

Exploitation, IPR and business model roadmaps (v2)

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Abstract

The main aim of the CIRC-UIITS project is demonstrating the improvement to the circularity of automotive and mass electronics sectors by recovering materials from wasted products, as well as supporting the reuse & remanufacturing of electronic components into new (high value) products in these sectors. To this aim, CIRC-UIITS wants to demonstrate the improvement to the circularity of automotive and mass electronics sectors, by recovering materials from wasted products, as well as supporting the reuse & remanufacturing of electronic components into new (high value) products in these sectors. Through a set of success stories coming from the application of circular economy principles in four value chains (car braking systems, tyre sensors, in-mold electronics – IME and Waste from Electrical and Electronic Equipments – WEEE), CIRC-UIITS wants to demonstrate the benefits coming from Digital Circular Economy through 4 pilots.

Deliverable D5.3 “Exploitation, IPR and business model roadmaps (v2)” builds on deliverable D5.1 that has been submitted in month 18 and describes the progress in exploitation activities as well as further plans until month 36, the end of the project.

After an introduction in section 1, section 2 focuses on the joint exploitation of the CIRC-UIITS Electronics Circularity toolbox that brings together most Key Exploitable Results and describes the general approach as well as first details on services offered in the future.

Section 3 summarises the activities that have been supported under the Horizon Results Booster programme and the main results, lessons learned as well as the way forward for the KERs that participated in this activities.

Section 4 describes dedicated Circular Economy Business Models that best suit selected KERs.

Finally Section 5 provides an update to the individual KER descriptions in deliverable D5.1.

Summarised the most promising results of CIRC-UIITS for future exploitation and commercialisation in the next 1-3 years are

- CIRC-UIITS Electronics Circularity toolbox bringing together most of the KERs in one competitive package.
- Potential foundation of a spin-off company around KER 7 and POLIMI,
- Potential foundation of a spin-off company around KER 9 and SUPSI and
- Potential foundation of a spin-off company around KER 14 and OFFIS.

List of acronyms

BOM	Bill of Materials
CE	Circular Economy
CRM	Critical Raw Materials
DIY	Do it yourself
ECU	Electronic Control Unit
EOL	End-of-Life
EPR	Extended Producer Responsibility
ESP	Electronic Stability Program
HMI	Human Machine Interface
IP	Intellectual Property
IPR	Intellectual Property Rights
KER	Key Exploitable Result
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
SLCA	Social Life Cycle Assessment
TPMS	Tire Pressure Monitoring Sensor
WEEE	Waste from Electrical and Electronic Equipment

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1. Introduction

CIRC-UIITS improved the circularity of the automotive and mass electronics sectors by recovering materials from waste products and reusing and remanufacturing electronic components into new high-value products. These sectors use many sensors, actuators, electronic control units and telecommunication systems to connect their products to the internet and enable real-time data exchange. However, this also creates environmental risks due to the dependence on semiconductors, which are scarce and hazardous materials. End-of-Life Vehicles (ELVs) and e-wastes are major sources of secondary raw materials that can be reused or recycled. The European Commission has published specific EU strategies for these sectors to make them more sustainable, circular and resilient. CIRC-UIITS aligned with these strategies, as well as with the Sustainable Development Goals (SDGs) set by the United Nations (UN), the European Green Deal and the EU Circular Economy Action Plan, and the EU Industrial Strategy. CIRC-UIITS addresses some of the priority areas of these plans, such as:

- CIRC-UIITS used digital technologies to support the transition to circular practices, track and share data about critical and hazardous materials, calculate the environmental footprint of products, linked with the EU LCA platform, and reduced transaction costs and increased collection rates.
- CIRC-UIITS increased resource efficiency and independence from imported materials, reduced the environmental impact of manufacturing processes, and identified the best EoL scenarios for reuse, refurbish, remanufacturing and recycling.
- CIRC-UIITS improved and standardized information and data sharing among industrial leaders in the same or similar value chains, demonstrated the benefits of circular behaviours, and organized dissemination, communication and education actions.
- CIRC-UIITS tested its achievements in four pilots: P1 – Brake system Electronic Control Units (ECU); P2 – Tyre Pressure Monitoring Sensors (TPMS); P3 – In-Mold Electronics (IME) and P4 – Obsolete Printed Circuit Boards (PCB).

CIRC-UIITS focused on connecting actors who implement one or more Key Enabling Technologies (KETs) with the rest of the value chain to increase circularity. It also integrates I4.0-based technologies (e.g., simulation, Artificial Intelligence (AI), Augmented/Virtual Reality (AR/VR), Digital Twin (DT), cobot, Blockchain (BC), data spaces) into the project. The strong expertise of the partners in both automotive and mass electronics has been exploited to reach the objectives. The reference framework of CIRC-UIITS covered different levels of its solution.

2. Exploitation of the “CIRC-UIITS Electronics Circularity Toolbox”

The CIRC-UIITS Electronics Circularity Toolbox is one of the main technological results of the CIRC-UIITS project. Given its goal to support actors belonging to the mass electronics and automotive sectors to perform more informed circularity-driven decisions, it fulfils CIRC-UIITS’ ambition to improve the uptake of circular practices in these target sectors, fostering the recovery of materials from waste products and the reuse and remanufacturing of electronic components into new high-value products.

Given the toolbox’s modular nature, its exploitation plan includes the participation of several partners, which have different roles based on their core activities and type of entity. The exploitation strategy must therefore take into account both the internal dynamics of the consortium and the external opportunities that can arise from the increasing demand for advanced circular solutions. Section 2 of the present document presents an integrated approach to exploitation that recognises the collaborative nature of the Toolbox’s development, the variety of partner roles, and the different forms of value generated throughout the project.

2.1. Partner roles

In order to introduce and explain the CIRC-UIITS Toolbox joint exploitation, it is important to define the starting point in terms of partners and their roles in the project. For what concerns partners there are three categories that will act in different but joint way in the exploitation:

- ICT and service-oriented partners: namely TXT and MARAS. These partners are either ICT companies focused on software development and services, both for generic purposes or sustainability-specific (i.e. MARAS). Within CIRC-UIITS, these companies have major roles in the development of WP2 and WP3.
- Academic, research and education-oriented partners: SUPSI, OFFIS, POLIMI, INNOVALIA, BESU, SAT, TNO. These consortium members are universities, research centers or public/semi-public institutions focused on theoretical research and methodology, or private entities focusing on education services & consultancy. These institutions get money from governments and/or form consultancy services to private companies. In particular, the consortium academic members can be classified as follows with respect to their main commercial source:
 - Focus on public research: SUPSI, OFFIS, POLIMI, TNO, INNOVALIA
 - Focusing on consultancy: BESU, SAT

These partners are involved in CIRC-UIITS with major roles in research WPs like WP1, WP2, WP3, WP5, WP6.

- Industrial partners: ERION, BEKO, BOSCH, CONTINENTAL, TRACXON. These partners are either OEMs and producers of real things and have (depending on cases) services offered on top of products or organizations that manage for OEMs the End of Life (EoL) phase of their products (waste management). They get money from the market as ICT partners but focusing more on physical assets rather than intangible services/software (OEMs) and from membership fees (waste management organizations). These partners are involved in CIRC-UIITS as end-users to test and validate the CIRC-UIITS research, innovation and technological offer.

In particular, they can be classified as follows:

- Producers and OEMs: BEKO, BOSCH, CONTINENTAL, TRACXON
- Producer Responsibility Organization: ERION

2.2. CIRC-UIITS toolbox exploitation vision and results packages

As mentioned, the toolbox was the starting focal point of the joint exploitation vision, as it is one of the main technical results of the project. Given that it is the result of a joint effort among several partners with core expertise covering different critical areas, the toolbox resulted in a virtuous tool to it fulfils CIRC-UIITS' ambition to improve the uptake of circular practices in these target sectors, targeting the recovery of materials from waste products and the reuse and remanufacturing of electronic components into new high-value products.

The following joint exploitation concept for the CIRC-UIITS toolbox builds on the draft of KER13 (see section 5), which was purposely extended to include the partners' activities that are linked to the toolbox scope, in order to create a project-encompassing vision based on the relevant partners' results (KERs), be them technological, methodological or consultancy-oriented.

As analysed, the CIRC-UIITS toolbox joint exploitation does not revolve only around the results of technical partners that designed and developed the toolbox. Other partners' possible involvement was mapped in a bigger project exploitation picture, based on the partners role activities and results in the project (see picture below).

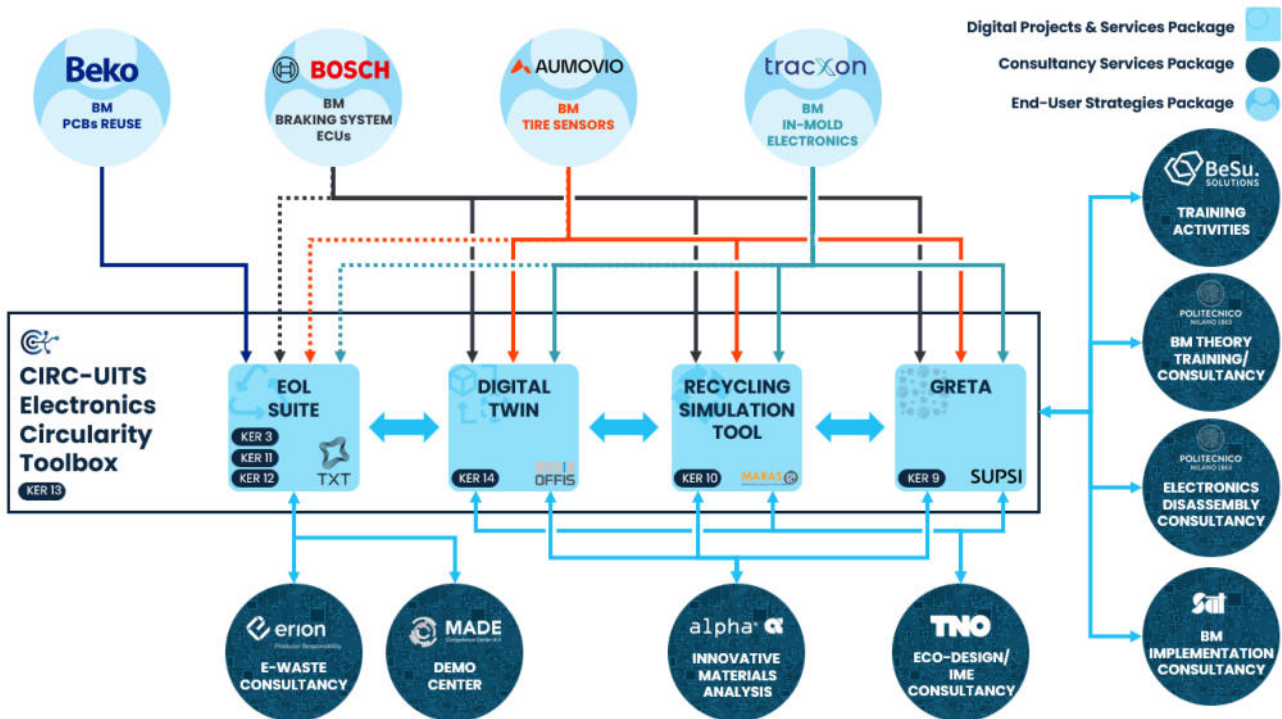


Figure 1: CIRC-UIITS toolbox joint exploitation vision

As a result of this mapping and based on the different roles of the partners in the project, three different packages of results were identified, which are linked in different ways to the CIRC-UIITS toolbox and highlight the synergies and complementarity among the different activities carried out within the project:

- **Digital Projects & Services Package:** it is composed of the four core tools of the toolbox – EoL suite (developed by TXT; it includes the Marketplace, the Advanced HMI and the Dataspace modules), Digital Twin (developed by OFFIS), Recycling Simulation Tool (developed by MARAS), GRETA (developed by SUPSI).
Based on their functions, these tools are self-standing but complementary
- **Consultancy package:** plethora of consultancy services offered by other consortium partners which are linked to the toolbox (to one single tool or the whole bundle, based on the customer’s necessity) and build on partners’ knowledge generated though CIRC-UIITS
- **End-User Strategies Package:** individual exploitation routes which are enabled by and linked to the CIRC-UIITS toolbox

The three packages will be described in more detail in the following sections.

2.2.1. Digital Projects and Services Package

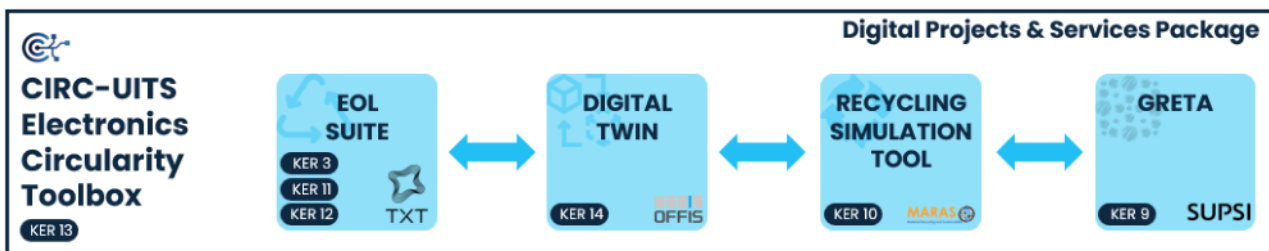


Figure 2: CIRC-UIITS technical tools included in the Digital Projects and Services Package

The heart of the Digital Services Package is the CIRC-UIITS Circularity Toolbox itself. Since its design phase, the Toolbox was conceptualised and consequently implemented as a modular digital ecosystem composed of several *complementary* tools, each addressing specific needs linked to circularity, end-of-life processes, remanufacturing, materials recovery, data-supported decision-making, and value-chain transparency, allowing the user the possibility to choose among separate tools or bundles based on their needs and interest.

As described in detail in Deliverable 2.7 “Platform development for the circular value chains”, from the earliest stages of development the Toolbox’s architecture was intentionally designed to allow:

- *Modularity*, enabling the use of individual tools as standalone solutions
- *Interoperability*, ensuring that different modules can be combined when needed
- *Scalability*, allowing the system to grow and integrate new functionalities over time
- *Customisation*, enabling users to build personalised bundles tailored to their operational or business needs

From a technical perspective, the toolbox is composed of 6 modules, developed by the 4 technical partners involved in the project:

- The *Marketplace module* (KER 3), developed by TXT
- The *Advanced HMIs module* (KER 11), developed by TXT
- The *Data Layer* (including the Data Space (KER 12), developed by TXT
- The MARAS Recycling Simulation models for assessment and advisory as part of the *Life Cycle Sustainability & Circularity Assessment (LCS&CA) module* (KER 10), developed by MARAS
- The *Digital Twin and Simulation module* (KER 14), developed by OFFIS
- The *GRETA module* (KER 9), developed by SUPSI

Each module is standalone and characterized by specific functionalities that address the needs of the target users identified (see section 5 to read the single KERs descriptions).

For the sake of optimized tools' usability in view of customers' satisfaction and for a more organic go-to-market strategy, some modules were grouped in bundles to optimize their take up. As a result, the three tools developed by TXT were grouped in the "End of Life (EoL) Suite". This is due to the fact that these three tools target mostly the End-of-Life phase of the products (electronic components, in this case). The GRETA module, on the other hand, despite its standalone nature, is often grouped with other modules, mostly the Recycling Simulation Tool and the Digital Twin and Simulation, acting as a set of distributed Advisory Services that closely interact with the targeted modules to extend their capabilities.

As previously mentioned, this design philosophy allows the Toolbox to address a wide range of use cases and diverse stakeholder groups across the electronics value chain. Manufacturers, recyclers, remanufacturers, waste management operators, and even regulatory or research organisations can access different parts of the system depending on their priorities.

Given the distributed development responsibilities among partners, the exploitation model for the Toolbox does not rely on a single centralised commercial strategy. Instead, each partner retains autonomy over the commercialisation of the tool(s) they have developed. This includes the definition of:

- Their own business model or exploitation strategy
- Target markets and customer segments
- Pricing structures and licensing conditions
- Decision-making regarding updates, maintenance, and long-term development

However, this autonomy exists within a collaborative framework. The consortium acknowledges that the various tools are complementary and can generate greater value when presented as a combined offer to potential customers.

To act on this joint approach, an opportunity-based collaboration model will be adopted. This means that:

- Partners that identify commercial opportunities will involve the relevant tool owners as needed
- Referral mechanisms will be established to ensure fairness and transparency
- Revenue-sharing arrangements may apply when a partner contributes to the commercialisation of another partner's tool

For example, if Partner A discovers a customer who requires a tool developed by Partner B, Partner A may receive an agreed percentage of revenue (e.g., 5%) as a referral fee. This principle applies reciprocally and does not require predefined market segmentation. Markets will not be artificially divided by country or region. Instead, partners will leverage their thematic networks, experience, and contacts, irrespective of geographical location.

This implies that in principle any technical partner can be the initiator of such dynamics, by finding a customer for their own services and potentially acting as referral for other technical partners and their tools. However, when taking into consideration the different technical partners' nature, it is expected that TXT will often act as a major contractor for contracts, tenders, or consultancy assignments involving the Toolbox. This is given its organisational profile, market presence, and capacity to manage large-scale projects. Other partners may support as subcontractors or workshare where relevant.

This setup, however, does not limit other partners from directly commercialising their own tools independently. The arrangement simply reflects operational efficiency and the complementary nature of technological strengths within the consortium.

These mechanisms have been consolidated in a Memorandum of Understanding (MoU), that is currently under development. The agreement is not intended to lock partners into rigid commercial terms. Instead, it:

- Establishes shared principles and mutual commitments linked to the CIRC-UIITS post project exploitation activities
- Affirms that specific commercial agreements will be negotiated case-by-case when opportunities arise
- Provides examples of possible arrangements (e.g., referral fees, subcontracting schemes)
- Clarifies expectations regarding cooperation and the protection of confidential and commercial interests

This flexible yet structured framework is essential to ensure that exploitation activities can adapt to emerging opportunities during and after the project.

The following subsections describe more in depth the 4 core tools of the Digital Projects & Services Package.

2.2.1.1. *EoL Suite*

The End of Life Suite is a bundle that includes three tools of the CIRC-UIITS Digital Toolbox: the *Marketplace Module* (KER 3), the *Advanced HMIs Module* (KER 11) and the *Data Layer*, including the *Data Space* (KER 12); all these tools were developed by TXT. The three tools have been developed with a specific focus on the requirements of the mass electronics and automotive sectors. They primarily address the current lack of an efficient and structured connection between OEMs and parts suppliers (Beginning of Life stage) with WEEE collectors and recycling plants (End of Life stage). This gap significantly limits effective End of Life management and, in particular, the systematic reuse of electrical components or sub-components, thereby constraining the potential for increased circularity within these industrial sectors. Moreover, the EoL Suite aims at strengthening the trust of all the actors involved by providing a secure data sharing function, which allows data owners to retain ownership and control over the data they share. This is especially important for OEMs, which are generally protective of their proprietary and often sensitive data, and are therefore typically reluctant to share it with external stakeholders, which in turn limits the exchange of information that is often critical to enabling circularity across the value chain.

The three tools have different objectives and functions, namely:

- **The *Marketplace Module*** is a centralized platform that connects end-of-life (EoL) actors (including recycling and WEEE treatment plants) with beginning-of-life (BoL) actors (including consumer electronics manufacturers), to enable the reuse of components for re-manufacturing. By facilitating

the return of used components into the production cycle, it opens up possibilities for new revenue streams, supports circularity across the value chain, improves access to second-hand PCBs and components, and helps meet European targets for critical raw materials and precious metal recovery.

- **The *Advanced HMIs Module*** assist recycling operators in the dismantling activities of WEEE appliances, facilitating the recovery of components and PCBs for reuse exploiting innovative AR/VR solutions for improved efficiency. Further support is provided when it comes to components not suited for reuse that have to be recycled instead. By exploiting advanced categorization techniques and powerful visualizations, the Advanced HMIs can guide the operator through the PCB sorting phase to ensure proper disposal of electronic boards, minimizing waste and improving operators' efficiency.
- **The *Data Layer*** (including the *Data Space*) provides a unified and secure data storage and exchange backbone, enabling seamless interaction among all Modules through standardized APIs. Acting as an abstraction layer over external systems such as shop-floor data sources and legacy platforms, it ensures efficient data integration, accessibility, and reuse. Through its core components (the Data Manager, Data Management, and Data Space Connector) the module supports data conversion, storage, and secure data sharing, facilitating streamlined workflows and informed decision-making across the toolbox.

