstract principles, applying them to the specific design – development – and use decisions to be taken. The assessment is often shaped as an ex-post justification.
- The **impact assessment is rarely transdisciplinary** (lack of understanding between social sciences and humanities and engineering).

Value propositions

Unique Selling Point USP - Unique Value Proposition UVP:

- **Integrated approach to the impact assessment**, encompassing ethical, legal (including human rights and privacy) and societal aspects that focusses on process and product assessment.
- **Tailor-made and adapted** to specific context, new and emerging technology, partner/client.
- **Ethical, legal and societal aspects:**
    - **continuously updated;**
    - **expanded** to include all relevant international, European norms and standards relevant to security research projects (RIA);
    - **operationalised over multiple projects** to make their assessment close to practical decisions and the abstract normative framework close to the design decision level.
- **Continuous feedback** between design proposal – ethical, legal and societal (ELS) review – design update, to prevent resource extensive revisions at a late development stage (agile approach).
- Process (**responsibility-by-design**).
- High **reliability of solutions and transferability between projects and technologies**, while a specific contextualisation (of national legal provisions) can be modularly adopted.
- **Transdisciplinary approach to implementation of responsible research and innovation (RRI) in practice**.
- The assessment aims at recommendations for integration in the design.

Kleemann Hellas S.A. (KLEEMANN)

Partner Profile

Founded in 1983 in Kilkis, Greece, KLEEMANN is one of the most important lift companies in the European and global market, providing any type of residential or commercial passenger and freight lifts, escalators, moving walks, accessibility and marine solutions, parking systems and lift components. Its distribution network expands to more than 100 countries.

KLEEMANN stands for innovation in design and technology, for flexibility and breakthrough thinking, for quality products and dedicated services and support.

Integrated manufacturing facilities, highly trained workforce, state-of-the-art IT systems and logistics support enable KLEEMANN to deliver reliable, highly personalised solutions.

Installation and maintenance companies handle the distribution of the company's products all over the world. Fine-tuned collaboration between management teams, employees and other involved parties allows KLEEMANN to build and maintain strong, long-term relationships with its customers and provide reliable services across the globe. The company's strategic approach and investments have enabled the specialised manufacture and export of products into multiple markets, developing global networks, international presence and product range.

KLEEMANN is proud of its strong global brand name, consistent with its commitment for quality standards, progressive technical and market knowledge and innovative research schemes.

In the OPTIMAI project, KLEEMANN is participating as a pilot partner. The developed OPTIMAI solutions will be deployed in the company's hydraulic lift plant and more specifically in the power unit's testing lab. The ultimate goal of the pilot testing is to automate quality inspection processes towards zero-defects, to provide optimal calibration in the production line and to improve overall production planning. Apart from being one of the main pilots of OPTIMAI, KLEEMANN is responsible for the identification of user requirements and the definition of the OPTIMAI use-cases.

Identification of opportunities

The developed OPTIMAI tools are expected to support the decision-making regarding the quality monitoring and recalibration processes towards zero-defect manufacturing. KLEEMANN is planning to use the OPTIMAI solutions both in a commercial and in a non-commercial basis. In a commercial basis KLEEMANN will promote the offerings and benefits of the tools in its close partner network and will support the application and deployment of the solutions. In a non-commercial basis KLEEMANN is aiming to expand the OPTIMAI solutions in the whole group, starting from the European facilities (Serbia). The OPTIMAI tools and technologies will be used only under specific commercial agreements with OPTIMAI's technical providers.

Addressable Market

KLEEMANN, as a large enterprise of the lift industry in the European and global market, will focus on the exploitation of OPTIMAI's results both internally and externally. KLEEMANN identifies internal and external potential customers and targeted internal and external stakeholders.

- Internal customers include other shop floors, departments of the same factory or other production lines and manufacturing facilities of the Group around the world (Serbia and China).
- External customers include machine suppliers, technical and commercial elevator companies, elevator installers, maintenance providers and research institutes.

Value propositions

As one of the major lift manufacturers worldwide, KLEEMANN expects that the OPTIMAI solutions, will attract the interest of internal and external stakeholders and will initiate new

collaborations with research, technology and industrial partners towards technology transfer and commercialisation.

Televes S.A.U. (TVES)

Partner Profile

Televes is a leading global company focused on the design, development and manufacture of Telecommunications and IT products and solutions for building, smart cities, hospitality and home infrastructures, that will enable all present and future services.

Founded in 1958, the company is headquartered in Santiago de Compostela (Spain), where it keeps its state-of-the-art manufacturing facilities. A key signature trade of the company, Televes believes in delivering superior quality products through an exquisite manufacturing process.

Nowadays Televes is much more than a leading brand. It is the head of a corporation comprised of strategic technological firms with a commercial presence in more than 100 countries. Televes is formed by 21 industrial and services subsidiaries, over 700 employees and holds more than 200 Industrial Property registers (European Patents, National Patents and Utility Models).

With nearly 60 years of experience, Televes has launched more than 1,500 different products, an achievement explained by the authentic passion for manufacturing. The company manufactures in its own facilities to guarantee maximum quality. It's also a pioneer in setting up 4.0 production lines with its own certification and quality control laboratories. In this way, our products proudly display the European Technology Made in Europe label.

European Technology Made in Europe:

At the beginning, as a pioneering company in the production of equipment to receive the radio television signal, Televes was forced to develop and manufacture most of the components of its products. This need for self-sufficiency led to one of the virtues that distinguish the company today. A passion for manufacturing. When most companies in the sector opt to subcontract the manufacturing processes in search of cost savings, Televes continues loyal to its industrial tradition. Controlling the entire production process on its home turf, from the design to the manufacture, enables the company to develop the products more swiftly and with greater guarantees of quality and reliability, as well as protecting the intellectual capital developed. This is the conviction contained in the slogan 'European Technology Made in Europe', which the markets associate with the Televes name as a synonym for quality, reliability and avant-garde technology.

In the OPTIMAI project, Televes is participating as a pilot partner. We will deploy OPTIMAI solution in our Antenna manufacturing line. As it was reported in D2.6, The antenna manufacturing line was designed following a high-volume high mix approach. Therefore, it is key to deal with quick and reliable setups changes and parts failure detention at earlier as possible in the manufacturing process. This challenging environment provides an ideal testbed for implementing and evaluating OPTIMAI's use cases. The final objectives of our pilot are to identify, detect and optimise stoppages and/or incidents that affect production efficiency.

Identification of opportunities

We, as manufacturers, always try to manufacture quicker, cheaper and better products. In that sense, defined uses cases are oriented to reduce the number of defects, reduce the number of setups, increase the operative line time and do improved scheduling. In that sense, our expectations are to increase the number of antennas sells because of the promised benefits of OPTIMAI that will allow us to provide a better and cheaper product.

Therefore, Televes is aiming to extend the OPTIMAI solutions to all our factories and productions lines. The OPTIMAI tools and technologies will be used only under specific commercial agreements with OPTIMAI's technical providers.

Addressable Market

As previously mentioned, our exploitation of results will be to extend internally OPTIMAI to all our automatic manufacturing lines in our factories in Spain and Portugal.

Value propositions

Based on antenna line improved KPIs we will explore to extend its use to other manufacturing lines and also open new collaborations with research, technology and industrial partners towards technology transfer and commercialisation.

Microsemi Semiconductor Ltd (MTCL)

Partner Profile

Microchip Technology Caldicot Ltd (MTCL), is a wholly owned subsidiary of Microchip Technology Inc.

Microchip Technology Incorporated is a leading provider of smart, connected, and secure embedded control solutions. Its easy-to-use development tools and comprehensive product portfolio enable customers to create optimal designs, which reduce risk while lowering total system cost and time to market. The company's solutions serve more than 120,000 customers across the industrial, automotive, consumer, aerospace and defence, communications, and computing markets. Microchip is headquartered in Chandler, Arizona.

In the OPTIMAI project, Microchip Technology is participating as a pilot partner. The developed OPTIMAI solutions will be deployed in the company's die saw, routing and encapsulation processes. The ultimate goal of the pilot testing is to automate quality inspection processes towards zero-defects, to provide optimal calibration in the production line, reduce the time taken for these activities and improve overall production planning. Apart from being one of the main pilots of OPTIMAI, Microchip Technology Caldicot Ltd is responsible for the deployment of training materials and pilot trials of the OPTIMAI systems (WP7).