The End of Life (EoL) Suite business model is designed to deliver a scalable, market-ready digital solution that supports circular economy strategies across the industrial value chain. The EoL suite targets both manufacturers and WEEE operators by enabling increased component reuse, reduced supply chain risks, improved regulatory compliance, lower production and operational costs, faster and more accurate dismantling processes, and new revenue streams from second-hand components, ultimately supporting ESG compliance, resilience, and sustainability.

The solution is developed and delivered through a strong ecosystem of key partners, including CIRC-UITs technology providers offering complementary modules (such as MARAS, OFFIS, and SUPSI), consultancy and service partners (BESU, MADE, ERION, POLIMI, SAT, and ALPHA), and industrial partners like BEKO acting as testers and early adopters. ERION also plays a strategic role as a market multiplier by facilitating access to its extensive network of potential customers. The core resources that will be exploited and leveraged to sustain the solution and that underpinning the business model are advanced IT and software engineering capabilities and proprietary intellectual property developed within the project, including the Data Layer, Marketplace Module, and Advanced HMI Module. Considering the scope and complexity of the key activities required to bring the solution to a fully market-ready status, the go-to-market strategy is expected to be implemented over a timeframe of approximately one to two years.

More detailed information about the Business Model for the EoL Suite can be found in Section 4.

2.2.1.2. Digital Twin and Simulation

The digital-twin module is accessed through a web-based frontend. The module accesses the latest design data and material inventories. From this hub the engineer can move seamlessly between five real-time modules – **Design, Decision, Critical Raw-Material, and Repair Tool** – updating as new information becomes available.

In the **Design Tool**, the user simply chooses alternative parts or material blends onto a virtual model. In the **Decision Tool** a live “sustainability scorecard” then refreshes across more than 15 key performance indicators, showing recyclability, carbon footprint, repair index, critical-material risk and other metrics

side-by-side. This means that the user can compare different product versions like “what-if” scenarios, for example “Repair Route A saves 12 tCO₂ versus Repair Route B”.

The **Critical Raw-Material Dashboard** displays EU-grade risk maps for every alloy or mineral in the bill of materials; if a selected material approaches a supply-risk threshold, an alert pops up, prompting the user to consider a safer substitute.

With the **Repair Tool** the user can generate the repair index for every product design according to the EN45554. Thus, changes from the design and decision tool can be instantly addressed by the user.

Where lifecycle-assessment data are missing, a machine-learning model automatically predicts recyclability, toxicity or other missing numbers, eliminating the need for manual data hunting.

All of these capabilities translate into instant, data-driven design decisions without the overhead of spreadsheets or delayed LCAs. Users can visualise trade-offs between sustainability, cost and risk in a single view, enabling clearer, faster choices. Pilot projects have demonstrated up to 250% increase in repairability index. Because the digital twin uses an API to fetch data from the GRETA tool, it integrates seamlessly into the workflow in the toolbox. Through this API, the digital twin can also integrate the results from the Recycling Simulation.

In summary, the digital twin adds the dimension of repair and critical raw material risk assessment to the toolbox. It combines the LCA and recycling data from the GRETA and recycling simulation so that an overall trade-off is visualized. It also incorporates an AI model that can help with missing data.

The exploitation strategy positions the digital-twin as a tiered SaaS solution, offering a base subscription for core modules and usage-based add-ons that scale from SMEs to large OEMs. High-margin professional services—implementation, custom model development and training—are bundled to accelerate adoption and generate additional revenue streams. Strategic co-selling with the other toolbox modules embed the creates stickiness and opens joint-marketing channels. A spin-off company holds the IP and commercial rights, ensuring clear separation from the non-profit research institute.

More detailed information about the Business Model for the Digital Twin and Simulation can be found in Section 4.

2.2.1.3. Recycling Simulation Tool for assessment and advisory

The Life Cycle Sustainability and Circularity Assessment (LCS&CA) module provides the analytical backbone of the CIRC-UIITS Electronics Circularity Toolbox, enabling the quantitative evaluation of environmental, economic, social and circularity impacts across the full product life cycle. Within the toolbox, the LCS&CA module consolidates inputs from design, use and end-of-life phases into a harmonised assessment framework supporting data-driven circularity decisions. The value added of the LCS&CA module lies in its tight integration with the Recycling Simulation and Digital Twin modules. The resulting assessment outputs are reused by the Advisory (GRETA) services and the Digital Twin to support scenario comparison, trade-off analysis and optimisation. From a functional perspective, the LCS&CA module acts as a shared assessment layer, providing validated indicators and datasets that can be exchanged across toolbox modules through standardised interfaces. This modular yet interoperable setup allows users to flexibly combine assessment, simulation and advisory functionalities while preserving methodological consistency. In short, the exploitation strategy for the LCS&CA module is based on its use as both a standalone assessment capability and an enabling component embedded in bundled digital and consultancy offerings. It targets manufacturers,

recyclers and system integrators, supporting circular design, recycling strategy definition and sustainability compliance analyses. More detailed information is provided in Section 5.x (KER 8 and KER 9 chapters) of this deliverable, while technical architecture and module interactions are described in Deliverables D3.2 and D2.4. The results of the LCS&CA functionalities through the industrial pilots is reported in Deliverable D4.2.

The recycling process simulation models as developed and described in WP3, D3.1, have been defined and developed by MARAS over the past 20 years by MARAS and have been applied as part of the LCS&CA assessment and advisory methodologies in the CIRC-UIITS project. The models as developed in the professional platform HSC Sim (HSC Sim 10) provide a rigorous and physics-based Digital Twin for the recycling processing system and is applied for End-of-Life assessment and advisory. The systemic view and the detailed mass, energy and exergy balances that these process simulation models are based on, enable rigorous resource efficiency and sustainability evaluations for production and recycling processes and the systems they are a part of. The results provide a range of physics based KPIs such as recycling and recovery rates, exergy indicators, qualities and quantities of the recyclates, losses and emissions of materials during production recycling, so hence environmental indicators.

The value of this physics-based modelling tool lies in the possibility to validate and assess different designs and design concepts in terms of recyclability, circularity and environmental impact and discern between designs by determining unique recycling and circular fingerprints as a function of design and End-of-Life product management (i.e. recycling flowsheet architecture). The quantified KPIs as calculated from the MARAS simulation model provides rigorous KPIs to support Advisory in Design for Recycling by identifying hot-spots in recycling not only considering recoveries, but also addressing losses and emissions. Based on a direct link between product data and recycling KPIs, critical issues in design can be addressed and Advisory is defined. In addition, on the basis of the assessment, dismantling and repair Advisory. The exergetic calculations prove to be an excellent KPI to capture both the effort/work of recycling processing, created products and residues and their quality and can also be applied to compare different recycling routes as well as to support in advisory and decision making in optimization of recycling processing, selection of best processing options in combination with improving design. The mass and energy basis of these models for all flows and materials provide input to LCA assessment (GRETA) within the LCS&CA module based on the easy link between process simulation and LCA within the HSC Sim software and hence MARAS models. This interaction facilitates the improvement of current 'averages based' EoL databases in LCA databases into process and product specific EoL environmental assessment values. The combination of total and material recycling rates and the exergetic KPIs allow for addressing and quantifying the possibilities and limits of recycling and Circular Economy and provide the basis for OEMs to drive Circular design. The MARAS Recycling Simulation model also can be applied to provide input to policy making to develop ambitious however realistic and feasible targets on the basis of dictating laws of physics and thermodynamics. Such basis is crucial to safeguard European industry and realise Circularity within what's is truly possible to achieve.

2.2.1.4. GRETA

The GRETA platform is meant to provide the CIRC-UIITS Electronics Circularity Toolbox with sustainability and circularity assessment (LCS&CA) and advisory functionalities. The LCS&CA functionalities of GRETA provide the analytical backbone of the CIRC-UIITS Electronics Circularity Toolbox, enabling the quantitative evaluation of environmental, economic, social and circularity impact across the full product life cycle. Within the toolbox, GRETA consolidates inputs from design, use and end-of-life phases into a harmonised assessment framework supporting data-driven more sustainable and circular decisions. Within the toolbox, GRETA is meant to cooperate with the Recycling Simulation and the OFFIS Digital Twin modules. Together with the MARAS tool, GRETA can perform the LCA of recycling processes, while the resulting assessment outputs are

reused by the Advisory functionalities of GRETA and by the Digital Twin to support scenario comparison, trade-off analysis and optimisation. From a functional perspective, the GRETA module acts as a shared assessment layer, providing validated indicators and datasets that can be exchanged across toolbox modules through standardised interfaces. This modular yet interoperable setup allows users to flexibly combine assessment, simulation and advisory functionalities while preserving methodological consistency.

Moreover, the GRETA platform, extends the CIRC-UIITS Electronics Circularity Toolbox from sustainability assessment to actionable decision support. GRETA translates LCS&CA results into guidance for identifying hotspots, comparing scenarios and improving product sustainability and circularity across design, use and end-of-life phases. The value added of GRETA lies in its role as an integrative advisory layer that builds upon data and results generated by other toolbox modules. Through dedicated APIs, GRETA exchanges data with the Digital Twin modules, ensuring consistency of assumptions and results across tools. This enables users to move seamlessly from quantitative assessment to guided optimisation without duplicating data or models. GRETA's advisory functionalities, including hotspot identification, best customisation and AI-supported modelling assistance, increase the usability and accessibility of complex sustainability analyses, particularly for non-expert users and SMEs. Within the toolbox ecosystem, GRETA therefore acts as a bridge between advanced analytics and operational decision-making, enhancing the overall value and adoption potential of the toolbox. In short, the exploitation strategy for GRETA is based on its use as both a standalone assessment and advisory capability and an enabling component embedded in bundled digital and consultancy offerings. It targets manufacturers, recyclers and system integrators, supporting circular design, recycling strategy definition and sustainability compliance analyses. Its business model combines subscription-based access with value-added services such as consultancy, training and system integration, enabling flexible market uptake while leveraging synergies with the LCS&CA, Digital Twin and Recycling Simulation modules.

More detailed information about the Business Model for GRETA tool can be found in Section 4, while the KER evolution and exploitation aspects are detailed in Section 5 (KER updates chapter). Technical developments and validation activities are described in Deliverables D3.2 and D2.4.

2.2.2. Consultancy Services Package



Figure 3: Consultancy services linked to the CIRC-UIITS toolbox offered by project partners

Beyond the digital tools, the project has generated substantial methodological, analytical, and domain-specific expertise. Many partners (especially research and technical institutions) are well positioned to offer consultancy and value-added services that complement the CIRC-UIITS Toolbox and enhance its usability for clients.

Several partners possess extensive experience in circular economy methodologies, practical implementation strategies, system design, assessment models, sustainability metrics, and applied training. Their competencies enable them to provide:

- Support in applying and integrating Toolbox methodologies and functionalities into real operational contexts

- Training and capacity-building activities linked to the tools
- Consulting on circular design, product lifecycle strategies, and operational transformations
- Support in translating data insights from the Toolbox into actionable decisions
- Advisory support for compliance and regulatory issues

These services do not deal with commercialisation of software; they leverage the knowledge developed in CIRC-UIITS to support organisations interested in circular transformations. Their link to the Toolbox can be limited to a single tool or to the whole set of tools.

Similar to the digital tools, these consultancy services can be activated on demand. If a technical partner encounters a client needing expert guidance or training, they can involve the relevant consultancy partners. In return, referral mechanisms (such as the same 5% referral fee) may apply. Vice-versa, consultancy partners can engage the technical partners and their tools should any customer be interested.

The Consultancy Services Package should therefore be considered as an ecosystem of added-value offerings that extend the reach and impact of the Toolbox.

The following sub-sections describe the Consultancies envisioned at this stage.

2.2.2.1. Educational and training activities – BESU

BESU provides demand-driven training services that can be commissioned by customers of either the full CIRC-UIITS Electronics Circularity Toolbox (EoL Suite, Digital Twin, Recycling Simulation Tool, GRETA) or an individual module. The training is engineered as a short-cycle, requirements-traceable development with a total lead time of 6–8 weeks, depending on scope and stakeholder availability.

Kick-off and requirements capture (week 1): A structured kick-off meeting collects the customer’s target audience profiles, competence gaps, operational context, and learning constraints (time budget, platform, languages, assessment needs). Outputs: training goals, learning outcomes, delivery format decision, and acceptance criteria.

Storyboard and instructional design (week 1–2): BESU produces a storyboard and content architecture (modules, micro-learning units, interactions, knowledge checks) aligned with the customer’s use cases and the selected toolbox module(s).

Content handover from tool providers (week 2–3): Relevant CIRC-UIITS tool owners provide validated technical inputs (workflows, screenshots, demo datasets, KPIs, limitations, do/don’t guidance) under an agreed review protocol to ensure correctness and consistency.

Increment 1 development (week 3–5): BESU implements a first functional training increment (interactive units, assessments, media, glossary), including traceability from learning outcomes to content items.

Review, testing, and validation (week 5–6): Joint review with customer and involved tool providers; usability testing and technical verification; defect fixing and content hardening.

Finalization and handover (week 6–8): Delivery as SCORM or xAPI package for direct LMS deployment and/or integration into the Toolbox environment, including metadata, versioning, and a short admin guide. Optional: train-the-trainer workshop to enable internal rollout and consistent facilitation.

The on-demand e-learning development process described above is effective because it keeps training tightly requirements-driven and acceptance-criteria-based, reduces delivery risk through early increments and

structured validation, and produces a technically verified, deployable outcome within a controlled 6–8 week cycle. The modular structure of **learning nuggets** adds further value: discrete micro-units can be curated, reused, and extended over time, allowing customers to introduce training step-by-step alongside new toolbox releases, additional use cases, or role profiles—without disrupting existing learning assets. In particular, xAPI enables strong potential for seamless integration into the toolbox itself, as learning interactions and competence progression can be captured at a granular level and linked directly to toolbox workflows (e.g., context-sensitive guidance, adaptive learning paths, and measurable adoption/impact via learning analytics), thereby supporting both correct tool usage and continuous improvement.

A **learning nugget** is a self-contained micro-learning unit that targets exactly one clearly defined learning objective and is designed to be consumed independently and reused across different learning paths. In the CIRC-UIITS toolbox context, a nugget typically takes **3–7 minutes** to complete and should not exceed **10 minutes**; if the content requires more time, it is split into multiple nuggets to maintain focus and modularity. Didactically, each nugget is anchored in a concrete workflow step (a specific tool feature and decision point), keeps cognitive load low by introducing only one concept or procedure at a time, and includes an active element such as a short scenario, interaction, or knowledge check with immediate explanatory feedback. Because nuggets are tagged by role, tool module, and competence area, they can be curated, updated, and added step-by-step into the toolbox as a structured, expandable learning library, and packaged consistently for delivery via SCORM or xAPI.

2.2.2.2. Circular Business Models Theory training activities & design support – POLIMI

In the context of the CIRC-UIITS project, POLIMI has developed expertise and competencies to design, develop, and fine-tune circular business models, particularly for electronic components in the automotive and mass electronics sectors. POLIMI, as an academic institution, can offer training services to companies willing to pursue a circular transition but lacking the necessary skills and knowledge among their managers. POLIMI can design and deliver structured and tailored courses ranging from the basics of the circular economy to advanced concepts and methods to design and manage real-life circular business models. The capacity-building sessions will be organized as a balanced mix of direct lecturing, case studies, and working groups. The board game developed by BESU in CIRC-UIITS might also be exploited in some capacity-building sessions. Furthermore, synergies and complementarities with BESU and their training and educational activities might be identified and exploited, even in an informal manner.

Besides, POLIMI has acquired the expertise to support companies in the automotive and mass electronics sectors that want to pursue a circular economy paradigm to design a complete and convenient circular business model. This type of POLIMI's consultancy would start by gathering the context and needs of the company, and the main alleviated pains or obtained gains that the consulted company can offer to its customers. Then, thanks to the expertise and know-how acquired in CIRC-UIITS, and some additional desk research, POLIMI can identify points of strength and weakness of the main competitors and the suitable customer targets. Based on that, the value proposition can be defined. Then, starting from this, the other main points of the business model can also be defined. The whole consultancy project would be carried out in close interaction with the customer, receiving from them the inputs and feedback needed to craft the business model.

Since POLIMI is a university, the only suitable way to activate this type of consultancy is through subcontracting from the CIRC-UIITS Toolbox partner that was the first to get in contact with the customer. However, to carry out the described work, close interaction with the customer is needed.

2.2.2.3. Electronics Disassembly services consultancy – POLIMI

POLIMI's spin-off will focus on offering services to automate and optimize the disassembly and desoldering procedures of components on the PCBs, to recover and subsequently remanufacture or reuse them. On top of that, complementary services about the criticality assessment of components and PCBs eco-design (mostly design for disassembly) will be offered. All the details are disclosed in Section 4.4 and in Annexes 4.4 and 4.5.

This service is necessary for companies that want to implement circularity actions with high volumes of electronic components. By automating the disassembly process, related throughput times and costs are significantly decreased, making the whole process economically feasible. This is consistent with the type of customers that can be addressed by the modules of the Toolbox (e.g., sustainability and circularity assessment, marketplace for components to be reused, eco-design improvements, etc.), as proved by CIRC-UIITS industrial pilots.

2.2.2.4. Circular Business Model Implementation consultancy – SAT

SAT offers through its spin-off company Kopacek KG (ISL) consulting, coaching, mentoring and training services. Currently the focus lies on implementing resource efficiency (collection, dismantling, re-use, recycling, recovery of critical raw materials) and Circular Economy (sharing economy, circular inputs, product use extension, resource recovery, product as a service) in practice.

ISL's services reach from short (2-3 days) training workshops on specific challenges to mentoring start-ups and entrepreneurs over several months, even years to projects co-developing innovation circular products and services.

ISL will use appropriate tools from the CIRC-UIITS toolbox in their consulting assignments and product/service development projects depending on customer requirements as well as offers to serve as a sales partner for Central Europe.

2.2.2.5. E-waste consultancy – ERION

Erion is Italy's largest multi-consortium, non-profit organisation operating under the Extended Producer Responsibility (EPR) framework. It brings together six consortia and a network of more than 2,500 member companies, and relies on a broad network of logistics providers and treatment and recycling facilities, with the aim of reintroducing secondary raw materials into the market.

Through its consortia, Erion manages multiple waste streams, including professional and household WEEE, batteries and accumulators, EEE packaging waste, tobacco waste and textile waste—building over time a solid track record in terms of authority, efficiency and quality.

Within the Toolbox, Erion's role is primarily advisory: it connects OEM producers with Erion's supplier network (e.g., treatment facilities) to test and validate the marketplace developed within the CIRCUITS project, enabling the valorisation and sale of reusable components such as PCBs and other high-value parts with reuse potential.

2.2.2.6. Demo Centre activities – MADE

MADE is a digital and sustainable factory that supports manufacturing companies on the path of digital transformation towards Industry 4.0 through training, education, and consulting activities. It provides a wide range of knowledge, methods and tools on digital technologies ranging from design to engineering, production management to delivery, and end-of-life management.

In particular, by exploiting its Demo Centre, MADE will enable companies to perform test runs of the EoL Suite, allowing them to evaluate its functionalities, benefits, and integration potential before full-scale

deployment. This hands-on experimentation lowers adoption barriers, reduces perceived risks, and increases awareness of the value of digital technologies for end-of-life management and circular economy practices. By combining consultancy services with practical demonstrations, MADE will support companies in understanding how the digital solution can be adapted to their specific operational contexts, thereby fostering wider uptake and long-term exploitation of the developed technologies.

2.2.2.7. *Innovative Materials consultancy – ALPHA*

MacDermid Alpha Electronics Solutions, a business unit of Element Solutions Inc, delivers innovative, high-performance chemistries, materials, and services that enable next-generation electronics. Within CIRC-UIITS ALPHA focused its work on providing low temperature solder alloy and process expertise in materials and finishes that can be processed with reduced use or resources (e.g. low temperature) maintaining the high level of performance requested by the automotive and electronics sectors. ALPHA offers to support also other customers with these consulting services within the CIRC-UIITS joint dissemination efforts.