Identification of opportunities

Microchip Technology Ltd is an advanced electronics packaging facility and as such takes tested silicon wafers and processes them into complex high-cost electronic packages. The developed

OPTIMAI tools are expected to support the decision-making regarding the quality monitoring and recalibration processes towards zero-defect manufacturing. During the OPTIMAI project Microchip Technology Ltd will look to use the OPTIMAI tools to replace or complement existing inspection methods. This in turn will reduce yield losses in the manufacturing process. Furthermore, a better understanding of the rejection rates for each criterion would be fed back into the manufacturing process to reduce waste.

Depending on successful trials at the Microchip Technology Caldicot Ltd site beyond the project the OPTIMAI tools and technologies will be used only under specific commercial agreements with OPTIMAI's technical providers.

Addressable Market

Microchip Technology Caldicot Ltd is a medium size business with multiple machines being used in the areas being targeted within the course of the project. This gives opportunities for further take up internally for the OPTIMAI solutions. Additionally, as a global business there is also the opportunity for take up of the system at other manufacturing sites around the globe.

Value propositions

As an end user of the OPTIMAI solution, Microchip Technology Caldicot Ltd will be focused on extracting the maximum benefit from the investments made within the project to drive down costs, improve productivity and further control quality within the manufacturing process.

Annex III – Individual and Joint Exploitation Plan Questionnaire

<table>
<tr><th colspan="2">CERTH</th></tr>
<tr><td>Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done?

What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision?

How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast):
• Further Internal Research
• Collaborative Research (i.e. result as a starting asset for future collaborative research projects)
• Internal Product Development (results used in developing, creating and marketing a product/process)
• Internal Service Creation (results used in creating and providing a service)
• Licensing
• Assignment (results exploited by other organisations by the transfer of ownership)
• Joint Venture (result used as background of a joint venture)
• Spin-off (a separate company established in order to bring to the market technology resulting from the project)
• Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)</td><td>CERTH as a research centre will increase its status and reputation on the fields of AR/VR technologies as well as in the employment of AI models and Blockchain technologies in manufacturing procedures. These achievements will aid CERTH in pursuing and participating in future R&D collaborations relevant to the OPTIMAI technologies.

Concerning the steps about the market strategy, CERTH will document the technological tools that the research centre could potentially exploit. In the next step, CERTH will receive non-disclosure agreements (NDAs) from the OPTMAI partners. Furthermore, several publications will be presented in scientific journals and international conferences relevant to the project's results. These scientific studies will increase the reputation of CERTH aiding in the participation in future national/international research projects. Finally, the developed technological modules within the OPTIMAI project will enhance the scientific and technical knowledge of CERTH scientists.

<table>
<tr><td>Further internal research</td><td>4</td></tr>
<tr><td>Collaborative research</td><td>5</td></tr>
<tr><td>Internal product development</td><td>3</td></tr>
<tr><td>Internal service creation</td><td>4</td></tr>
<tr><td>Licensing</td><td>1</td></tr>
<tr><td>Assignment</td><td>2</td></tr>
<tr><td>Joint Venture</td><td>3</td></tr>
<tr><td>Spin off</td><td>4</td></tr>
<tr><td>Standardization activities</td><td>4</td></tr>
</table>
</td></tr>
</table>

FINT

Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	FINT's plan is to take advantage from the developing KERs in order to reach a level of product maturity that will allow their commercialisation as soon as possible after the project end. FINT's team intents to use the pilot testing and the insights that are going to be collected from the project trials as the main knowledge source for the appropriate product transformation in order to achieve tailored offerings. FINT aims to provide the above described KERs to various domains. Each of those domains have different specifications and needs. However, as most of these domains have the same sensor acquisition needs and similar requirements, FINT is capable to reuse the same developments in multiple markets. The final result will be tailor products that will incorporate specific sets of parameters and configurations that will be able to fulfil the needs of each targeted domain. Also, we need to consider that the market for such products is on rise at the moment. The timing that FINT enters this market is particularly auspicious. The mindset of the stakeholders is shifted towards automizations, IoT and AI. FINT's business development department is continuously assessing the market and believes that the market window for such solutions will remain open for at least 8 years in the developed markets, while it can be even extended further in the developing markets. The business plan of FINT includes the strategic cooperation with international added-value partners that will distribute and re-sell the products to the customers, while at the same moment providing high quality maintenance and support contracts. Further internal research: 4 Collaborative research: 5 Internal product development: 5 Internal service creation: 5 Licensing: 5

	Assignment	4
	Joint Venture	4
	Spin off	2
	Standardization activities	1

FORTH	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities or to contribute to ongoing standardization work)	KERs will strengthen FORTH's status as a centre of excellence in the domains targeted. FORTH will utilise results as-is in pursuing future R&D collaborations and conduct any necessary development to tailor the solution to an interested party's needs. 1. Document the concept and original content in detail. 2. Provide detailed drawings, descriptions, plans and records that prove the concept and work as intellectual property of FORTH. 3. Obtain (where necessary) non-disclosure agreements (NDAs) from Project Partners. 4. Exploitation through high-impact publications (journals and international conferences), particularly in the areas of human-computer interaction. 5. Establish FORTH as a centre of excellence in the focus area, driving its participation in future joint national/international initiatives based on this updated status. 6. Improve FORTH research and training activities for FORTH scientists and engineers (especially those involved in the OPTIMAI project) via the scientific and technical knowledge obtained.

Further internal research	3
Collaborative research	5
Internal product development	3
Internal service creation	3
Licensing	1
Assignment	2
Joint Venture	3
Spin off	2
Standardization activities	4

EVT	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	EVT will use the results of the project to add new functionality to its systems. As the system is modular, the results can be iteratively integrated into the existing products. EVT's evaluation and communication tool catalogue will be steadily increased. Existing tools will be updated with new functionality. Further internal research: 5 Collaborative research: 5 Internal product development: 5 Internal service creation: 3 Licensing: 3 Assignment: 3 Joint Venture: 1 Spin off: 1 Standardization activities: 4

VIS	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research	Without any doubt the results developed within OPTIMAI will bring a competitive advantate over competitors offering more innovative solutions that will easy the deployment and integration of the simulation and the digital twin in existing production workflows. Evolving the developments achieved in OPTIMAI into commercial products will follow the development workflow of Visual Components. Once tested in the pilots, the

• Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	research results will be further evolved, introducing requirements collected from customers and prospects. The product will be validated in next to marked scenarios, and once the validation is completed can be initiated the release process toward commercial.

Further internal research	5
Collaborative research	4
Internal product development	5
Internal service creation	5
Licensing	5
Assignment	1
Joint Venture	1
Spin off	1
Standardization activities	5

YBQ	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing	Further developments will be needed at the end of the project to industrialise the solution, to achieve TRL 9 and to reach CE certification in relevant industrial environment. The further steps are a) industrialization of the device; b) CE Certification; c) industrial production of the device; d) commercialisation through distribution agreement for B2B market. Stakeholders involved are among others but not limited to: large companies as early adopters of the commercial product; electronic device distributors for B2B market; Software system integrators willing to use the solution as a open platform for their tailored software solutions for enterpises.

Further internal research	3
Collaborative research	3

• Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	Internal product development: 5 Internal service creation: 3 Licensing: 5 Assignment: 2 Joint Venture: 4 Spin off: 2 Standardization activities: 3

UTH	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	University of Thessaly (UTH) will not get a direct business advantage over competitors from the results. AI models that have been developed so far will not be commercialized. However, they are going to be further developed and updated to address the challenge of Zero-Defect Manufacturing. Since UTH's direct target audience is mainly research groups, there is no immediate step into putting our product into the market. UTH will benefit from a possible dynamic collaboration with these groups in offering highly innovative insights into how they can exploit the produced AI models and algorithms in the field of quality inspection and monitoring in manufacturing. Further internal research: 5 Collaborative research: 5 Internal product development: 5 Internal service creation: 5 Licensing: 5 Assignment: N/A Joint Venture: 2 Spin off: N/A Standardization activities: N/A

ENG

Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	Within OPTIMAI, ENG has enhanced an existing portfolio product as described in 2.2.8, the DIDA platform. Existing industrial processes can be fine tuned without specific expertise, just deploying on premise the solution. Ad-hoc refinements will be made available to customers following the requirements of the specific case. Manufacturing Industry actors are the actual beneficiaries of the solution, but also other technological providers may benefit of the Edge processing components by integrating the tools with their sensors/AI algorithms. The actual ENG catalogue will be updated with the new functionalities developed within OPTIMAI. As first step ENG foresees the On the edge processing component should be better refined/enhanced also through the validation with other possible demonstrators within furher collaborative/internal research. Once the solution will be at TRL9 a Joint Venture, and actual commercialisation will on the roadmap. Further internal research: 5 Collaborative research: 5 Internal product development: 4 Internal service creation: 4 Licensing: 3 Assignment: 1 Joint Venture: 3 Spin off: 1 Standardization activities: 3

UNIMET	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision?	UNIMET will use the results of the project to expand its catalogue of solutions by adding the measurement, verification and calibration methodologies and processes developed in the OPTIMAI along with more use cases where our technology is applicable.