2.2.2.8. *Eco-design In-mold Electronics- TNO*

TNO at Holst Centre is an innovation center specializing in Hybrid Printed Electronics (HPE) and In-Mold Electronics. Their consultancy services focus on enabling eco-design principles for IME by integrating sustainability into product development and manufacturing processes. Key offerings include:

- **Design-for-Circularity:** Expertise in creating IME solutions that are recyclable, repairable, and separable, reducing environmental impact throughout the product lifecycle.
- **Material and Process Innovation:** Guidance on using low-carbon plastics and metals, recycled content, and advanced thermoforming and roll-to-roll printing techniques for sustainable production.
- **Lifecycle Assessment (LCA):** Support in evaluating environmental impacts and implementing circular strategies such as reuse, recycling, and repair for IME components.
- **Advanced Demonstrators:** Development of prototypes showcasing eco-design features like repairability and disassembly, particularly for automotive and IoT applications.

2.2.3. End-User Strategies package

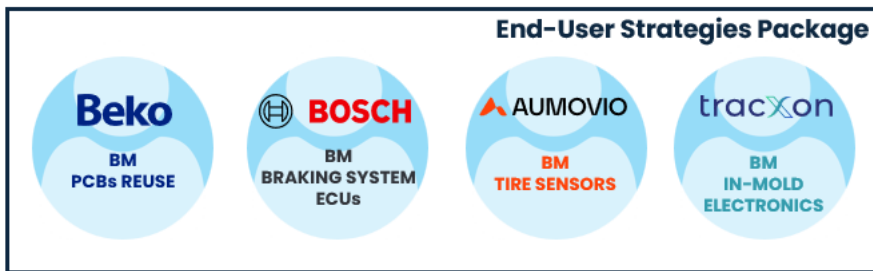


Figure 4: CIRC-UIITS end-user post project strategies linked to the CIRC-UIT toolbox

The third exploitation package is oriented toward industrial stakeholders and end users, drawing heavily on the insights and outputs generated by the project’s pilot activities (primarily within Work Package 4). These industrial demonstrations have shown how the Toolbox can be embedded within real operational environments, validating both its technical functionality and its practical relevance.

The pilots conducted by partners such as Beko, Bosch, Aumovio and Tracxon have produced concrete outputs which demonstrate:

- The applicability of Toolbox tools to real industrial contexts

- The improvements that digital circularity tools can bring to operations
- The potential value for manufacturers, recyclers, and target value chain suppliers

These pilots effectively serve as reference cases for future exploitation. They demonstrate credibility, real-world relevance, and pathways for replication in other industrial contexts.

As with the Consultancy Package, each pilot industrial partner has interacted with specific Toolbox modules based on their operational focus. These relationships can be used in the exploitation plan as proof of concept. Moreover, they can be extended beyond the specific configurations used during the pilots.

For instance, at the moment Beko has worked extensively only with the EoL bundle; similarly, Bosh, Aumovio and Traxcon interacted and validated mostly the Digital Twin, The Recycling Simulation and the GRETA (Advisory) tools. This proves the effectiveness of the functionality-driven approach of the toolbox: whereas Beko was more interested in investigating EoL strategies to recover specific electronic components of interest (i.e. PCBs) from waste streams, Bosch, Aumovio and Traxcon have mostly leveraged the functions of the Recycling Simulation, Digital Twin and GRETA tools towards continuous improvement of the products' eco-design to optimize the reuse and remanufacturing of reusable components as well as the recycling of non-reusable ones.

Nonetheless, looking ahead, additional links between the pilot activities and CIRC-UIITS tools may emerge. For instance, Bosch, Aumovio and Traxcon could potentially engage with the Marketplace tool of the EoL Suite; moreover, Industrial users may request customised integrations, creating joint development opportunities.

The end-users Circular Business Models are described in more detail in section 4.

3. Outcomes of the Horizon Results Booster

3.1. Summary of Horizon Results Booster support for CIRC-UIITS

After the decision of the CIRC-UIITS consortium to apply for support under the Horizon Results Booster programme, SAT wrote and submitted the application in June 2024 that was approved in early July 2024 with the following support activities:

- PDES - Module C - Assisting projects to improve their existing exploitation strategy
- G2M - Support and guidance for Intellectual Property Rights
- G2M - Training in innovation management
- G2M - Examining exploitation/business implementation options
- BPD - Business Plan Development

The *PDES - Module C - Assisting projects to improve their existing exploitation strategy* service provided guidance and training to improve the existing project strategies towards effective exploitation of KERs. The exploitation strategy improves the following aspects:

- review of the key exploitable results of the project;
- revise, complement and clarify existing exploitation plans of project results and/or outline exploitation paths of results;
- techniques to identify all relevant stakeholders in the exploitation value chain;
- support to perform a risk analysis related to the exploitation of results.

KER 3 (TXT), KER 7 (POLIMI) and KER 15 (BESU) participated in this service. The final report can be found in the Annex.

The *G2M - Support and guidance for Intellectual Property Rights* service consisted of a 2 workshops:

- The Training Session was 2 hour long and was devoted to the presentation of “basics” on IPR (definitions, procedures, regulations at national and international level, patenting, IP licensing and sale, freedom of operation and due diligence and finally transfer of IP).
- The 2-hour Coaching Session focused mainly on an in-depth description of the main EU funded support services: the IPR Helpdesk, the IP Booster, the IP Pre-diagnostic. In addition, general questions of KER 1 (TNO) have been answered.

Even if the focus was on KER 1 (TNO) several partners from other KERs participated in the Training Session and some even in the Coaching Session. The final report of this service can be found in the Annex.

As the Horizon Results Booster programme finished already on October 31, 2024, the remaining 3 services (G2M - Training in innovation management, G2M - Examining exploitation/business implementation options and BPD - Business Plan Development) could not be started anymore.

Therefore the CIRC-UIITS consortium decided to also apply for the consecutive programme BOOSTER. SAT applied again in the name of the CIRC-UIITS consortium and the new programme started mid November 2024 with the following approved services for CIRC-UIITS:

- 1.1. Entry-Level Consultation (ELC)
- 1.2 Follow-up support via single point of contact/mentoring (FUS)
- 2.3 Go-to-Market support (G2M)
- 3.3 Intellectual Assets Management (IAM)

- 3.4 Coaching for Public Speaking (CPS)
- 3.5 Audio-Visual Support (AVS)

In the Entry-Level Consultation (ELC) the maturity and readiness of the selected KERs for the different follow-up services has been discussed with SAT.

After that the *Entry level consultation - First call* of the *1.2 Follow-up support via single point of contact/mentoring (FUS)* with SAT took place on 28.11.2024.

Most of the efforts of KER 1 (TNO) and KER 14 (OFFIS) went into the *2.3 Go-to-Market support (G2M)* service:

Module A:

23.01.2025 Introductory call

07.03.2025 Exploitation Pillars Training (both KERs)

- Setting the ground: **initial analysis** by the experts; kick-off call to present the service, tools, working methods and expected work to be done by the “Booster” beneficiaries and the experts; request the beneficiaries to fill in the ‘exploitation intentions table’.
- Delivery of the **exploitation pillars training** on the go-to-market process and related concepts

Module B:

26.03.2025 Unique Value Proposition workshop (KER 14)

28.03.2025 Unique Value Proposition workshop (KER 1)

- Delivery of the **Unique Value Proposition (UVP)** workshop(s): experts to perform desk research related to the project(s) and their results including type of results, technology, technology readiness level, standards, patents and other relevant information; workshop to serve as a forum to review the previously filled in material and define the target market/segments.
- Assess/review/identify the **Key Exploitable Results (KERs)**; define the UVP for each KER; discuss the intellectual assets (IA) of each KER including plan for IA management.
- Advice on setting up, tailoring and/or updating the results profile on the **Horizon Results Platform** showcasing the selected Key Exploitable Result(s) if applicable

Module C:

06.05.2025 Exploitations Strategy Seminar (KER 1)

07.05.2025 Exploitations Strategy Seminar (KER 14)

- Developing and further improving a high-quality **exploitation strategy** by revising, complementing, and clarifying existing exploitation plans of the Booster beneficiaries' results and considering the elements linked to the intellectual assets found in the Key Exploitable Result(s).
- Based on the input from the Booster beneficiaries via self-assessment and other suggestions.
- Definition of **exploitation objectives** and **key performance indicators**.

Module D:

05.06.2025 Business Plan workshop (KER 14)

20.06.2025 Business Plan Implementation workshop (KER 14)

- Introduction: **initial meeting** to prepare for the business planning workshops and request the beneficiaries to fill in the necessary tools for experts to assess.

- Preparation: delivery of **business planning workshop(s)** using Lean Canvas filled-in by the beneficiaries to discuss the main components of the Business Plan for each KER; and to prepare an Exploitation Roadmap.
- **Business plan development:** the beneficiaries prepare their business plan and receive guidance from the experts. Following an assessment by the experts, the subsequent workshop(s) focus on key aspects of the business plan, e.g. financial plan, identification of investment and financing needs and concrete solutions for the subsequent implementation of the business plan.
- Business plan finalisation: feedback from the experts and a **training session on innovation management** explaining how to effectively and efficiently manage innovation in terms of products/services, processes, organisational culture and structure.
- Wrap up with a dedicated **workshop presenting the main achievements**, fostering learning and sharing experiences key performance indicators.

In between the webmeetings several tools (Exploitation Intentions table, Characterisation Table, Market Definition Canvas, Value Proposition Canvas, Presentation sheet, Use Options, Lean Canvas, Risk Matrix and Risk Map, Exploitation Roadmap, BOSAT, Business Plan, Commercialisation Plan) have been filled by the KER Leaders OFFIS and TNO.

More details have been summarized in the GSM Final Report that can be found in the Annex.

The still ongoing *3.1. Networking (NET)* service helps KER 7 (POLIMI) **expand their contact database and capitalise on project results** by connecting with key stakeholders and initiatives. It includes **developing a networking strategy, mapping opportunities** to engage relevant stakeholders, **matchmaking with entrepreneurs**, and **offering guidance on building networks** at various levels.

After the Capacity Training Workshop on 10.06.2025 for the whole CIRC-UIITS consortium, it has been decided to focus the rest of the *3.3. Intellectual Assets Management (IAM)* service around KER 7 (POLIMI) and support them **develop an intellectual assets management strategy** to ensure readiness for dissemination and exploitation, **focusing on identifying intellectual assets**, offering **advice on ownership, IP rights, valuation, and licensing**, with additional support on **IP management**.

Please see the Annex for the Final Report.

The *3.4 Coaching for Public Speaking (CPS)* service enhances **beneficiaries' public speaking skills to effectively present research results to key stakeholders** and at events, offering support with material preparation, audience targeting, and improving speaking techniques, with a detailed report on the guidance provided. After a Theory session – basics (what it is, how it works, content, visual aspects, tips) for all CIRC-UIITS partners, a Practice Session (Pitch event simulation) took place on 10.11.2025 for KER 7 (POLIMI) providing valuable recommendations for improvement.

With the help of *3.5 Audio-Visual Support (AVS)* the CIRC-UIITS Video has been produced. It can be watched at <https://www.youtube.com/watch?v=HfflNkkaXE>.

3.2. Main results for KER1 Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics (TNO/Tracxon)

Summary

The Horizon Results Booster services were followed for our KER up until module C. Main goal was to enhance the exploitation and dissemination strategies and formulating a lean canvas. These activities were performed

to strengthen our ability to deliver impact beyond research by focusing on practical steps for market readiness and stakeholder engagement. The activities we did together with the specialist included the sharpening of our proposition, development of a comprehensive dissemination and exploitation strategy and go-to-market actions. We found that our business model can likely only succeed if (and this is expected) through sustainability legislation from the EU. Our customers need this incentive before they will be able to adopt our solution.

Main Results

The booster activities yielded several significant results. First, we successfully identified and characterized our proposition, creating detailed tables that outlined exploitation intentions and characterization metrics. This process clarified potential use options for our KER, including direct application, licensing opportunities, and the creation of spin-offs. Additionally, an exploitation roadmap was developed, which included financial projections and resource allocation plans aimed at scaling technologies to market. The roadmap emphasized the importance of securing industrial and governmental funding to advance the technology readiness levels of the solutions. Risk assessment was another critical outcome, with technological partnership, and market risks mapped and prioritized for mitigation. Main risk is the need for the EU wide sustainability legislation for our customers. Furthermore, we produced a Lean Canvas, defining value propositions, identifying early adopters, and highlighting competitive advantages for innovative solutions based on integrated modular electronics (IME). Finally, repairability and circularity key performance indicators were established, providing measurable metrics for resource savings, energy consumption, and life extension benefits derived from repair activities.

Lessons Learned

Several important lessons emerged from the booster activities. One key insight was the necessity of developing an intellectual property strategy early in the project lifecycle. This approach helps prevent disclosure risks and ensures that the project maintains a strong competitive position. Another lesson was the critical role of industrial engagement in scaling innovations; relying solely on public funding will prove insufficient for achieving market penetration. We are also still at quite low TRL: the technical feasibility of repairability demonstrations was confirmed, but also highlighted the need for optimized disassembly methods to improve efficiency. Higher TRL is probably necessary for spinning out successfully.

Way Forward

Looking ahead, securing further funding to increase TRL of our solution remains a priority, with efforts directed toward building industrial partnerships. The team will also engage with standardization initiatives and policy frameworks, to ensure regulatory compliance and market acceptance.

3.3. Main results for KER3 Electronics Re-use marketplace module (TXT/ERION)

Main results

As a result of the development process conducted within the project, the main result for KER 3 consists, naturally, in the Electronics re-use Marketplace itself (formerly known as the CIRC-UIITS Marketplace). The activities carried out in WP2 (tested and validated in WP4) have produced a fully mature, robust technological asset ready for large-scale adoption. The tool has been designed and implemented as an advanced digital module capable of facilitating the meeting of supply and demand for reusable electronic components, supporting circular-economy practices in the electronics sector. Thanks to its modular, scalable architecture,

the marketplace ensures smooth user experience, reliable functionality, and seamless integration with other tools in the CIRC-UIITS Toolbox, as well as standalone usage, depending on the needs.

Another highly significant result emerged from the validation conducted at the WEEE recycling plant in northern Italy. This activity involved experienced operators and the plant supervisor in a real operational context. The simulation of a complete re-manufacturing process (from recovering the PCB of interest to selling it through the CIRC-UIITS Marketplace) allowed to collect valuable feedback from potential users of the developed technology in a real-world scenario. The validation results clearly confirmed the market readiness of the CIRC-UIITS Marketplace. It attracted particular attention because no comparable commercial solutions exist. It was praised for its transparency, its ability to allow both parties to fully evaluate negotiation opportunities, and its potential to accelerate recovery operations. Validators also recognized the platform's capability to generate new revenue streams if adopted at scale, confirming the Marketplace's value as an innovative, mature, and market-ready technological asset.

Similarly positive feedback has been collected when the tool was presented in another WEEE Recycling Center, as part of the dissemination activities. In this context, the Marketplace was introduced through a guided live demo, during which the plant manager was brought through a typical buy–sell workflow, followed by an open discussion to collect feedback and ideas. The conclusions aligned closely with those of physical validation. The tool has been perceived as highly promising, its added value was immediately recognizable, and the interest in its potential adoption was notably high.

The validation showed that manual PCB sorting generates significant economic losses due to misclassification, confirming the need for digital tools to improve accuracy. The Marketplace and HMIs Module tests demonstrated their potential to guide operators toward retrieving only high-value components. Issues with barcode readability and process sensitivity indicate required improvements in robustness and automation. Operators see value in the tool if it reduces wasted time and errors. Overall, future development must focus on speed, reliability, and easier integration into plant workflows.

Lessons learned

The development and validation of the CIRC-UIITS Marketplace highlighted several important lessons regarding the current landscape of circular electronics and the opportunities for innovation within the PCB value chain. First, it became evident that no comparable tool or platform currently exists to facilitate structured, transparent, and data-driven buy–sell interactions between actors involved in the PCB reuse/recovery value chain. This absence of digital infrastructures capable of matching supply demand and offer represents a major technological and operational gap in the sector that can be filled by the CIRC-UIITS Marketplace.

A second key insight concerns the critical pain point addressed by the Marketplace: the need to effectively “close the loop” between demand (composed mainly of manufacturers and re-manufacturers searching for specific PCBs at BoL) and offer (represented by EoL WEEE treatment plants) that extract and recover PCBs from EoL electronic appliances. The validation activities confirmed that bridging this gap is not only feasible but highly valued by stakeholders, who recognized the potential for enhanced efficiency, transparency, and new revenue opportunities.

These lessons collectively reinforce the importance of a digital, centralized, and negotiation-oriented marketplace as a key enabler for scaling circular practices in the electronics sector.

EU and Italian WEEE regulations allow EU component reuse only within authorized facilities and under strict traceability and documentation rules. Some hazardous or complex components cannot be reused without

pre-treatment, and End-of-Waste procedures are required to restore product status. The Marketplace must distinguish between post-consumer waste and post-industrial parts that never became waste. It must incorporate compliance filters, authorization logic, and documentation flows. Only a regulation-aligned system can enable legitimate and safe component sourcing.

Way Forward

Next steps highlight the path to guide the adoption of the CIRC-UIITS Marketplace and ensure proper market readiness. In particular, the workplan will focus on interoperability and scalability of the proposed solution.

A first step concerns standardization, particularly the creation of clear and unified procedures for introducing new PCBs and electronic components into the platform. This includes defining a standardized data model and structured metadata formats that allow consistent characterization of components across different contributors. Establishing such standards will ensure this solution can be adopted by different actors, fulfilling their needs and simplifying the onboarding process.

Another crucial step consists in the development of a trust and certification framework to regulate how new participants (both from buyer and seller side) can be added to the Marketplace. This system should verify their reliability and legitimacy, potentially through certification steps, reputation scoring, or identity verification mechanisms. Such a framework is essential to ensure secure, transparent, and credible transactions within the ecosystem in which actors can be trusted, to ensure a secure and reliable data and information sharing process.

Business development requires identifying stakeholders interested in recovered components and determining which PCBs have enough value to justify extraction. Economic thresholds must guide when the Marketplace should activate searches to ensure value outweighs operator effort. Knowledge sharing among producers, PROs, and treatment plants is essential for data accuracy and traceability. Live demonstrations and training help stakeholders understand the tool's benefits and operational impact. The business model depends on aligning economic value, regulatory compliance, and operational capability.

Together, these next steps will strengthen the platform's technical foundation, increase confidence among stakeholders, and accelerate progress toward large-scale adoption.

3.4. Main results for KER7 Optimized Disassembly/Rework Operations (POLIMI)

Summary

KER7 focuses on the development of optimized disassembly and rework operations for electronic components, with particular emphasis on automated and semi-automated desoldering and component recovery from Printed Circuit Boards (PCBs). The objective of this Key Exploitable Result is to overcome the economic, technical, and operational barriers that currently limit large-scale reuse, remanufacturing, and selective recycling of electronic components at end-of-life (EoL). Within CIRC-UIITS, POLIMI has developed a set of methodologies, algorithms, and prototype solutions that combine robotics, artificial intelligence, computer vision, and process engineering to enable selective and efficient disassembly operations. These solutions are designed to significantly reduce throughput time, manual labour dependency, and component damage rates compared to conventional manual disassembly practices.

The Horizon Results Booster services supported KER7 in consolidating its exploitation strategy, clarifying its value proposition, identifying target markets and stakeholders, and defining an intellectual assets management approach coherent with POLIMI's role as a public research organisation. The Booster activities

also contributed to aligning KER7 with the broader joint exploitation vision of the CIRC-UIITS Electronics Circularity Toolbox, positioning optimized disassembly as a key enabling capability for several other KERs and circular business models within the project

Main results

The main result of KER7 is a validated framework for automated and optimized disassembly and rework operations applied to electronic components mounted on PCBs. This framework integrates several technological and methodological elements developed during the project, including:

- AI-based visual recognition algorithms for component identification, positioning, and condition assessment;
- Robotic manipulation and custom end-effector design for selective desoldering and component extraction;
- Process optimisation strategies to minimise thermal and mechanical stress on recovered components;
- Decision-support logic for prioritising components based on economic value, critical raw materials content, and reuse potential.

These elements have been tested and demonstrated in pilot scenarios linked to the CIRC-UIITS value chains, confirming the technical feasibility and the strong potential impact of automated disassembly solutions in industrial contexts where manual operations are currently dominant. The results clearly show that automation can significantly improve recovery yields and process repeatability, while reducing operational costs and safety risks for operators.

From an exploitation perspective, the Horizon Results Booster activities enabled POLIMI to clearly position KER7 not as a standalone product, but as a customisable service-oriented solution addressing specific customer needs. Potential customers include electronics OEMs, large-scale WEEE treatment plants, asset owners managing large fleets of electronic equipment, and industrial actors pursuing circular business models based on component reuse and remanufacturing.

A key outcome of the Booster support was the definition of a coherent exploitation route centred on the creation of a future POLIMI spin-off. This spin-off would commercialise tailored automated disassembly solutions and related services, such as criticality assessment of components and eco-design support for improved disassemblability. This positioning was recognised as the most suitable route given POLIMI's institutional nature and the early-to-intermediate Technology Readiness Level (TRL) of the developed solutions.

KER7 was also strongly positioned as a horizontal enabler within the CIRC-UIITS toolbox joint exploitation framework. Optimized disassembly operations directly enhance the effectiveness and economic viability of other KERs, notably the Electronics Re-use Marketplace (KER3), the Digital Twin with advisory functions (KER14), and several end-user circular business models developed by industrial partners. This systemic role reinforces the strategic relevance of KER7 beyond its individual technological scope

Lessons learned

Several key lessons emerged from the Horizon Results Booster activities related to KER7. First, it became evident that technological performance alone is not sufficient to guarantee market uptake. Potential adopters require clear evidence of economic viability, scalability, and integration into existing operational workflows. As a result, early engagement with industrial stakeholders is essential to align technical development with real-world constraints and priorities.

A second important lesson concerns intellectual assets management. Although many of the underlying technologies rely on open-source software and commercially available hardware, the true value of KER7 lies in the know-how, process integration capabilities, and system-level optimisation developed within CIRC-UIITS. The Booster activities highlighted the importance of protecting this knowledge through appropriate contractual arrangements, trade secrets, and structured service offerings rather than relying solely on traditional patenting strategies.

Another lesson relates to the strong interdependence between disassembly solutions and product design. The effectiveness of automated disassembly is highly influenced by upstream eco-design choices. This insight reinforced the need to position KER7 not only as a downstream EoL solution, but also as a contributor to design-for-disassembly strategies, in synergy with other CIRC-UIITS tools and consultancy services.

Finally, the Booster process confirmed that POLIMI's credibility as a research institution is a significant asset in early market engagement. However, for long-term commercial exploitation, a dedicated entrepreneurial structure is necessary to ensure responsiveness, scalability, and sustained customer support.

Way forward

Looking ahead, the primary objective for KER7 is to increase the TRL of the automated disassembly solutions and move from pilot-scale demonstrations to industrial-grade implementations. This will require additional R&D investments, further validation in real operational environments, and refinement of robotic hardware and control strategies to handle a wider variety of PCB types and component classes.

The establishment of a POLIMI spin-off remains the central exploitation pathway. In the short to medium term, the focus will be on securing public and semi-public funding to support technology maturation, while leveraging existing relationships with industrial partners as early adopters. These partners, already involved in CIRC-UIITS pilots, represent ideal testbeds for scaling up and industrialising the solutions.

From a joint exploitation perspective, KER7 will continue to be promoted as a key enabling technology within the CIRC-UIITS Electronics Circularity Toolbox. Close collaboration with other toolbox partners will be pursued to ensure technical interoperability and coherent value propositions when addressing customers interested in integrated circular solutions.

In parallel, efforts will be made to strengthen networking activities with recyclers, OEMs, and policy-driven initiatives addressing critical raw materials and supply chain resilience. These actions are expected to further increase market awareness and position optimized disassembly as a cornerstone technology for future circular electronics ecosystems.

3.5. Main results for KER14 Digital Twin with advisory functions (OFFIS)

OFFIS was involved in developing a modular digital twin platform that enables companies to assess and optimize environmental, circularity, and supply chain risks during early product development.

The platform addresses key industrial pain points: unreliable supply chains, high carbon footprints, and incomplete lifecycle data. Existing solutions like manual LCAs or scattered reparability evaluations fall short of delivering real-time, actionable insights.

Key modules include:

- Design Tool: A real-time module that helps engineers compare product designs using key sustainability KPIs to support eco-conscious decisions.
- Decision Tool

- Critical Raw Material Dashboard: Assesses supply risk and criticality of materials using current EU methodologies.
- Matrix Completion for LCA data: Predicts missing sustainability indicators (e.g., recyclability, material toxicity) using machine learning.
- ECU Fault Detection: Applies AI-based computer vision to detect defects in electronic components, validated in collaboration with BOSCH.

Modern manufacturing companies are increasingly confronted with unreliable supply chains, unpredictable spare parts availability and costs, and a high carbon footprint over the entire product lifecycle. These challenges not only affect operational stability but also threaten long-term sustainability and compliance with emerging regulations.

While current approaches such as Life Cycle Assessments (LCA) offer partial insights, they are often limited in scope and rely on manual, time-consuming evaluations of reparability, material criticality, and recyclability. As a result, companies are forced to make design and procurement decisions based on incomplete data, often accepting substantial risk regarding environmental performance and supply chain resilience.

The solution developed by the OFFIS team is a modular digital twin platform that integrates comprehensive sustainability assessment tools into early product development phases. The digital twin uniquely integrates multiple sustainability assessments with interactive multi-criteria optimization to empower manufacturers in both product design and end-of-life circularity—addressing two critical gaps in today’s sustainability solutions.

Within the Booster Training the OFFIS team learnt why their digital Twin stands out and two major points were identified: a) Design Optimization Uniqueness and b) End-of-Life Precision.

Unlike static analysis tools, the OFFIS dashboard enables live comparison of current vs. redesigned products across 15+ circularity KPIs (e.g., recyclability score, repair cost). This directly solves the industry challenge of balancing sustainability with feasibility—pilots reduce material waste by up to 40% while maintaining cost efficiency. By synthesizing data from GRETA, Recycling Simulation Tool, and OEMs, the OFFIS DT provides actionable scenarios (e.g., “Repair Route A saves €12k vs. Recycling Route B”). Competitors lack this granularity, leaving manufacturers guessing—we turn fragmented data into prioritized recovery pathways, increasing component reuse rates by 55%.

Furthermore, we learnt about the suitable business model and the marketing strategy. The business model is centered around a tiered subscription-based software-as-a-service (SaaS) offering, complemented by high-margin professional services, strategic partnerships, and data monetization streams. The core product—a modular Digital Twin Platform designed to support sustainable product development—is offered through various licensing tiers. To complement this subscription model, usage-based add-ons allow clients to pay per simulation or for high-volume API calls—ideal for SMEs or clients with fluctuating needs. Additional revenue is generated through co-selling agreements with platform partners such as Siemens and Autodesk, who receive a share of subscription revenues when CIRCUIITS is adopted via their ecosystems.

The **marketing strategy** is multi-layered and designed to establish CIRCUIITS as a trusted and indispensable tool within industrial sustainability workflows. The go-to-market approach begins with strategic partnerships—particularly with sustainability certifiers (e.g., Cradle to Cradle), ERP/PLM software providers (e.g., Siemens Teamcenter, Autodesk), and circular economy networks. These partnerships not only enhance credibility but also ensure that CIRCUIITS is embedded into existing industrial processes from the outset.

To measure and optimize the effectiveness of these marketing initiatives, a set of concrete KPIs will be introduced. These include lead-to-customer conversion rate per channel, cost per qualified lead (CPQL) for industry events and digital campaigns and return on marketing investment (ROMI) to assess campaign profitability. In addition, customer acquisition cost (CAC) will be tracked across all acquisition channels to ensure efficient budget allocation.

A multi-touch attribution model—supported by CRM analytics—will further help evaluate the specific impact of webinars, whitepapers, LinkedIn outreach, and co-selling campaigns on lead generation and conversion. These KPIs will ensure that marketing resources are focused on the most impactful activities and that CIRCUITS gain visibility in a targeted and data-driven manner.

OFFIS could plan deep technical integration with OEM platforms via plug-and-play APIs. These integrations are critical for reducing customer onboarding friction and increasing product stickiness, as clients embed CIRCUITS' functionality directly into their existing digital engineering environments.

By combining recurring software revenue with strategic services, ecosystem integration, and data licensing, the business model is designed for scalability, differentiation, and long-term customer retention.

Within the discussion it was also very clear that only a Spin-Off of OFFIS employees would be the only reasonable commercialization route, as OFFIS is a non-for-profit research organization. As the product is at a very early stage no Spin-off was started during the project duration.

Highlight of the Booster services was the guided work on the Value Proposition Canvas. It helped the OFFIS team to identify the customers' needs and how the digital twin would successfully fit into the market. In addition, also other market players and projects were identified. As the OFFIS team members have all a scientific technical background the Booster service was definitely a valuable support.

3.6. Main results for KER15 Serious games aimed at secondary school students to raise awareness of circular economy and skills needed for CE jobs (BESU)

Within the project, a business model was developed for a **product–service system (PSS)** that combines a ready-to-teach workshop format with a game-based learning environment for circular business model innovation. The PSS integrates three core components: a physical workshop set including all necessary materials, a digital representation of the tools and game elements on an online whiteboard, and structured tutor support via digital tutorials and guidance material. Together, these elements enable educators, trainers and consultants to deliver practice-oriented trainings on circular business models with minimal preparation time.

The central value proposition of the PSS lies in **reducing preparation efforts** for facilitators **while increasing learning impact** for participants. Educators frequently report that developing their own materials, sourcing case studies and designing interactive methods is time-consuming and often not aligned with circular economy and Green Deal agendas. The developed workshop and game combination addresses this gap by providing a fully prepared, pedagogically structured and thematically focused training package. The inclusion of real or realistic case study data and explicit circularity dimensions within the game mechanics allows learners to engage with complex sustainability trade-offs in a highly interactive format.

From a business perspective, the model is based on a **hybrid offering**: the physical workshop sets constitute a tangible core product, complemented by ongoing digital services such as access to updated materials, additional case studies and facilitation support. The initial market focus is on freelance coaches and consultants working in the fields of sustainability, innovation and organizational development, followed by

corporate learning and development units and higher education institutions. These segments have a high need for credible, ready-to-use content on circular business models and are under pressure to respond to policy frameworks such as the European Green Deal. Initial economic calculations indicate that the PSS can be operated on a sustainable basis at realistic annual sales volumes, with scalability supported by digital content distribution and trainer partnerships.

The consultancy of the Booster activity also **recommended to generate partnership concepts** for distribution, sales and trainer networks that can support market entry and scale-up. Potential collaborations with digital whiteboard providers and training platforms have been identified to embed the game and workshop templates in existing ecosystems and to increase visibility among professional facilitators. Overall, the business model demonstrates that a combined physical–digital solution with strong thematic focus on circularity can occupy a distinct niche in the wider training and facilitation market.

A key lesson from the Horizon’s Results Booster activity for KER15 is the **high relevance of “ready-to-teach” solutions** for the target groups. It was recommended to engage with pilot users consistently emphasising that their main bottleneck is not the lack of interest in circular economy topics, but limited time to design high-quality, experiential learning formats. The strong acceptance of the workshop set and game confirms that reducing preparation time while providing didactically sound materials is a decisive adoption factor.

Secondly, the Booster activity showed that **hybrid designs outperform purely physical or purely digital formats** in this context. While digital platforms enable convenient preparation, remote delivery and easy updates, many trainers and learners still value physical artefacts, tangible game components and co-located interaction. By mirroring all physical elements in a digital whiteboard environment, the PSS allows for flexible combinations of on-site, hybrid and online formats without duplicating design efforts.

Another important insight concerns the **content gap in circular business models**. Existing mainstream tools, particularly conventional business model canvases, rarely reflect circularity, lifecycle thinking or systems perspectives. The project’s focus on embedding circular principles and real case data in the game mechanics clearly differentiated the product and resonated with users who are expected to contribute to sustainability and Green Deal objectives but lack practical teaching resources.

At the same time, the project revealed **challenges in addressing different customer segments**. While educational institutions often require alignment with curricula, accreditation procedures and internal decision processes, freelance consultants and corporate trainers tend to be more agile and responsive. For the business model, this implies a phased approach: early adoption and initial revenues are more likely to come from flexible professional users, while institutional integration in schools and universities requires longer-term relationship building and adaptation to formal learning objectives.

Finally, the Horizon Booster activity supported to highlight the importance of **clear IPR and partnership structures**. The combination of game mechanics, workshop materials, case study data and digital templates involves multiple contributors and potential partners. Early clarification of background and foreground IP, licensing models and partner roles proved crucial to avoid later conflicts and to enable future commercial exploitation.

Following the end of the funding period, the focus will shift from development and piloting to **market introduction and scaling**. The PSS will be prepared for a structured launch, including refinement of branding, packaging and communication materials tailored to the primary early adopter segments (sustainability consultants, freelance trainers and corporate L&D units). An online presence will be further developed to enable information, ordering and onboarding in a coherent customer journey.

On the service side, the project results will be expanded into a **continuous support and update model**. This will include a digital hub where facilitators can access tutorials, facilitation guides, updated case material and potentially additional game scenarios. Options for subscription-based access to premium content and updates will be explored to complement one-time workshop set sales and to ensure long-term engagement with users.

A structured **train-the-trainer programme** is planned to create a network of certified facilitators who can use and disseminate the workshop and game in different sectors and countries. This network is expected to increase reach, ensure quality in delivery and provide continuous feedback for iterative improvement of the materials and business model.

In parallel, the team will pursue **strategic partnerships** with organisations that can enhance reach or integrate the PSS into broader educational and professional development offers. This includes dialogue with digital whiteboard providers, training platforms and institutions active in circular economy capacity building. Collaboration models may involve co-branding, licensing of templates, or inclusion of the workshop and game as part of larger training programmes.

Finally, the post-project phase will include **systematic monitoring of educational and environmental impact**. Data will be collected on utilisation rates, learner engagement, perceived learning outcomes and the extent to which trainings support institutional sustainability and Green Deal-related objectives. These insights will inform further adaptation of the business model and support evidence-based communication with funders, partners and potential customers.

4. Business models for selected KERs

In this section, the Business Models and the Business Plans developed independently from the HRB Service are briefly presented in their key aspects. The details are then shown in Annex 4. Concerning the business models, the main work focused on reviewing those already presented in D5.1, in particular for those points that were left open. Besides this, three business plans were drafted: one for BESU's new serious video game, one for BESU's new serious board game, and one for POLIMI's future spin-off about disassembly activities. About POLIMI's spin-off, a tailored business model, absent in D5.1, has also been drafted.

4.1. BOSCH's Circular Business Model for Brake System ECUs

BOSCH has developed a Circular Business Model that will enable the company to recover and reuse or recycle the ECUs of cars' braking systems, linked to the CIRC-UIITS BOSCH Pilot. The advantage pursued by BOSCH in this way is twofold: on the one hand, a decrease of the environmental impacts linked to the resources extraction and processes through traditional linear processes. On the other hand, creation of components' and materials' stockpiles to offset the impacts of supply disruptions and shortages obtained by the recovered ECUs.

The key activities needing to be carried out in this business model start from the implementation and continuous improvement of the products' eco-design solutions developed within CIRC-UIITS. A dedicated team of specialized, highly trained people will be needed for this activity. A reverse supply chain will also need to be designed and implemented. It will start from car dismantlers (e.g., POLLINI), which will recover ECUs from EoL vehicles and from car repair shops, returning repairable, remanufacturable, or recyclable ECUs and receiving new ones for car repair activities. When ECUs are not repairable or reusable, only sub-components will be recovered for reuse. In case this is not possible, BOSCH will bring the ECUs to recyclers that can recover the most critical metals or plastic materials, to be used to manufacture new ECUs. The support of Producer Responsibility Organisation (e.g., ERION) to manage this reverse value chain will be crucial. Materials processing companies (e.g., ALPHA) and research entities and recycling experts (e.g., POLIMI, OFFIS, MARAS, and SUPSI) will be key to improving the eco-design.

CIRC-UIITS toolbox is a key enabler of this circular business model, since OFFIS' module is key to improving the eco-design of the ECUs, MARAS' module to optimizing the recycling of non-reusable components, and SUPSI's module to assess the sustainability of the processes. In perspective, even TXT's suite might be key for BOSCH's business model, since the AR solutions and the marketplace can favor dismantlers' role. POLIMI's KER about automated disassembly procedures is also a key enabler for BOSCH's business model, making the recovery of key sub-components from the ECUs economically feasible and sustainable compared to alternative manual disassembly solutions currently in place.

Customers will be traditional car manufacturers, to whom BOSCH will offer braking systems' ECUs, which are repaired, remanufactured, or recycled, and car repair shops, to which BOSCH will offer repaired ECUs as spare parts. A new dedicated team for the recovery of ECUs from EoL vehicles will be created by BOSCH.

BOSCH's circular business model is detailed in ANNEX 4.1.

4.2. BEKO's Circular Business Model for PCBs reuse supported by ERION and TXT's Marketplace and AR

BEKO has developed a Circular Business Model around the pilot project it leads in CIRC-UIITS about the recovery and reuse of PCBs for washing machines. The recovered PCBs will first be used in the context of the maintenance service offered to washing machines' private owners (product life cycle extension), and secondly, in a later stage, in the manufacturing of new, greener washing machines.

To recover these PCBs, a very close relationship with WEEE dismantlers is required. In CIRC-UIITS, it has been proven that Producer responsibility organisation like ERION can perform the crucial role of mediating between the OEM (like BEKO) and the dismantlers. ERION can also cover the key role of supporting the dismantlers in learning how to use enabling digital technologies provided by TXT, i.e., advanced reality solutions supporting the dismantling of the PCBs and the marketplace where they can sell the recovered PCBs to OEMs like BEKO. Therefore, the EoL suite from the CIRC-UIITS toolbox is a key enabler for BEKO's circular business model. In perspective, POLIMI's solutions for automated disassembly might be adapted to washing machines' PCBs, and become a key enabler for dismantlers in recovering them.

For BEKO, the revenues will come from the avoided production costs of new PCBs and from enhancing the sustainability of their product-service system offer with a maintenance service that leverages secondary PCBs. The sustained costs will include fees paid to dismantlers to purchase the recovered PCBs and access to the marketplace supplied by TXT. Besides, labor and equipment costs will be needed for the key activity of PCBs functioning testing, which will be carried out internally by BEKO. The PCBs recovered as spare parts will be internally certified by BEKO as EoW (End of Waste) parts. They will then be organized in warehouses of spare parts to be installed in washing machines under maintenance and, if needed, new washing machines.

BEKO's circular business model is detailed in ANNEX 4.2.

4.3. AUMOVIO's Circular Business Model for tire pressure monitoring sensors

AUMOVIO has developed a circular business model centered on the eco-design interventions it has been implementing in CIRC-UIITS. These interventions will first enable a zero-defect manufacturing logic, which will lead to the recovery of defective tire sensors (production scraps), their repair, and their sale. A team within AUMOVIO is already dedicated to the implementation of this solution. This approach will be scaled to other types of products as well. Then, in the next two to three years, AUMOVIO will establish a reverse value chain to recover the tire sensors that reach their end of life, disassemble them thanks to their new design, and either reuse them, repair them, recover some sub-components for reuse, or recycle them, based on their state. Again, the same approach will be extended to other types of products as well.