<table>
<tr>
<td>How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast):
• Further Internal Research
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• Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)</td>
<td>About the steps to go to market strategy, will go in concordance with the actual strategy of UNIMET with the existing catalogue of products that will be enhanced by OPTIMAI.

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<tr><td>Licensing</td><td>3</td></tr>
<tr><td>Assignment</td><td>?</td></tr>
<tr><td>Joint Venture</td><td>1</td></tr>
<tr><td>Spin off</td><td>1</td></tr>
<tr><td>Standardization activities</td><td>3</td></tr>
</table>

With OPTIMAI we are increasing the applicability of our 3D scanning, dimensional analysis and calibration of QC systems services by assessing its appliance with different types of manufactured parts and production lines with different conditions, additionally to integrate our components with the different elements of the Optimai overall platform. We are also assessing to create a methodology for the calibration of the measuring equipment used in the project.</td>
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<table>
<tr><th colspan="2">UPV</th></tr>
<tr>
<td>Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done?

What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision?

How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast):
• Further Internal Research</td>
<td>UPV will benefit from several KERs where stand out: i) contribution to the Smart Data Model initiative by providing data models for industry 4.0, ii) methodology for creating OPTIMAI Agents and support software, iii) adaptive multi-sensorial network & fog computing framework.

These KERs are valuable for UPV because the associated knowledge will be: i) applied in future projects and developments, ii) translated to the UPV academic curriculum. The projects bring to us the opportunity to apply and polish our research in real Industry</td>
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<td>

Collaborative Research (i.e. result as a starting asset for future collaborative research projects)
Internal Product Development (results used in developing, creating and marketing a product/process)
Internal Service Creation (results used in creating and providing a service)
Licensing
Assignment (results exploited by other organisations by the transfer of ownership)
Joint Venture (result used as background of a joint venture)
Spin-off (a separate company established in order to bring to the market technology resulting from the project)

Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)
</td>
<td>
4.0 environments. Moreover, educating our students in cutting-edge technologies will allow improving the competitiveness of the education we offer.
To translate this knowledge to the UPV academic curriculum no further research is foreseen to be necessary. However, as a research group, we will apply the acquired knowledge in other projects and verticals.

N/A
<table>
<tr><td>Further internal research</td><td>3</td></tr>
<tr><td>Collaborative research</td><td>4</td></tr>
<tr><td>Internal product development</td><td>1</td></tr>
<tr><td>Internal service creation</td><td>1</td></tr>
<tr><td>Licensing</td><td>3</td></tr>
<tr><td>Assignment</td><td>3</td></tr>
<tr><td>Joint Venture</td><td>2</td></tr>
<tr><td>Spin off</td><td>2</td></tr>
<tr><td>Standardization activities</td><td>5</td></tr>
</table>
</td>
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</table>

CARR	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process)	The services that CARR plans to take to market using OPTIMAI exploitable results will provide CARR with a clear competitive advantage over competitors e.g., through: - reaching new clients in the industrial domain by exploiting new networks and connections created; - applying best practices in training programmes and increasing their relevance to the manufacturing industry; - creating bespoke communications strategies aimed at the industrial sector. The assets can be commercialised as tailored solutions for both public and private sector clients. Key stakeholders include manufacturing companies, R&D projects with an industrial focus, regulators, policy makers and academia.

• Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	Further internal research: 5 Collaborative research: 3 Internal product development: 5 Internal service creation: 5 Licensing: 1 Assignment: N/A Joint Venture: 1 Spin off: 1 Standardization activities: 1

UAB	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	The UAB-IDT do not plan to commercialize the OPTIMAI Regulatory model within the market. Nevertheless, our participation in the project would open a door to explore new research lines and opportunities, as well as to trace links between the academy and the industry. The OPTIMAI Regulatory Model will enable to publish on relevant peer-reviewed journals and to participate on events related to Industry 4.0, Ethical and Legal Governance, and Legal Compliance—among other fields. In addition, we expect to capitalize the acquired know-how via the participation in other projects on Industry 4.0. Finally, establishing long-lasting collaborations and synergies between private companies and universities is one of the major outputs expected from the project. As we stated in our initial exploitation plan, exploitation will be based on the dissemination and transfer of results through the standardisation system to the market, thus creating a link between research, innovation, and standards activities. Standardisation activities have been identified as one of the innovation support measures significantly contributing to bridging the gap between research and the marketplace, to support the fast and easy transfer of the project research and innovation results to the