The EoL tire sensors will be recovered by car dismantlers. Even though the sensors will stay property of AUMOVIO, in a product-service system approach, a fee for the recovery service will be paid to the dismantlers. The amount of the fee will be based on the number of sensors that the dismantlers will manage to return to AUMOVIO. Relations with dismantlers might be mediated by Producer responsibility organisation (e.g., ERION) and managed by a dedicated business unit. This business unit will originate from the already existing team dedicated to the products' eco-design implementation and AUMOVIO's circular transition. This team will gradually be structured and empowered until it becomes a proper business unit. Tire dealers will also be a major source of recovered sensors, and the relations with them will be managed by the same business unit. The tire dealers will give back old sensors to AUMOVIO and receive new ones in exchange for a fee. The assessment of the conditions and the reusability of the sensors will also be carried out internally at AUMOVIO.

In case the retrieved sensors are not entirely reusable or repairable, a reverse flow will be established with the suppliers of all the sensors' sub-components, to allow the remanufacturing or repair of sub-components. These will include: (i) rubber valve suppliers, (ii) suppliers of other plastic parts, (iii) PCBs suppliers, (iv) other electronic components suppliers, (v) sensors' Li-ion batteries suppliers. In case these sub-components are not recoverable, not even with the support of suppliers, they will be recycled with the support of recycling plants in a closed-loop approach.

Materials suppliers (e.g., ALPHA) and carmakers (e.g., CRF) will be involved in the continuous eco-design improvement, together with universities (e.g., POLIMI for disassemblability and SUPSI for environmental impact assessment), research centers (e.g., OFFIS for eco-design improvement), and recycling experts to improve recycling procedures of sub-components (e.g., MARAS).

CIRC-UIITS toolbox modules are key enablers of AUMOVIO's presented circular business model. The OFFIS' module can optimize the eco-design of AUMOVIO's products, favoring circularity. MARAS' module can optimize the recycling procedures for the components that cannot be entirely recovered, while SUPSI's module can assess the sustainability of the processes. In perspective, TXT's EoL suite can also be utilized: AR solutions can support car dismantlers, as well as the marketplace can enable smooth exchanges of recovered sensors (and, in the future, other parts as well). POLIMI's automated disassembly solutions can also be, in perspective, a key enabler, making the recovery of sub-components feasible in terms of time- and money-consumption.

AUMOVIO's circular business model is detailed in ANNEX 4.3.

4.4. POLIMI's Business Model and Business Plan for the spin-off for automated disassembly procedures development

Thanks to the activities carried out in terms of automated disassembly solutions design in CIRC-UIITS, POLIMI has developed the expertise and the capability necessary to design such solutions to sell them on the market. Therefore, POLIMI intends to open a spin-off company dedicated to designing automated desoldering solutions for electronic components mounted on PCBs. These solutions need to be specifically tailored to meet the needs of the customers and of the components to be recovered. Customers like electronics OEMs, companies owning many assets with many electronic components needing maintenance activities, and large-scale dismantlers need to manage vast amounts of EoL electronic components. It is strategic to recover from these components relevant sub-components to be reused, remanufactured, repaired, or recycled. This enables not only an environmentally less impacting sourcing of components and materials, but also a more secure supply of items typically rich in terms of content of critical raw materials. However, a big hurdle to implementing such a reverse process is represented by the high throughput times, labor costs, and failure rates required and caused by the currently available manual techniques.

The automation of these desoldering and disassembly processes would overcome the mentioned barriers. In its spin-off, POLIMI will provide customized service for the design and development of such automated procedures. Furthermore, the offer of the spin-off will be enriched by services linked to the criticality assessment of the components mounted on the PCBs (based on the classical dimensions of criticality, i.e., the supply risk and the vulnerability of the company to such a supply risk) and a service supporting customers in improving the eco-design of their PCBs. The criticality assessment of the components will support the prioritization of the components for which to develop the disassembly solutions. The eco-design support will lead to an improvement in the disassemblability of the PCBs, further optimizing the disassembly process for the customers.

This value proposition is enabled by the unique tangle of expertise and skills in image recognition AI, robotics, criticality assessment, and eco-design that POLIMI possesses, largely thanks to the work conducted within CIRC-UIITS. POLIMI's spin-off will manage to develop the optimal disassembly procedures for customers by testing them on samples supplied by customers themselves. The procedures will then be implemented in customers' processes.

The implementation and optimization of the automated disassembly solutions enabled by POLIMI's spin-off will be a key step for customers willing to implement a circular business model. Among CIRC-UIITS' partners,

BOSCH's and AUMOVIO's circular business models are also enabled by the disassembly solutions developed by POLIMI. When the automated disassembly solution scales up further in terms of TRL, services to support its implementation and optimization will be marketable and will be offered by POLIMI's spin-off customers, like BOSCH and AUMOVIO, willing to implement circular business models around their electronics-based products.

POLIMI's spin-off business model is detailed in ANNEX 4.4.

POLIMI has also developed a Business Plan for the spin-off's growth. For the sake of uniformity, the same Business Plan template used by the HRB for some of the KERs, as discussed in section 3, was employed. However, in this case, the business plan was designed autonomously, without the HRB support.

The main alternative to POLIMI's spin-off solution currently in place is performing such a disassembly manually, which, as mentioned above, presents relevant barriers in terms of throughput time and labor costs. There are some other actors, besides POLIMI, that are currently working on developing automated or semi-automated solutions to the disassembly of electronic components. However, they are all still at a low TRL and far from being marketable. For this reason, it is important for POLIMI and its future spin-off to scale up the TRL of this solution as quickly as possible and enjoy the advantages of being the first to the market. Furthermore, POLIMI's spin-off will manage to enrich the offer, unlike most potential competitors, with the services linked to criticality assessment and eco-design support mentioned above.

The main way in which the launch of the spin-off will be financed after the end of the CIRC-UIITS project is the awarding of public funding. Calls from the Horizon Europe Programme, EIC Programme, as well as calls internal to the Politecnico di Milano University and from Lombardy Region will be applied to. That funding will be used to continue the research and advance the TRL of the solution as quickly as possible.

Potential early adopters have been identified as those potential customers who (i) are more proactive in transitioning towards a circular economy, and (ii) are aware of POLIMI's work and its potentialities, by enjoying a close relationship with POLIMI. BOSCH's, AUMOVIO's, and TRACXON's circular business models developed within CIRC-UIITS are also enabled by POLIMI's solution and represent three cases of potential early adopters.

The perceived urgency of accessing this kind of solution by the potential customers is very high, due to the proven lack of security of the supply chains of critical and strategic components like the integrated circuits that POLIMI's spin-off solutions might enable to recover. Events like the chip shortage a few years ago, the rising geopolitical tensions with countries where both key components and the critical raw materials they embed are produced, and, most recently, the NEXPERIA case, have highlighted the need for solutions that offset the vulnerability of sectors like the automotive industry to such supply shortages and disruptions. Players of these industries are fully aware of these issues and are proactively looking for solutions like the one presented here.

Concerning background IPR, POLIMI has none linked to this solution. Concerning foreground IPR, POLIMI's solution is mainly based on open-source software technologies, and hardware equipment that can be purchased on the market. The main added value possessed by POLIMI is the expertise and knowledge developed within CIRC-UIITS, which requires no IPR actions. However, each type of component needs a tailored end-effector to be recovered, specifically designed for this task. The more end-effectors you can design, the more types of component recovery you can offer. Therefore, each designed end-effector will be patented. However, they will be patented only after the opening of the spin-off, to retain intellectual property within the spin-off itself.

The estimated costs to launch the spin-off, detailed in Table A18, need to cover mainly the hardware equipment purchase and the highly skilled personnel costs. For about one year after the end of CIRC-UIITS, this will be achieved through the awarding of publicly financed projects. Then, after the official launch of the spin-off, this source of funding will be complemented by investments from business angels. The spin-off's solutions are expected to become marketable within two years after the end of CIRC-UIITS. At that stage, the spin-off should quickly become able to sustain itself economically by selling solutions to its customers. The details of the market pricing are illustrated in Table A17, and the expected revenues in Table A18.

In three years, it is expected that POLIMI's spin-off will have been on the market for a year and will have started contributing to make the EU's supply chains of electronic components more secure and more sustainable.

The details about POLIMI's spin-off business plan and exploitation roadmap are in Annex 4.5.

4.5. BESU's Business Model and Business Plan for the new video game

The knowledge about the circular economy and the network of partners, experts on the same topic, that BESU managed to develop within the CIRC-UIITS project, enabled it to design and develop a new product. This product is a video game that will allow families and schools to learn the principles and key points of the circular economy effectively and engagingly.

The video game will be sold via a web platform. The revenues will be generated from a small fee for each download and from the sponsorships agreed upon with companies. In the video game, users will wear the shoes of a "circular economy heroine/hero", who needs to solve some challenges to implement the circular economy (e.g., eco-design improvement, reverse value chain development, etc.). The challenges will be presented in a manner that they can be approached even by kids in families and schools autonomously. Companies that are willing to share a sustainable brand image can appear within the challenges of the video game. However, to do so, they will need to sponsor the game itself. Besides, initiatives like this one, aiming at contributing to sustainable development, often receive funding from donors.

The main customer targets are the school's teachers and families. For them, the video game will represent an engaging way to effectively learn (or let kids learn) about the circular economy, and make kids passionate about this topic. In a context like the one of the EU, where the circular transition requires and will require significant amounts of passionate professionals, engaging kids with this video game means contributing to shaping the future professionals of the circular economy. Obviously, to make the video game accessible to the different EU countries, it will need to be available in several different languages.

The details about BESU's video game business model are presented in ANNEX 4.6.

The video game will be quite light and simple, not needing any kind of server support. Thus, the only costs for BESU, besides the video game's development and maintenance, are linked to the website hosting.

As detailed in Table A23, there are already several actors on the market offering serious games in different formats, including online entertainment, about the circular economy, or, at large, environmental sustainability. However, trends clearly show that the demand for these types of products is not saturated yet, with millions of potential customers across the EU alone.

In terms of background IPR, BESU possesses only its own brand and trademark. In terms of privacy, BESU will need to ensure compliance with the relevant GDPR legislation. The music used in the video game will exclusively be open source or developed by BESU itself. No in-game transactions will be in place. Other relevant legislation and frameworks to be considered in the video game design and development include:

- The EU Accessibility Act;
- The cybersecurity by design;
- The EU Directive on consumers' rights.

The launch of the video game is expected by October 2026 (10 months after the end of CIRC-UIITS). The intermediary steps include:

- (i) Finalization of the video game design (by the end of the project, December 2025);
- (ii) Beta version testing and bug fixing (by six months after the end of the project, June 2026);
- (iii) Setting up the web hosting (by six months after the end of the project, June 2026);

In three years, the video game is expected to have an impact in contributing to raising awareness among consumers and potential future circular economy professionals about the urgency and potential of the circular transition.

All the details about BESU's video game business plan and exploitation roadmap are presented in the ANNEX 4.7.

4.6. BESU's Business Model and Business Plan for the new board game

Starting from the knowledge about the circular economy acquired in the CIRC-UIITS project and its background knowledge about serious gaming, BESU is developing a board game based on cards. This serious game will support the advanced training of third-level education students (i.e., both universities and vocational training) and professionals who are already employed. This serious game will provide an engaging and effective way to train highly skilled professionals in the circular economy, not limited to its basics and principles, but also providing advanced knowledge and notions about circular business models, circular processes, and eco-design. The game will also be usable at events like workshops, hackathons, and similar. It will also be important to receive endorsement for the game from potential customers, moreover, from academia.

Besides the selling of the game itself, BESU will also offer, as an additional paid service, its own role as a moderator at the events where the game is going to be used. BESU will be able to cover this role thanks to the expertise in circular economy that it has developed throughout the CIRC-UIITS project. The physical production of the game, as well as the design and production of the packaging, will be outsourced to third-party designers and manufacturers.

At the start, the sales channels will be direct sales. After the first sales, the game will also be sold through traditional e-commerce channels. In case the game is very successful, a simpler, less advanced, and much cheaper version will be developed. This version of the game will target families and private consumers, and will revolve more around the aim of educating them rather than training them. It will be sold at local book stores and even shopping malls.

All details about BESU's board game's business model are available in ANNEX 4.8.

There are many players on the market offering serious games about green transition and circular economy (see Table A29 for details). However, the demand for skilling and reskilling professionals for the circular transition is very high and far from being satisfied in the EU. Therefore, the market still has a lot of room available for this serious game.

The companies that will be more easily interested in this product will be those, like SMEs, that usually do not possess the internal capacity to train their personnel about the circular economy on their own. Even large companies, though, where the expertise is confined to a few employees, can be interested in leveraging this

serious game to reskill the rest of the personnel. However, early adopters are expected to be moreover among teachers in the universities, since teaching is their core activity, and they tend to be people prone to innovation, even in pedagogical and teaching fields.

In terms of IPR, for the background, the BESU's logo and trademark are the only relevant resources. In terms of foreground IPR, BESU will define appropriate copyright for this serious game.

The game's design will be finalized by the end of the CIRC-UIITS project (December 2025). Then, it will be tested and fine-tuned in dedicated workshops and sessions with BESU's own network within the first six months after the end of the project (June 2026). Then, the serious game will be commercialized by means of direct sales in October 2026. Finally, in case of a huge success of the game, the cheaper, simplified version will be commercially available in bookshops by the end of 2028.

The initial version of the game will cost around €500 per unit. In case the e-commerce channel is reached, the price will need to be cut down to about €250 per unit. Finally, the simplified version of the game for book stores will cost around €30-40 per unit.

In three years after the end of the project, in terms of impact, this serious game is expected to have contributed to the training of at least 1.000 higher education students and professionals in the EU, supporting the development of skills in the workforce necessary to fulfil the ambitious targets about the circular economy and overall climate neutrality of the Union.

4.7. TXT's Business Model for the EoL Suite

Within CIRC-UIITS, TXT has developed a set of modules that are embedded in the CIRC-UIITS Toolbox, as explained in Section 2. They include (i) the data layer, which is used by all the modules of the Toolbox, (ii) the marketplace, and (iii) the advanced HMI supporting dismantling. The latter two compose the so-called EoL suite owned by TXT. The two modules are complementary in terms of functionality, and ad-hoc projects can be tailored and sold to customers, leveraging either or both modules based on specific needs.

The value proposition of the EoL suite is twofold: the marketplace offers a safe and immediate way to purchase and sell secondary components and spare parts rich in critical raw materials, allowing compliance with current regulations and offsetting dependence on unsafe supply of such materials. The advanced HMI reduces error rates and dismantling operation times for target components from WEEE and, potentially, EoL vehicles, allowing them to be sold at a competitive price.

In terms of key activities, TXT has already carried out within CIRC-UIITS most of the technical steps needed to make the EoL suite operational. The next activities include the industrialization of the solution, the formal definition of the team working on it, the design of the customer service, contractualization with the key partners, and the marketing campaign. In terms of key resources, TXT possesses the key IT and software engineering expertise. Furthermore, the IP developed within CIRC-UIITS is a main asset to manage and offer the EoL suite.

The CIRC-UIITS Toolbox team represents both a selling channel for TXT and a key partnership. When a customer contacts another member of the CIRC-UIITS Toolbox, and the latter contacts TXT asking for support in complementing the offer to the customer with the EoL suite, the Toolbox represents a further sales channel. When, on the contrary, a customer demands from TXT services that are complementary to the EoL suite and can be satisfied by another module or service linked to the Toolbox, TXT can leverage the mechanisms explained in Section 2 to involve the partner owning such a module or providing such a service. Further key partners coming from the CIRC-UIITS consortium include the industrial pilots' leaders, as early adopters and testers of the proposed solutions.

Customer targets of the EoL suite include OEMs and component suppliers willing to purchase spare parts and secondary components to be remanufactured or reused. The same need could be satisfied for recyclers looking for sources of secondary material. Dismantlers would also be interested in the marketplace as sellers of such components. These types of actors could also leverage the advanced HMI solutions to dismantle the components and then sell them on the marketplace. Producer responsibility organisation (e.g., ERION) might also be interested in this solution, to provide it to dismantlers themselves, covering the role of the multiplier. Similarly to them, consultants and other types of sustainability experts could also play the role of multiplier of the solutions when providing a service to dismantlers, recyclers, or OEMs.

The sales channels include direct sales, workshops, conferences, and the CIRC-UIITS Toolbox. The main revenues will come from the sale of ad-hoc projects, based on the EoL suite solutions, designed and tailored to the particular needs of the customers. Every single project will represent a specific paid order. Another major source of revenue, linked to the marketplace, will involve the sale of a subscription fee to the users of the marketplace. The subscription will be monthly. Yearly subscription, with a discount compared to the sum of 12 monthly subscriptions, will also be made available. Finally, value-added consultancy services, around the usage of the software, will be made available in exchange for a fee.

All the details about TXT's EoL suite's business model can be found in Annex 4.11.

4.8. SUPSI's Spin-off Business Model

SUPSI is planning the launch of a spin-off dedicated to offering the services linked to the GRETA tool. The first version of the business model for such a spin-off was developed in the context of the Horizon 2020 TREASURE Project. The work carried out in CIRC-UIITS enabled the enlargement and improvement of the portfolio of activities and services that GRETA can offer. This positively impacted on the related business model, which is reported in Annex 4.11. The points in the business model enabled by CIRC-UIITS' work are highlighted in red.

Overall, SUPSI's spin-off will support OEMs, components and materials suppliers, recyclers, and sustainability assessment experts with assessment and advisory services embedded in GRETA. The supported assessment will pertain to the environmental, social, and economic dimensions. Circularity will be assessed and supported by advisory functions as well. Revenues will be ensured by subscription fees to GRETA and tailored consultancy (pay-per-use) to support the development of specific sustainability reports and the obtaining of environmental labels or declarations. Additional revenues might be gathered through tailored services such as consultancy for model preparation, training, and integration of GRETA with software already in place, sales of templates, plugins, databases, and data to conduct sustainability assessment. Dedicated software applications, human resources, knowledge, data assets, and ICT infrastructure represent the key resources, as well as the major sources of costs (labor, ICT systems and infrastructure costs, together with marketing and advertising and administrative costs).

In terms of value proposition, the activities carried out in CIRC-UIITS allowed the coupling of the sustainability assessment service already offered by GRETA with a service of sustainability advisory enabled by AI-based functions (e.g., the chatbot). AI-based solutions have also introduced modeling-based functions that were not previously present in GRETA. Furthermore, thanks to the activities developed in WP2 and WP3 and tested in WP4's pilots, GRETA can now offer assessment and advisory services related to the circularity of the products.

A further key element introduced into GRETA, thanks to CIRC-UIITS, is the building of datasets to support sustainability and circularity assessment and advisory in the automotive sector. Furthermore, in perspective, the datasets SUPSI is gathering to support sustainability assessment and advisory services might be sold in the future, according to a business logic based on selling the data to other LCA practitioners and experts.

Another key feature of the business model enabled by CIRC-UIITS is the further sales channel represented by the CIRC-UIITS toolbox, based on the joint exploitation mechanism presented in Section 2 of the deliverable. The other members of the Toolbox can also be key partners, enabling SUPSI's spin-off to enrich and complement its offering, analogously to what has been explained for TXT in Section 4.7. The partnerships developed with the CIRC-UIITS pilot leaders are a further key element of the business model. Since the start of the project, they have been covering the role of early adopters and testers of the services offered by GRETA, adopting a co-creation approach.

Thanks to the assessment activities carried out at CIRC-UIITS, SUPSI managed to acquire the necessary expertise to enlarge the customer segments for GRETA's spin-off to include also material suppliers (e.g., ALPHA) and recyclers. Furthermore, the enabled reparability scenarios comparison and circularity indicators engine, and the AI-based sustainability advisory, combined with the already existing sustainability assessment functionalities, further enhance the capability of the users to develop more sustainable product designs.

All the details about SUPSI's spin-off business model are disclosed in Annex 4.11.

5. KER Updates from D5.1

KER 2 – Innovative disassembly solutions for repairing refurbishment, re-use and recycling leading to reduction of raw materials and circular production improvements

Section 1: Key Exploitable Results (KER)

1.1 Please fill in the following information

KER Name	Innovative disassembly solutions for repairing refurbishment, re-use and recycling leading to reduction of raw materials and circular production improvements Inclusive impact on CO2 footprint and potential of savings by using sustainable dashboard.
Lead partner	BOSCH
Participating partners	OFFIS, ALPHA, ERION, POLIMI, MARAS
TRL	Initial: 2 At the end: 6-7
Work Package	WP4

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

Go's and No-Go's for engineers to generate an ESP with the target of an optimized ESP for reuse, repair and recycle. => Eco-design rules
Design-rules for reparability, recyclability and reusability in the automotive environment as well as material suggestion.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
OFFIS	Digital twin and connection to the LCA and critical raw materials. AI based vision system to identify broken ESPs by the housing
ERION	Feedback of physical Recycle
POLIMI	Automatic dismantling of chips
MARAS	Simulated recycling and circularity feedback based on the recycling and CE assessment of the MARAS recycling simulation model, recycling KPIs and exergetic values for repair

KER 3 – Electronics Re-use marketplace module

1.1 Please fill in the following information

KER Name	Electronics Re-use marketplace module
Lead partner	TXT
Participating partners	ERION
TRL	Initial:/ Current:/ Expected at the end: 6
Work Package	WP2 – Task 2.2

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

Dedicated secure tool where users can sell/purchase electronical objects and components to facilitate the reuse and circularity of semiconductors and strategic materials. It is being developed and tested in the framework of Pilot 4, which is testing the sorting criteria and selection of washing machine at the End of Life that are suitable for the recovery of reusable PCBs. The marketplace tool connects end of life operators with manufacturers to secure the supply of spare parts, collecting PCBs available and suitable for refurbishing and reuse. It leverages an agent-based negotiation sub-component and a blockchain-based Smart Contract solution.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
TXT	Tech developer and only owner of the KER
ERION	Erion will support the design of the architecture of the Marketplace and the testing of its functionalities as intermediary with the OEM (Beko, in the case of Pilot 4). No ownership of the KER is foreseen.

1.4 The new technology/product (KER) could be used in the form of...

- Software
- Products
- Research Roadmaps
- Policy recommendations
- Processes
- Services
- Pre-standards
- (Collaboration) platforms
- Data
- Reports
- Codes of conduct
- Educational material
- Prototypes
- Skills and knowledge
- Other (please explain)

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

Due to the new sustainability-related EU regulations and shortage of raw materials, securing the supply of spare parts in a circular way could drive the market interest (manufacturers, suppliers) to the marketplace tool. This could help avoiding the fluctuations in prices and availability of some components on the secondary market; in addition, this new approach could support the opening of a new market.

1.6 What is the current state of the art in the domain of this new technology/product (KER)?

At the moment, the reuse of components from domestic appliances is limited to some small-scale business case of some operators refurbishing for second market. In terms of marketplace, there exist several of them for second-hand sell/purchase, but not for electronical components coming from WEEEs; moreover, they normally connect end users/customers, and do not target the connection between beginning of life and End of life actors of the value chain.

1.7 What technology/product/company do you think will be the major competitors for this KER?

Identifying a specific B2B marketplace for selling and purchasing of second-hand PCB components for reuse can be challenging as it represents a niche market. Some platforms exist related to PCB selling and purchasing that can be loosely compared to the CIRC-UIITS Marketplace, even if they don't offer the same functionalities:

Alibaba: A vast B2B marketplace that includes a dedicated section for electronic components selling and purchasing (including PCBs), however it doesn't focus on used/refurbished components, even though it is possible to find some.

Direct Industry: A professional marketplace for industrial products that includes electronics and electrical components such as PCBs. Again, the focus is not on reused/refurbished PCBs even though some retailers offer such option.

1.8 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)

1.9 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)? 1-2 years

Section 4: Risk identification and mitigation

4.1 Which risks do you see in the project and especially in the parts of the projects you are dealing with (achieving KER's, technical and economic targets) and which actions do you see to mitigate them?

Nº	Risk description	Impact (High / Medium, Low)	Mitigation action
1	Low presence of reusable PCBs in waste stream.	High	Possibility to target other sources of reusable PCBs other than treatment plants (distribution for example)
2	It could be difficult to get onboard the targeted customers as they are very fond of their traditional processes and supply sources.	Medium	Dissemination and study on pilot plant on revenues/new possibilities to be promoted

KER 8 – Methodologies to calculate and interpret sustainability assessment results

Section 1: Key Exploitable Results (KER)

1.1 Please fill in the following information

KER Name	Methodologies to calculate and interpret sustainability assessment results
Lead partner	SUPSI
Participating partners	MARAS, OFFIS, TXT, BOSCH
TRL	Initial: 4 At the end: 6
Work Package	WP3

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

These methodologies aim to facilitate the calculation and interpretation of sustainability assessment results. The main objective is to empower individuals who aren't experts in Life Cycle Assessment (LCA) and recycling to evaluate the sustainability and circularity impacts of the decisions they make. These methodologies will form the basis for carry out assessment and advisory tools.

The methodologies selected to evaluate the environmental, economic, social, recycling and circular outcomes within the CIRC-UIITS project are:

- PEF, Product Environmental Footprint method, a standardized approach based on Life Cycle Assessment (LCA) principles to assess the environmental impacts of products and services. PEF reduces subjectivity by standardizing elements like system boundaries and indicators, providing an objective way to evaluate environmental footprints.
- LCC, Life Cycle Cost is a method used to evaluate the total costs associated with a product or system throughout its entire life cycle, taking into account not only the initial purchase and installation costs but also the ongoing operating, maintenance, and disposal costs. LCC analysis may also consider the environmental impacts and sustainability factors associated with a product or system over its entire life cycle. This approach helps decision-makers make more informed choices that consider both economic and environmental aspects when selecting products or technologies.
- UNEP, United Nations Environment Programme, created the Guidelines for Social Life Cycle Assessment (SLCA) of Products. These guidelines complement environmental Life Cycle Assessment (LCA) and address social and socio-economic impacts throughout a product's life cycle. Stakeholder involvement is vital, considering categories like workers, local communities, and consumers. SLCA covers impact subcategories like human rights and working conditions, using impact indicators.

- The circular assessment methodology has now been defined as a modular framework that combines different types of methods. First, it includes product-level circularity indicators that quantify the overall circularity performance of a product in absolute terms, namely the Circular Footprint Formula (CFF), the Material Circularity Indicator (MCI) and the Product Circularity Indicator (PCI). Second, it integrates specific methodologies that capture key circularity features of a product, such as its repairability and recyclability. Repairability is assessed through a dedicated repairability assessment approach (based on EN 45554 and related schemes such as iFixit, AsMer, RSS and the French Repairability Index), while recyclability is characterised through physics-based recycling indicators derived from the recycling simulation models (e.g. Recycling Index, Material-RI, recovered material quality and energy/exergy-related indicators). The methodology is operationalised through circularity frameworks tailored to the CIRC-UIITS pilots for design, failure scenarios and EoL use cases, where relevant circularity strategies (e.g. reuse, repair, disassemblability, remanufacturing, refurbishment, recycling) are mapped to a coherent set of KPIs (MCI, PCI, CFF, recycling and repairability indicators) according to pilot-specific needs at product and component level. The circular assessment methodology has been developed to be fully interoperable with the LCA modelling, sharing the same life cycle system model and inventory data. This ensures that LCA can explicitly account for product-specific circularity characteristics, while the circularity assessment can consistently build on the same datasets and modelling assumptions used for the environmental assessment. Recycling simulation methodology is based innovative recycling flowsheet simulation modelling approach to assess, quantify and optimise the recycling performance at EoL and evaluate different EoL processing options. The method is based on rigorous and physics-based process simulation models which include the complex interlinkages of functional materials in complex electronic EoL product/parts as well as all chemical transformation processes in the reactors in the system model in versatile flowsheet simulation modules, covering full recycling system flowsheets for industrially viable BAT recycling options. This approach permits the rigorous evaluation of the recyclability of a product within the circular economy. Rigorous physics and technology based recycling KPIs and EoL LCA assessment will be provided which allows to discern between different design and processing options. Full mass, energy and exergy balances are revealed. The process simulation model has been developed in the industrial software platform HSC Chemistry Sim® 10 (www.mogroup.com), providing a professional and industrial platform for process simulation tools and recycling as well as environmental impact calculations. (KER MARAS)

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
MARAS	Provide, develop and apply the methodology for EoL assessment, specifically focusing on recycling assessment, recycling and CE KPIs,

Partner	Contribution (explain)
	including the link to EoL LCA. Recycling models are a KER (and IP) of MARAS individually.
OFFIS	Offer support in defining assessment methodologies related to reusability.
TXT	Assist in defining assessment methodologies.
BOSCH	Assist in defining assessment methodologies

1.4 The new technology/product (KER) could be used in the form of...

- | | | | |
|--|--|---|--|
| <input type="checkbox"/> Software | <input type="checkbox"/> Products | <input type="checkbox"/> Research Roadmaps | <input type="checkbox"/> Policy recommendations |
| <input type="checkbox"/> Processes | <input checked="" type="checkbox"/> Services | <input type="checkbox"/> Pre-standards | <input type="checkbox"/> (Collaboration) platforms |
| <input checked="" type="checkbox"/> Data | <input checked="" type="checkbox"/> Reports | <input type="checkbox"/> Codes of conduct | <input type="checkbox"/> Educational material |
| <input type="checkbox"/> Prototypes | <input checked="" type="checkbox"/> Skills and knowledge | <input type="checkbox"/> Other (please explain) | |

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

These methodologies present an enticing prospect for potential markets/users by providing the necessary knowledge to comprehend environmental, economic, social, and circular data associated with specific products or processes. They also facilitate understanding of how to advance these products or processes with a sustainability and circularity mindset. Furthermore, these methodologies form the foundation for carry out various assessment and advisory tools, supporting comprehensive evaluations and informed decision-making toward sustainability & CE objectives.

1.6 What is the current state of the art in the domain of this new technology/product (KER)?

The methodologies' current status is as described in the previous section. We've identified optimal methodologies for assessing environmental, economic, and social data: the PEF (Product Environmental Footprint), LCC (Life Cycle Costing), and UNEP (United Nations Environment Programme), respectively. For the evaluation of circular data, a modular circular assessment methodology has now been defined, combining product-level circularity indicators (PCI, MCI, CFF) with dedicated repairability and recyclability assessment methods. The methodology has been developed to be interoperable with the LCA modelling, sharing the same life cycle system model and inventory data so that circularity-specific characteristics of products can be consistently reflected in the environmental assessment and vice versa. Optimal and rigorous methodology for recycling assessment and optimisation has been identified and will be explored and applied. Detailed and product and recycling processing route specific LCA assessment is intrinsically part of the recycling simulation models and can be linked to the other environmental methodologies to improve EoL LCA assessment and databases.

What technology/product/company do you think will be the major competitors for this KER?

We stand for open research, we do not see the following competitors as direct competitors, but wanting to include major private consulting and software providers bodies and firms, we can mention:

- Environmental and sustainability consulting firms: Some major consulting firms, such as ERM (Environmental Resources Management), Ramboll, and Deloitte, may have divisions or specific expertise in sustainability and life cycle analysis.
- Circularity consulting firms: There are companies specialized in promoting corporate circularity, such as the Ellen MacArthur Foundation or consulting firms specifically focused on transitioning to circular business models. However, these companies lack of scientific and physics-based rigour and know-how.
- Software and technological solutions providers: Companies offering tools and platforms for life cycle analysis and sustainability management, such as PRé Sustainability (creator of SimaPro), thinkstep, and SimaPro (only competitors for LCA, recycling assessment is not part of these software solutions).
- Strategic consulting firms: Strategic consulting firms like McKinsey, BCG (Boston Consulting Group), and Bain & Company may offer sustainability consulting services as part of their broader offerings.
- Waste management consulting firms: Also, consider firms specialized in waste management and environmental impact assessment, as they could compete in the end-of-life phase of products, however rigorous process simulations tools as developed here are not part of their toolbox and innovative in their nature.

1.7 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods (please, indicate): consultancy (also based on existing background knowledge)

1.8 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)?

KER 9 – GRETA - web-based microservices application for evaluating sustainability and circularity in manufacturing

Section 1: Key Exploitable Results (KER)

1.1 Please fill in the following information

KER Name	GRETA - web-based microservices application for evaluating sustainability and circularity in manufacturing
Lead partner	SUPSI
Participating partners	
TRL	Initial: 4 Current: 4 Expected at the end: 6
Work Package	WP3

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

The Assessment Tool in the CIRC-UIITS projects is central to evaluating the environmental, economic, social, recycling and circular impacts of the current and of the new products designed in CIRC-UIITS project. This involves gathering and analysing comprehensive product data from the pilot phase to ensure a thorough evaluation. The primary objective is to assess the effects of the current product across these diverse areas as well as to assess reparability compared to End-of-Life recycling. Following the analysis of the current product, attention shifts to the advisory function of the platform, aimed at assisting designers in creating a new iteration of the original product with reduced impact. Here, the LCS&CA platform component once again plays a role by calculating the effects of the redesigned product. The tool consists of two major components:

- GRETA is a tool that also aids users in evaluating potential end-of-life scenarios for products.

LCS&CA has been developed both methodologically (these methodologies are part of KER 8), and in terms of application. Methodologically, state-of-the-art approaches for environmental, circular, social, recycling and economic aspects are addressed. From an implementation perspective, the LCS&CA functionality has been implemented starting from, and extending, the existing SUPSI GRETA platform.

GRETA is a web-based microservices application for evaluating sustainability and circularity in manufacturing. It offers diagnostic and advisory features, supports LCA, LCC, SLCA and Circularity Assessment. Users can compare scenarios, integrate with production systems, export PDFs, and utilize REST APIs. It can import processes modelled in OpenLCA and BOM data from standard files. GRETA serves two user types: sustainability experts and customers, enabling data-driven decisions in manufacturing.

- Sustainability Expert: This role involves creating life cycle process models and defining customization spaces, allowing customers to make specific customizations to products, machines, or processes.
- Customer: Typically, a manufacturer, this role utilizes GRETA to evaluate the sustainability aspects of their products, machines, or processes.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.



Partner	Contribution (explain)

1.4 The new technology/product (KER) could be used in the form of...

- | | | | |
|--|--|---|---|
| <input checked="" type="checkbox"/> Software | <input checked="" type="checkbox"/> Products | <input type="checkbox"/> Research Roadmaps | <input type="checkbox"/> Policy recommendations |
| <input checked="" type="checkbox"/> Processes | <input checked="" type="checkbox"/> Services | <input type="checkbox"/> Pre-standards | <input checked="" type="checkbox"/> (Collaboration) platforms |
| <input checked="" type="checkbox"/> Data | <input checked="" type="checkbox"/> Reports | <input type="checkbox"/> Codes of conduct | <input type="checkbox"/> Educational material |
| <input checked="" type="checkbox"/> Prototypes | <input checked="" type="checkbox"/> Skills and knowledge | <input type="checkbox"/> Other (please explain) | |

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

- **Sustainability and circular Assessment:** It offers LCA/LCC/SLCA and CE assessments, allowing users to evaluate the sustainability impact of their products and processes. An assessment of circularity will also be provided.
- **Scenario and design comparisons:** Users can compare different manufacturing and circular design scenarios, helping them understand and mitigate potential impacts and optimize strategies.
- **Integration with Real Production:** It can be easily integrated with actual production environments, including IoT services and REST services, enhancing the integration of sustainability analysis into manufacturing operations.
- **External Application Access:** It provides a set of REST APIs for external applications to utilize the assessment functionalities, enabling integration into broader systems.
- **Import Capabilities:** It can import processes modelled with OpenLCA and BOM data from standard formats like PDX, simplifying the data input process.

1.6 What is the current state of the art in the domain of this new technology/product (KER)?

Currently, sustainability and circularity assessments in manufacturing are mainly carried out using generic desktop LCA software and company-specific tools, often complemented by spreadsheet-based models and separate indicator calculators for circularity and social aspects. These solutions enable advanced environmental analysis, but usually require expert users, have limited integration with production and BOM data, and only partially support multi-dimensional assessments (environmental, economic, social, circularity) and systematic exploration of design and end-of-life scenarios. In this context, the KER builds on the state of the art by consolidating these assessment dimensions into a unified, web-based environment and by making them more accessible and operational for manufacturing practitioners.

1.7 What technology/product/company do you think will be the major competitors for this KER?

- **OpenLCA:** It's an open-source software for LCA. OpenLCA allows users to model and assess the environmental impacts of products and processes. It's popular due to its accessibility and flexibility, enabling users to analyze the life cycle of various products and make informed decisions based on environmental considerations.
- **Gabi:** Gabi is another LCA software, developed by the same company as OpenLCA (GreenDelta). It provides comprehensive life cycle assessment functionalities, allowing users to analyze and optimize the environmental performance of products, processes, and supply chains. Gabi offers a user-friendly interface and a wide range of databases for LCA studies.
- **SimaPro:** SimaPro is a leading commercial LCA software developed by PRé Sustainability. It's widely used in academia, industry, and consultancy firms. SimaPro offers a robust set of tools and databases to perform detailed life cycle assessments, including inventory analysis, impact assessment, and interpretation of results. It allows users to assess the environmental footprint of products and systems, aiding in decision-making for sustainability improvements.

1.8 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods (please, indicate): publications

1.9 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)?

Yes, in terms of consultancy, advice and training & teaching.

KER 10 – Recycling Simulation tool – methodology & tool to assess recycling and EoL sustainability and circularity

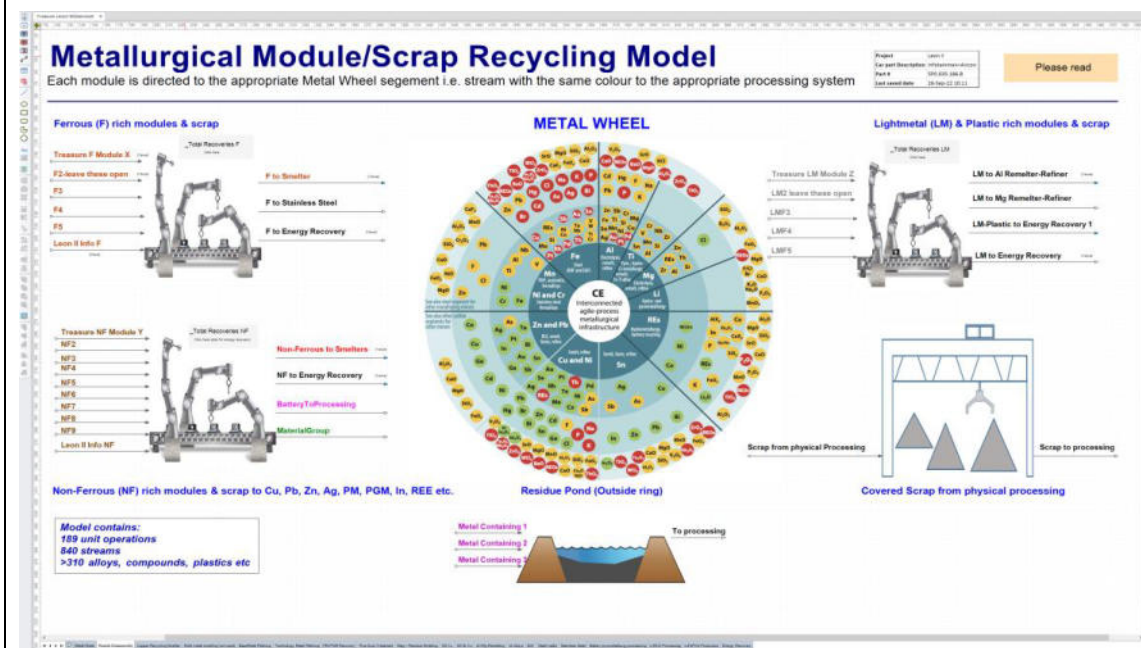
Section 1: Key Exploitable Results (KER)

1.1 Please fill in the following information

KER Name	Recycling Simulation tool – methodology & tool to assess recycling and EoL sustainability and circularity
Lead partner	MARAS
Participating partners	
TRL	Initial: 5 At the end: 7
Work Package	WP3

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

Recycling flowsheet simulations models digitally twin the entire recycling system and allow to quantify, assess and optimise end-of-life processing flowsheets (ranging from disassembly, shredding/sorting to the wide range of metallurgical and other final treatment processing flowsheets) for products and parts and are developed and applied to assess the full circularity of the end-of-life stage of parts and products. The models cover the full recycling and metallurgical processing flowsheets for all best available techniques for the economically viable multi-metal metallurgical and final treatment recycling processing which exist in industry (see Figure). Evaluation of recycling circular economy systems and product design is performed in the simulation models in terms of mass, energy as well as exergy balances (detail of all streams in kW (both mass, thermal and solution thermodynamics)).