	European and international markets and stakeholders. Further internal research: 5 Collaborative research: 3 Internal product development: 3 Internal service creation: 1 Licensing: 1 Assignment: 2 Joint Venture: 1 Spin off: 1 Standardization activities: 4

TRI	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) Standardisation activities (results used either to develop new standardisation activities, or	Further exploitation in the form of: - Further Internal Research - 5 - Collaborative Research (i.e. result as a starting asset for future collaborative research projects), in EU-funded projects under HE funding scheme. – 5 - Remainder N/A The ethics and legal requirements were developed as part of D7.3 and in the context of OPTIMAI pilots related to legal framework of Spain, Greece and UK. The guidelines independently have a limited exploitation opportunity, because they are context specific (OPTIMAI pilots & three countries). Nevertheless, when combined with TRI's work on integrated risk impact assessment (ethical, legal and societal) under WP9, it can serve as a powerful ethical and legal framework for new and emerging technologies, such as AR, digital twin and blockchain. TRI will be using findings of this research for further internal research as well as collaborative research, such building on the OPTIMAI results and integrating the ethical and legal framework in new EU-funded projects either in manufacturing or beyond. We particularly perceive an opportunity in standardisation activities, either through contributing to ongoing standardisation processes of AI or developing new standards

to contribute to ongoing standardization work)	related to new and tech in the manufacturing context (AR, digital twin, blockchain).

KLEEMAN	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	The direct business advantage that KLEEMANN will gain through OPTIMAI is the optimization of quality inspection activities. This is expected to reduce costs while simultaneously improve quality, which gives a considerable business and manufacturing advantage over the competitors. As a result, the reliability of the company will also be strengthened. KLEEMANN is planning to use the OPTIMAI solutions both in a commercial and in a non-commercial basis. In a commercial basis KLEEMANN will promote the offerings and benefits of the tools in its close partner network and will support the application and deployment of the solutions. In a non-commercial basis KLEEMANN is aiming to expand the OPTIMAI solutions in the whole group, starting from the European facilities (Serbia). The OPTIMAI tools and technologies will be used only under specific commercial agreements with OPTIMAI's technical providers.

Further internal research	3
Collaborative research	3
Internal product development	1
Internal service creation	2
Licensing	1
Assignment	1
Joint Venture	1
Spin off	2
Standardization activities	2

TVES

Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects) • Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	Better cost, quality and time to market We will provide examples of real-world implementation and real results to validate the proposed prototype. NA Further internal research: 2 Collaborative research: 3 Internal product development: 1 Internal service creation: 3 Licensing: 1 Assignment: 1 Joint Venture: 1 Spin off: 1 Standardization activities: 1

MTCL	
Will your company get a direct business advantage over competitors from the results? Will you commercialize the asset as-is, or further developments have to be done? What are the expected steps in your go-to-market strategy? What are the stakeholders to be involved to achieve your exploitation vision? How do you see the result after M36? Which is the likelihood for it to lead to (provide a value from 1 – low, to 5 – high and the rationale for the forecast): • Further Internal Research • Collaborative Research (i.e. result as a starting asset for future collaborative research projects)	MTCL as an end user is not looking to commercialise the OPTIMAI product but is looking for direct improvements to factory efficiency and yield improvement. Continued use of the solution after the end of the project is an aim if the project is successful and can justify any post project cost. Further internal research: 3 Collaborative research: 3 Internal product development: 2 Internal service creation: 3

• Internal Product Development (results used in developing, creating and marketing a product/process) • Internal Service Creation (results used in creating and providing a service) • Licensing • Assignment (results exploited by other organisations by the transfer of ownership) • Joint Venture (result used as background of a joint venture) • Spin-off (a separate company established in order to bring to the market technology resulting from the project) • Standardisation activities (results used either to develop new standardisation activities, or to contribute to ongoing standardization work)	Licensing: 1 Assignment: 1 Joint Venture: 1 Spin off: 1 Standardization activities: 3

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