The introductory window of the recycling system model covering the full recycling and metallurgical processing flowsheets for all best available techniques for the economically viable multi-metal metallurgical and final treatment recycling processing based on full detail of mass, energy and exergy balances for all materials, compounds and elements combined in a product or part.

Recycling Simulation Models are developed in the industrial software platform HSC Chemistry Sim[®] 10 (www.mogroup.com) and provide a professional and industrial platform for process simulation tools and recycling as well as environmental impact calculations. The simulation-models within HSC Sim contain an intrinsic link to LCA. (OpenLCA and Ecoinvent databases).

The approach is well suited to import product data (full material declarations/IMDS data files, etc) (often after data processing as the formats and details are not yet fully compatible for automation) and link this to rigorous process performance simulation. It is including all materials present in the assessment, as well as required primary materials and energy sources required for processing the EoL product. Being based on physics and thermodynamics, it allows for assessment of end-of-life recycling options balanced with reparability on rigorous KPIs, assessment of design options and scenarios for different EoL processing options both on recycling, energetic and exergetic KPIs CE indicators and environmental impacts associated.

The recycling flowsheet simulation modelling provides the following results and knowledge, which provide the basis for this KER to be exploited for consultancy and advisory.

- KPI's on recycling/recovery for whole parts/product as well as for individual elements/materials
 - Total recycling rate (% and mass), which can also be expressed in terms of kW via the enthalpy of the complex solutions
 - Individual material recycling rate of all materials/elements/compounds included in the car part (% and mass)
 - Energy recovery in MWh/t of feed or per car part
 - Exergy in kW of all flows as the entropy
- Recommendations/advisory on most optimal recycling flowsheet architecture balancing reparability with recycling based on physics-based recycling standards
- Design for recycling assessment and advisory
- Quantitative input to repair assessment by providing material exergy values
- Method for evaluation of circularity (for both recycling system and product design) in terms of not only mass, but also energy and exergy balances (detail of all streams in kW - both mass, thermal and solution) – provide a rigorous basis to improve existing CE indicators and provide a physics exergy based alternative Circularity indicator allowing to assess both recycling and reparability in EoL system simultaneously.
- Intrinsically link recycling process simulation and all mass and exergy flows to LCA in order to perform product design and recycling technology based environmental EoL assessment which can discern between different designs (alternatives) and processing options (unique product driven recycling fingerprint).

The expert knowledge and process simulation model provide the basis for exploitation by providing consultancy, calculations and advise for the EoL phase of products as well as for Design for Recycling and optimal design of recycling systems (including balancing reparability with recycling processing).

The recycling process simulation models provide the EoL pillar of the LCS&CA methodology and Advisory (These methodologies are part of another KER) with the intention to be linked to the CIRC-UIITS Circularity Platform). The LCS&CA development on recycling will be based on MARAS' existing and further expanded recycling simulation models as developed in HSC Sim providing physics based KPIs for assessment and advisory. This includes EoL LCA and CE assessment indicators as developed from the simulation models.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

1.4 The new technology/product (KER) could be used in the form of...

- | | | | |
|--|--|---|---|
| <input checked="" type="checkbox"/> Software | <input checked="" type="checkbox"/> Products | <input checked="" type="checkbox"/> Research Roadmaps | <input checked="" type="checkbox"/> Policy recommendations |
| <input checked="" type="checkbox"/> Processes | <input checked="" type="checkbox"/> Services | <input checked="" type="checkbox"/> Pre-standards | <input checked="" type="checkbox"/> (Collaboration) platforms |
| <input checked="" type="checkbox"/> Data | <input checked="" type="checkbox"/> Reports | <input type="checkbox"/> Codes of conduct | <input checked="" type="checkbox"/> Educational material |
| <input checked="" type="checkbox"/> Prototypes | <input checked="" type="checkbox"/> Skills and knowledge | <input type="checkbox"/> Other (please explain) | |

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

Many industry and consultancy projects as performed by MARAS over the years, combined with a continuous development and innovation of the methodologies, tools and models and definition of Recycling and Circularity Indicators, have proven the applicability of the knowhow and consultancy of MARAS for industry and consultancy. The innovative nature of the proposed business provides the opportunity to truly make a positive change towards a more circular approach of recycling and industry, in a period in which the need of change of society towards more responsible, sustainable and circular behaviour is getting a much wider understanding in society, industry and regulation. Above all the approaches used provides the much-needed economic basis to understand the viability of solutions. This is a key strength as well that leads to a significant opportunity. This makes these models, resulting physics and industry based and clear KPIs and advisory attractive and needed to potential users.

The fact that MARAS is at the forefront of innovation, and that the need for quantification and tangible results is increasing, which are provided by this work, provides opportunities for potential users.

The Recycling simulation tool (including link to LCA and Circularity Assessment) allows for the following:

- Sustainability/resource efficiency and circular recycling assessment on designs and processes: It allows for resource and energy and exergy efficiency assessment, including EoL environmental (LCA) assessment to evaluate the sustainability and CE consequences of a product and/or recycling processing flowsheet selection.
- Design assessment and comparison different design options can be assessed, and recycling performance can be quantified (both on mass, energy, exergy and LCA basis). This allows for comparing different design scenarios and optimisation.

- Recycling scenario comparison and optimisation the rigorous basis allows for assessment and optimisation of best recycling flowsheet system set-up and comparison of different EoL processing options on a rigorous physics and industrial basis. The scenario comparison will hence support the assessment of end-of-life scenario alternatives, thus creating value for end-of-life actors, including balancing recycling with repairability.
- Design for Recycling the approach allows for detailed pinpointing of critical issues in recycling and allows to discern between different design and required recycling options (including LCA on EoL). Detailed feedback on Design for Recycling will be provided on this basis, allowing to step away from simplistic and too general DfR approaches
- Import Capabilities being used in industry, these tools facilitate the import of product data matched with (thermodynamics) process simulators. At the same time, this tool provides a standard and guideline for data requirement to assess CE for products and designs.
- Definition and calculation of recyclability KPIs/CE indicators
- Digitalisation of the Circular Economy the digital twin simulation models, basis for digitalisation of data processing and linking, intrinsic link to other environmental assessment methods such as LCA and possibilities and know-how to convert complex models to fast real time calculating Neural Net/AI models, allow for digitalisation of the CE allowing for cooperation and knowledge transfer between stakeholders in the value chain

What is the current state of the art in the domain of this new technology/product (KER)?

Numerous tools claim to facilitate sustainability and circularity assessments in manufacturing, however these tools and sustainability& circularity assessment approaches and indicators have been governed and captured by too simplistic and non-physics-based approaches and excel based models over a long time (even by so called 'well-known' institutes and universities).

This differs fundamentally from the level of depth in which minerals and metallurgical processing industries must operate on a daily basis and which provides the background and principles behind the work of MARAS as described in the top section of this KER.

Compared to data-driven, static and data-fixed recycling (excel based spreadsheet) 'models' being applied for recycling assessment, being based on average values, this tool provide a rigorous, physics based backbone for industry and technology relevant recycling assessment, quantifying and providing the product and recycling flowsheet specific and unique recycling fingerprint, based on rigorous KPIs and the detail of all materials/compounds/elements present and their interaction in recycling and their role in CE and resource efficiency as a function of each unique design. The models are dynamic (over time, design and flowsheet set-up) and flexible and applicable for any new product/process/etc.

However, this application aims not only to enable these assessments but also to ensure a seamless interaction with users through linkage with LCA tools and the Circularity platform. Its primary goal is to empower users to comprehend assessment data effectively and utilize it to enhance the sustainability and circularity of their products on a true physics and rigorous basis and allow accessibility to the users and providing a path-way to CE.

1.6 What technology/product/company do you think will be the major competitors for this KER?

No comparable physics-based models or approaches do exist in the market. If there are models around, these in general still building on simplistic Excel-based approaches. The only risk is that the need for depth and physics-based rigour as provided by MARAS' models is not always well understood in the market and perceived within the field of recycling, therefore allowing simplistic recycling rate tables and empirical excel based 'models' to be applied as these are easy to understand, but not capable of assessing recycling and S&C.

How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods (please, indicate): publications

1.7 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)?

Yes, in terms of consultancy, advice and training & teaching.

Section 2: IPR Strategy and Protection

2.1 Foreground IP (Intellectual protection of the KER):

2.1.1 How do you plan to protect this new product/technology (KER)?

- Trade secret
- Copyright
- Trademark
- Patent
- Utility model
- Industrial design
- Other methods (please, indicate):
- No protection is foreseen (please, explain why):

IPR will be protected by not sharing the detail (algorithms, etc.) of the models. IPR will be claimed through publications in internationally peer reviewed journals and by reference to the background IPR.

2.2 Background IP (existing IP, before the start of the project):

2.2.1 Does this new technology/product (KER) rely on any existing IP/background IP? What is it and which partner(s) own it? How is this background IP protected?

The rigorous physics-based methodology and development of recycling simulation models to be applied over the entire recycling system (on the basis of mass, energy and exergy), linking product design, disassembly with (metallurgical) recycling performance and LCA and the application thereof for recycling system design, advice and design for recycling assessment and advisory for CE is background IP of MARAS B.V.

The same applies for DfR, flowsheet development, modular recycling approaches and assessment etc. This has been already discussed among others in addition to the work shown in our Google Scholar and ResearchGate accounts respectively:

- 2013 UNEP: [Metal Recycling | Resource Panel](#)
- 2014 1st Edition: [Handbook of Recycling | ScienceDirect](#)
- 2017 Fairphone: [How recyclable is the Fairphone 2? - Fairphone](#)
- 2024 2nd Edition: [Handbook of Recycling | ScienceDirect](#)
- 2016 Schaik, A. van, Reuter, M.A., 2016. Recycling indices visualizing the performance of the circular economy. *World Metall.* 69(4):201–16
- 2024 Schaik, A. van and Reuter, M.A. (2024). Simulation-Based Design for Recycling of Car Electronic Modules as a Function of Disassembly Strategies. *Sustainability* 2024, 16(20), 9048; <https://doi.org/10.3390/su16209048>

The various indicators (Recycling Index, Material Recycling Flower, Metal Wheel, Exergy Indicator) and their visualization are background IP of MARAS. Recycling models, development and methodology, approached and principles and content thereof is background IP (as also documented in a long list of publications and reports).

Application of process simulation models linked to LCA is background IP of MARAS and developed and applied for various other cases in the past.

CE assessment based on exergetic analyses has been developed within MARAS and is also part of the background IP.

Section 3: Market Analysis

3.1 What are the different applications for this new technology/product (KER)?

- **OEMs**: Design assessment and Design for Recycling The assessment tool can be used by designers who, during the design phase, want to assess and improve various product design concepts, on the basis of rigorous physics and industry based sustainability and circularity aspects, to make more sustainable decisions and improve recyclability of contained materials, reduce resource dependency and assess Circularity of products. Also exergy values can be applied in repair assessment of OEMs to validate their designs in terms of repair.
- **Recycling industry (including repair/disassembly)**: End-of-life actors can also utilize this assessment tool to evaluate end-of-life product scenario alternatives, quantify and assess different EoL options and balance repair and recyclability, exergy indicators can be used to select most CE efficient processing
- **LCA community** –recycling process and product design specific EoL LCA
- **Regulators/policy makers** Use insights into circularity derived from a true industry and physics basis respecting and including physics laws to define path-ways towards circularity (and at the same time understanding its limits).

3.2 Who will be the target customers/users?

These expert tools provide the basis for consultancy, training and advisory for:

Dismantling/recycling industry

- Consultancy and advisory to dismantling/recycling industry such as car dismantling companies and WEEE recycling (shredding and sorting) plants on additional disassembly or the effect thereof to optimize recycling. This is supported by the simulation software developed in CIRC-UIITS.

Recycling industry (shredding/sorting plants for automotive and WEEE recycling)

- Consultancy/advisory on most optimal recycling flowsheet architecture (based on the best available technologies at industrial level including dismantling, physical separation and sorting, as well as extractive metallurgy and processing) – this can be applied to develop flowsheets for different products, design alternatives, disassembly and reparability scenarios and recycling objectives, etc.
- consultancy/advisory on set-up, mass balancing and performance of large scale and benchmark trials on shredding and sorting plants and data collection. The CIRC-UIITS simulation models, based on industrial reality, provide guidance.

LCA community

- Provide input/consultancy/advisory to LCA community (both industry and academic development) on how to link recycling process simulation and all mass and exergy flows to LCA in order to perform product design and recycling technology based environmental EoL assessment which can discern between different designs (alternatives) and processing options (unique product driven recycling fingerprint).
- Especially of interest is the exergetic basis of the MARAS simulation models, that provides clarity on what the possible baseline of the complete material supply chain is. This provides the critical clarity on financial viability of the supply chains as the simulation basis is based on the physics of the industrial reality.

Consultancy to OEMs (both automotive and WEEE)

- Recycling assessment, calculation of recycling rates, recycling KPIs and CE indicators
- Design for Recycling assessment and advisory: feedback and input to eco-designers based on metallurgical incompatibilities (qualitative from the Metal Wheel) and quantitatively based on the findings of the recycling simulations and derived insights into recoveries and losses of materials/elements/compounds of these car parts.
- Evaluation of recycling CE systems and product design in terms of mass, energy and exergy based KPIs

Training/teaching and education

- Training and education of MSc and PhD students. We already provide extensive under- and post-graduate courses using the types of simulation approaches developed in CIRC-UIITS.

Regulators/policy makers/ NGO's

- Physics-based recycling standards, development of industry relevant and ambitious and realistic recycling targets, providing insights/consultancy/know-how on true performance, possibilities and limits of recycling, sustainability, and circularity on a rigorous physics basis. This is the basis for realistic regulation on recycling and CE. Projects/links already performed/existing with JRC. It is interesting to note that at present there is a report being developed for the JRC in ISPRA (Directorate General Sustainability EC) by members of MARAS, that will highlight for example the importance of having simulation-based i.e. physics-based analysis of supply chains in order to be able to understand the physics limits of supply chains.

The consultancy, advisory and training of this KER as developed and exploited by MARAS B.V. is innovative and unique in the field and differs from existing approaches based on its rigor, physics basis, and both scientific and industry-based expertise, which do not exist in this field.

The potential market is world-wide/global. Consultancy and training can be applied at National, European and global level. This is already happening with the MARAS expertise as mentioned above.

3.3 What is the strength/advantage and weakness/disadvantage of this new technology/product (KER) comparing to existing technologies/products?

Strength/Advantage (e.g. Uniqueness or innovativeness)	Weakness/Disadvantage
<ul style="list-style-type: none"> MARAS is a consultancy company (founded in 2005), which provides technology-based system solutions and knowledge in the field of recycling and resources, sustainability, and circular economy. The strength of MARAS is that it combines knowledge intensive consultancy, extensive industrial expertise and experience with sound and industrial relevant research and a strong scientific background. An extensive industry network has been established. MARAS has a strong and long-term (since 2000 and before) academic as well as industrial background, with good H-factor scientific recognition. MARAS is on the forefront of development and innovation in modelling, understanding, quantification of recycling and S&C systems on a rigorous, physics and industry relevant basis. Significant publications that corroborate this, MARAS-Team contributing are the Handbook of Recycling Ed. 1&2, the latest 2024 as well as being lead authors of the United Nations Environmental Program (UNEP) report on metal recycling. MARAS performs industry projects and consultancy for amongst others automotive and WEEE recycling industry (shredders, recyclers, metallurgical industries), automotive and electronics producing OEMs, governments, NGO's and collective systems and waste and surface water industries. These projects and cooperation with industry, recyclers, OEMs and 	<ul style="list-style-type: none"> Low-level of sophistication of existing perception on recycling: Recycling, sustainability and circularity have been governed and captured by too simplistic and non-physics-based approaches and excel based models over a long time (even by so called 'well-known' institutes and universities). MARAS has a detailed and rigorous knowledge of the depth and extensiveness of the recycling processes and infrastructures, parameters, processes, and the complexities, non-linearities and details to be understood and incorporated to quantify, optimise, and assess these systems. The 'weakness' is that this need for depth and physics-based rigour is not always well understood in the market and perceived within the field of recycling, which is in general still building on simplistic Excel-based approaches. These does not have the depth and knowledge nor the drive to fully understand what is truly needed to quantify and achieve Circularity. This could result in pushing the methodologies to the side, as these models and physics basis are perceived too difficult and too complex. The true threat is simplistic representation of very complex systems and therefore having the extreme risk of crossing the boundaries as predicted and that are possible through the laws of physics. To unclutter the huge number of legislations that are based on recycling numbers and

regulators demonstrate that a strong link, applicability with and understanding of industry and business is ensured and guaranteed within MARAS. The work includes modelling and process simulation, large industry trials, dismantling work, recycling and recovery rate calculations and resource efficiency assessment of products and recycling systems/flowsheets, Design for Recycling, and the development of the Recycling Index to allow communication of all issues around recycling, technology, Circular Economy and Sustainability to industry, academics as well as consumers.

- Introduction and application of physics-based, industry relevant, widely applied and validated methodologies and models for S&C assessment in EoL
- Potential for Future Expansion: The methodology, as will be applied on project pilot cases, has proven potential for future use beyond the project for a wide range of applications to assess and advise on S&C and EoL of complex products.
- Automation and Efficiency: The Recycling Simulation and S&C assessment tool will provide clear guidelines for automation of data acquisition, assessment calculations, aggregation, and results presentation, which can lead to increased efficiency in sustainability and circularity assessments.
- Provides the necessary inputs to the advisory tool.
- The advisory methodology based on the Recycling Simulation and S&C assessment methodology integrates technical, sustainability, circularity, environmental evaluations on a rigorous basis into the functional development and assessment, providing a comprehensive view. This allows for well-informed and balanced decision-making that takes into account various dimensions of sustainability and circularity.

date that have not been tested by the laws of physics, is a grave danger to the economic viability of circular economy and the Green Deal proposed in the European Community.

- MARAS is at the forefront to shed light on true recyclability, but the field is still cluttered by too much information that has not the required rigour to realize it economically.
- Currently, main limitations are related to the not fully automatable linkage of product compositional data to the structured format required for thermochemistry simulations, resulting in a labour-intensive data processing process.

- Integration and linkages to other disciplines: The recycling simulation and S&C assessment methodology can be linked to the other parts of the LCS&CA methodology and advisory and the Circularity platform.

KER 11 – Data space connector and data management module

Section 1: Key Exploitable Results (KER)

1.1 Please fill in the following information

KER Name	Data space connector and data management module
Lead partner	TXT
Participating partners	N/A
TRL	Initial: / Current: / Expected at the end: 7
Work Package	WP2 – Task 2.2

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

The Data Space module allows secure and trusted data exchange between parties in a standardised way. It ensures that data owners retain control over the shared asset by specifying access policies. The module consists in two submodules: the Data Space Connector, which enables secure data retrieval from legacy systems, and the Data Management, which guarantees security and traceability of the transaction during data exchange.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
TXT	Only developer and owner of the technology

1.4 The new technology/product (KER) could be used in the form of...

- Software
- Products
- Research Roadmaps
- Policy recommendations
- Processes
- Services
- Pre-standards
- (Collaboration) platforms
- Data
- Reports
- Codes of conduct
- Educational material
- Prototypes
- Skills and knowledge
- Other (please explain)

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

Two main advantages:

- Secure, standardised and trusted way to exchange data
- Streamline data exchange between all parties using a data space connector technology (enabler)

1.6 What is the current state of the art in the domain of this new technology/product (KER)?

Several Data Spaces are being developed in various sectors, at a various state of development (see <https://www.dataspaces-radar.org/radar/>). They all comply with the guidelines (Reference Architecture Model -RAM) provided by the International Data Spaces Association (IDSA). Only two Data Spaces exist in the automotive sector: CATENA-X and GDSO (specific for tyre industry). No specific Data Space exist in the PCBs (or WEEE).

In terms of Data Space Connectors, several connectors exists (see monitoring report here https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Data-Connector-Report-No-15-May-2024.pdf). which are all based on the IDSA's RAM. The connector developed by TXT within CIRC-UIITS is based on the most recent version and supports all the basic functionalities of the Minimum Viable Data Space (as described in the RAM) and includes also additional components and custom extensions for data transfer.

1.7 What technology/product/company do you think will be the major competitors for this KER?

Other integration providers companies that have developed a Data Space Connector (e.g., Engineering and Reply in the Italian market).

1.8 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods. Please indicate:

1.9 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)? 1-2 years

Section 4: Risk identification and mitigation

4.1 Which risks do you see in the project and especially in the parts of the projects you are dealing with (achieving KER's, technical and economic targets) and which actions do you see to mitigate them?

Nº	Risk description	Impact (High / Medium, Low)	Mitigation action
1	It could take time and effort to take a market share due to competition of existing similar instances	Medium	Study of proper dissemination based on technology advantages compared to competitors
2	Technology advancements and maintenance could cause disruptions in the operations of the system	High	Incremental adoption of critical features while defining fall-back procedures for recovery
3	Maintenance cost can increase based on the amount of data shared and numbers of transactions	Medium	Clearly define type of data and usage in agreement with the customer

KER 12 – Advanced HMIs module

1.10 Please fill in the following information

KER Name	Advanced HMIs module
Lead partner	TXT
Participating partners	N/A
TRL	Initial:/ Current:/ Expected at the end: 6
Work Package	WP2 – Task 2.2

1.11 KER description (Please include principal characteristics/functions/how it works, etc.)

The technology is composed of a front-end sub-component and a back-end sub-component. In the back-end, an AI-based model supports the operator by autonomously sorting the selected electronic components (e.g. PCBs in the CIRC-UIITS use case) based on their economic value. The system is deployed in a customised 3D-printed PCBs enclosure.

In the front-end, interfaces support operators in accessing data and functionalities in the shopfloor or in mobility. Several interfaces can be supported, also including augmented reality. The operator interacts autonomously with the interface, assessing immediately critical information provided by the AI-model for an efficient task completion.

1.12 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
TXT	Only developer and owner of the technology

1.13 The new technology/product (KER) could be used in the form of...

- Software
- Products
- Research Roadmaps
- Policy recommendations
- Processes
- Services
- Pre-standards
- (Collaboration) platforms
- Data
- Reports
- Codes of conduct
- Educational material
- Prototypes
- Skills and knowledge
- Other (please explain)

1.14 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?



The system allows the operators to access in a friendly and effective way functionalities and information thanks to human centric ad hoc developed interfaces.

These interfaces are highly efficient and effective because they are thought as mobility first in the shopfloor. The AI-based model provides reliable information on PCBs (electronic components) categorisation, leveraging automatic recognition for a more precise and faster sorting process.

The interfaces and the AI model allow fast and efficient communication to the operator leaving outside any useless detail allowing the worker to focus on essential information they need during the job in a contextualised way.

1.15 What is the current state of the art in the domain of this new technology/product (KER)?

There are several developments trying to propose human centric interfaces with new hardware devices (HMD – Head mounted display) and new technologies like augmented/virtual reality.

These interfaces still lack adoption in factories due to barriers of technology (connectivity), processes and mentality.

1.16 What technology/product/company do you think will be the major competitors for this KER?

Operation support platforms/augmented reality applications.

1.17 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity
- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods. Please indicate:

1.18 Will this new technology/product (KER) be commercializable? Yes No

If yes, what is the time to market after the end of the project (in years)?

1-2 years

KER 13 – CIRC-UIITS electronics circularity toolbox

1.1 Please fill in the following information

KER Name	CIRC-UIITS electronics circularity toolbox
Lead partner	TXT
Participating partners	OFFIS, SUPSI, MARAS
TRL	Initial: / Current: / Expected at the end: 6
Work Package	WP2 – Task 2.2

1.2 KER description (Please include principal characteristics/functions/how it works, etc.)

Toolbox supporting mass electronics and automotive value chain actors for more informed and circularity-based decisions during all phases of the life-cycle of products (e.g. product design, EoL, etc.).

The toolbox is composed of various modules: Data Layer, Marketplace Module, Advanced HMIs Module, Simulation & Digital Twin Module, Distributed Advisory Services Module, LCS&CA Module.

1.3 If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

Partner	Contribution (explain)
TXT	Hosting and maintenance of the CIRC-UIITS Digital Toolbox; owner of Data Layer, Marketplace Module and Advanced HMIs Module
OFFIS	Digital Twin with advisory functions
SUPSI	Distributed Advisory Services Module, LCS&CA Module (GRETA)
MARAS	LCS&CA Module – recycling and S&CA simulation, Digital Twin of recycling, Advisory (EoL)

1.4 The new technology/product (KER) could be used in the form of...

- | | | | |
|--|---|---|--|
| <input checked="" type="checkbox"/> Software | <input type="checkbox"/> Products | <input type="checkbox"/> Research Roadmaps | <input type="checkbox"/> Policy recommendations |
| <input type="checkbox"/> Processes | <input checked="" type="checkbox"/> Services | <input type="checkbox"/> Pre-standards | <input type="checkbox"/> (Collaboration) platforms |
| <input type="checkbox"/> Data | <input type="checkbox"/> Reports | <input type="checkbox"/> Codes of conduct | <input type="checkbox"/> Educational material |
| <input type="checkbox"/> Prototypes | <input type="checkbox"/> Skills and knowledge | <input type="checkbox"/> Other (please explain) | |

1.5 What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product?

New toolbox including a set of services targeting remanufacturing, repairability, re-use (both for as and repaired components), sustainable product design in the strategic sectors of mass electronics and automotive.

Problems tackled: scarcity of strategic raw materials, eco-design, enhance circularity in manufacturing (mass electronics and automotive sectors), closing the circle in value chain by connecting beginning of life and End of life operators. Improved and newly developed KPIs for measuring sustainability and circularity coming from the underlying LCS&CA methodologies have been integrated.

1.6 What is the current state of the art in the domain of this new technology/product (KER)?

Currently, there are various digital platforms that exist or are being developed for circular economy in electronics. These platforms aim to facilitate the reuse, repair, refurbishment, remanufacturing, and recycling of electronic devices and materials, as well as to provide information, feedback, incentives, and communities for circular actors and stakeholders.

However, no recycling simulation models and advisory exists which is based on rigorous physics on processes and design, based on full mass, energy and exergy balances of all processes, materials, and flows involved, combining both industrial reality with rigorous KPIs allowing to assess product and recycling systems.

In only one toolbox, users can measure and measure and improve sustainability and circularity both for existing product/services and at beginning of life stages support in eco-design. Moreover, the service is accessible also to non-sustainability experts, thus enlarging the toolbox potential target customers' base.

In the same toolbox, End of Life actors (e.g. recyclers) can both improve their recycling accuracy and connect with beginning of life actors (OEMs, suppliers) for spare parts sell and reuse, effectively contributing to circularity good practices in the manufacturing sector.

In this sense, the toolbox covers the whole value-chain, from beginning to end of life phases.

Finally, the CIRC-UIITS circularity toolbox offers the user the convenient possibility to add tools and/or use only a subgroup of the tools based on the product and need of the customer.

1.7 What technology/product/company do you think will be the major competitors for this KER?

Some examples of the platforms mentioned in the previous:

- **Recykal:** This is a platform that connects consumers, businesses, recyclers, and producers of electronic waste in India. It allows users to sell or donate their e-waste through a mobile app or website. It also offers collection, transportation, and recycling services for e-waste. The platform aims to improve the efficiency and transparency of e-waste management and create value for all stakeholders.
- **Recupel:** This is a platform that uses artificial intelligence to identify and classify e-waste based on images. It allows users to scan their e-waste using a smartphone camera and get information on its type, category, weight, and recycling potential. It also provides guidance on how and where to dispose of e-waste properly. The platform aims to increase the awareness and convenience of e-waste recycling.
- **DigiPrime:** This is a platform that develops and demonstrates the concept of a circular economy digital platform for various industries, including electronics. It involves a consortium of 36 partners from 11 countries. It provides data-driven tools and solutions for circular product design, circular business models, circular logistics, and circular skills development. The platform aims to enable and accelerate the transition to a circular economy through digital innovation.
- **Circularise:** This is a platform that uses blockchain technology to create a secure and transparent traceability system for materials and products in the electronics sector. It allows users to share and access information on the origin, composition, and environmental impact of materials and products without compromising sensitive data. The platform aims to increase trust and collaboration among different actors in the electronics value chain and facilitate the reuse and recycling of materials.
- **iPoint:** A software solution that helps companies to collect, manage and report data on the materials, substances and compliance of their electronic products and components, such as ECU. The solution supports circular practices such as design for recycling, material recovery and substitution, and eco-labelling. It allows us to collect, track, manage, process and report product, component and materials-related data across the entire lifecycle of a product, assessing the environmental, health and safety-related impact of products over their lifecycle and implement circular business models.
- **EcoVadis:** A platform that provides sustainability ratings and performance improvement tools for global supply chains, including the electronics sector. The platform assesses the environmental, social and ethical performance of companies based on various criteria, such as waste management, resource efficiency and circular economy.

1.8 How do you plan on exploiting the project results after the end of the project?

- Use for further research
- Develop and sell the new product/service
- Spin-off activity

- Cooperation agreement/Joint venture
- Sell IP rights or IP-based business
- License IP rights
- Transfer ownership of IP rights to another partner from the consortium
- Standardisation activities (new standards or support ongoing procedures)
- Other methods. Please indicate:

1.9 Will this new technology/product (KER) be commercializable? Yes No
If yes, what is the time to market after the end of the project (in years)? 2-3 years

Section 2: IPR Strategy and Protection

2.1 Foreground IP (Intellectual protection of the KER):

2.1.1 How do you plan to protect this new product/technology (KER)?

- Trade secret
- Copyright
- Trademark
- Patent
- Utility model
- Industrial design
- Other methods, please indicate: Closed source code
- No protection is foreseen Please explain why:

2.2 Background IP (existing IP, before the start of the project):

2.2.1 Does this new technology/product (KER) rely on any existing IP/background IP? What is it and which partner(s) own it? How is this background IP protected?

GRETA (SUPSI), PACElab WEAVR (TXT), circularity tool (MARAS)

Background IP MARAS

The rigorous physics-based methodology and development of recycling simulation models to be applied over the entire recycling system (on the basis of mass, energy and exergy), linking product design, disassembly with (metallurgical) recycling performance and LCA and the application thereof for recycling system design, advice and design for recycling assessment and advisory for CE is background IP of MARAS B.V.

The same applies for DfR, flowsheet development, modular recycling approaches and assessment etc. The various indicators (Recycling Index, Material Recycling Flower, Metal Wheel, exergy on EoL simulation) and their visualization are background IP of MARAS. Recycling models, development and methodology, approached and principles and content thereof is background IP (as also documented in a long list of publications and reports)

Application of process simulation models linked to LCA is background IP of MARAS and developed and applied for various other cases in the past. CE assessment based on exergetic analyses has been developed by partners within MARAS and is also part of the background IP.

IPR is protected by not sharing the detail (algorithms, etc.) of the models. IPR is also claimed through publications in internationally peer reviewed journals, books, journals, reports and industrial consultancy work.

Section 3: Market Analysis

3.1 What are the different applications for this new technology/product (KER)?

The toolbox addresses several potential needs of different actors involved in the mass electronics and automotive value chains, based on their objective:

- disassembly
- assess the reparability of components
- remanufacturing
- as-is reuse of components
- reuse of repaired components
- support to product (eco-design)
- support to recycling of WEEE (to boost partial reuse of subcomponents in the future)
- enabling superior decision making in circular design
- highlighting criticality of products materials

The project focuses on mass electronics and automotive sector, but the toolbox could be applicable to other manufacturing sectors.

3.2 Who will be the target customers/users?

The main customers foreseen are:

- OEMs and other tier-suppliers.
- Recyclers.
- WEEE collectors, consortia, and other actors.
- Consultants and other sustainability experts by the Suppliers, consultants, EoL actors

Other entities such as policymakers and NGOs could be potentially interested (to be further investigated)

3.3 What is the strength/advantage and weakness/disadvantage of this new technology/product (KER) comparing to existing technologies/products?

Strength/Advantage (e.g. Uniqueness or innovativeness)	Weakness/Disadvantage
<ul style="list-style-type: none"> - in improving the performance of recycling and most optimally balancing with disassembly and repair, thus supporting the circularity of critical raw materials and boosting potential reuse of subcomponents - providing rigorous and transparent, undebatable KPIs to measure and improve sustainability and circularity - linking high class expertise/experts in the various disciplines in the electronics 	<ul style="list-style-type: none"> - potential need to get support from external databases - automation of data linkages from OEMs to assessment methodologies (this is also the case for existing technologies/products)

<p>production and recycling value chain to provide assessment, KPIs and advisory on the different aspects of sustainability and circularity</p> <ul style="list-style-type: none"> - support in eco-design for non-sustainability experts - possibility to add tools and/or use only a subgroup of the tools based on the product and objective 	
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Section 4: Risk identification and mitigation

4.1 Which risks do you see in the project and especially in the parts of the projects you are dealing with (achieving KER's, technical and economic targets) and which actions do you see to mitigate them?

Nº	Risk description	Impact (High / Medium, Low)	Mitigation action
1	Developing functions that are not useful to the target customers	High	Work in collaboration with OEMs in the framework of pilots to design and validate the technologies
2	Not enough data available to train/apply AI/Neural nets in order to define an AI based integration of the detailed LCS&CA methodologies in the Circularity Toolbox sustainability analysis	High	Work in collaboration with data providers (OEMs, suppliers, EoL actors...) to ensure information flow into the Toolbox
3	Digitalisation of data	Medium	Define algorithms for data digitalisation
4	Low level of expertise in general/existing tools/field of LCS&CA which affects the perception of e.g. public and policy makers that sustainability and circularity are easy issues to solve and lack of knowledge that a multi-discipline rigorous approach is required to truly quantify, understand and improve/realise CE which is limited by Nature's Laws	Medium/High	Raise awareness in the field of recycling and sustainability that only a rigorous physics- based approach can realise CE and sustainability. Do this through demonstration cases as e.g. performed in the CIRC-UIITS project and publications (as we already do over many years).

6. Annexes

ANNEX 3.1: Final Report “PDES – Module C” (Booster I)

PDES – Module C Final Report

for

« CIRC-UIITS »

Circular Integration of independent Reverse supply Chains
for the smart reUse of IndusTrially relevant
Semiconductors



CIRC-UIITS

Project ID Number
101091490

Exploitation Strategy Seminar
10-11/10/2024

Provided by:

EXPERT BENDISTINTO

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1. Executive summary

This report summarises the process followed for the PDES-C service delivered to CIRC-UTS and the main outcomes of the Exploitation Strategy Seminar (ESS) held on the 11th of October 2024. The seminar was conducted from remote (online).

It presents the seminar, the agenda of the day, the participants. It then introduces the terminology used, and the three main tools presented and exercised:

- the characterisation table
- the exploitation roadmap and
- the risk matrix.

The Expert was appointed on 05/07/2024 and the Project Coordinator was contacted on 07/07/2024. The Coordinator informed the Expert that the ESS would have taken place online.

On the 02/09/2024 a conference call with Project Coordinator was organised to discuss expectations, get a first insight on the state of the art, present the service, and introduce preparatory activities, it was agreed to have a two-half days ESS. On the same day the Expert sent to the Project Coordinator and uploaded on the HRB platform all the info and the Exploitation Summary Table to be shared with Project Partners and filled. A Preliminary Report was sent out on the 03/10/2024 with the Expert strongly suggesting sharing the document with all the Partners before the ESS to have a common starting point at the ESS.

The ESS was then attended by 8 Partners out of 21. The agenda presented in this report is the one actually run.

During the seminar, the discussions included a focus on how exploitation needs to aim at sustainability of the activities, after the end of the project. Sessions were held in plenary, with all the partners attending, actively contributing, according to their role.

On the same days of the preliminary call, the Expert sent to the Project Coordinator, to be shared with Project Partners, all the materials used, and slides presented.

After the ESS the Expert requested the partners to update the Characterization Table and the Exploitation Roadmap based on the discussion and results obtained during the meeting.

Anonymous feedbacks were gathered from participants through the HRB platform project's dedicated workspace, and it was as well discussed the possibility of a follow-on service (Business Plan Development).

From the Expert's perspective, some quick preliminary remarks that will be better detailed in the Recommendations section are provided below. Project Partners need to carefully consider the following remarks:

- a. For all the KERs, concentrate the attention to clearly define the problems the potential users are facing now, without the proposed solutions. It is advised to describe the problems rather than illustrate the proposed solution.
- b. During the meeting, it emerged that for KER 2 there is an automated service that, based on the analysis of the request of 'buyer', is watching the best proposal from the 'sellers'. Validate the acceptance of the users of this feature and, if not sure, consider it an optional to be added later.

2. List of Abbreviations

Abbreviation	Definition
BoL	Beginning- of-Life
BOM	Bill of Materials
CE	Circular Economy
CRM	Critical Raw Materials
ECU	Electronic Control Unit
EoL	End-of-Life
EPR	Extended Producer Responsibility
ESP	Electronic Stability Program
HMI	Human Machine Interface
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
SLCA	Social Life Cycle Assessment
TPMS	Tire Pressure Monitoring Sensor
WEEE	Waste from Electrical and Electronic Equipment

3. Introducing the PDES-C

3.1 The PDES-C

The aim of this service is to strengthen the capacity of projects in using their research results enhancing partners' capacity to improve their exploitation strategy.

Project activities and the research work done or to be done are considered in terms of Key Exploitable Results (KERs). KERs are results which have commercial and/or societal significance. The results selected for the discussion during the service are analysed from a viewpoint which is exploitation only and considering how they will be used to generate, after the end of the project, impact. This is the market/customer demand or societal needs/user point of view.

The service and the virtual Exploitation Strategy Seminar (ESS) provided the participants with the opportunity to work on:

- 1) the identification/grouping of key exploitable results;
- 2) the first definition of the related use mode;
- 3) the identification and mapping of risks related to the exploitation;
- 4) follow-up actions.

The ESS for CIRC-UIITS was conducted remotely, online.

3.2 Agenda of the day

10^h of October 2024

11,00 – 11,15: Ice breaking (Expert, All)

Welcome, virtual tour de table, presenting the Exploitation Strategy Seminar agenda.

11,15 – 11,30: Communication, Dissemination and Exploitation (Expert)

Introducing the main elements connected to communication, dissemination, exploitation and value creation.

11,30 – 11,45: Achieving Project Goals – Characterisation Table (Expert)

Introducing the main elements connected to the Characterisation of Key Exploitable Results.

11,45 – 12,00: Achieving Project Goals – Exploitation Roadmap (Expert)

Introducing the main elements connected to Exploitation Roadmap.

12,00 – 12,30: Achieving Project Goals – Reviewing Key Exploitable Results (Expert, All)

Working to further develop, fine-tune the Characterisation Table and the Exploitation Roadmap.

11th of October 2024

9,00 – 10,30: Exploitation Strategy Seminar: working group for KER1 (Expert, All)

Online session to introduce the KER1, further develop, fine-tune the Characterisation Table, the risk map and sketch the Exploitation Roadmap.

10,30 – 11,00: Break

11,00 – 12,30: Exploitation Strategy Seminar: working group for KER2 (Expert, All)

Online session to introduce the KER2, further develop, fine-tune the Characterisation Table, the risk map and sketch the Exploitation Roadmap.

12,30 – 13,30: Break

13,30 – 15,00: Exploitation Strategy Seminar: working group for KER3 (Expert, All)

Online session to introduce the KER3, further develop, fine-tune the Characterisation Table, the risk map and sketch the Exploitation Roadmap.

15,00 – 15,15: Closing Remarks (Expert, All)

Closing Remarks.

15,15 – 15,30: Wrap-up (Expert, All)

Wrapping up.

3.3 List of Participants

No. Partner	Organisation	Name and Surname
2	OFFIS	Ole Meyer
4	PoliMI	Paolo Rosa
4	PoliMI	Lorenzo Gandini
4	PoliMI	Julien van Damme
4	PoliMI	Daniele Perossa
6	Centro Ricerche Fiat (CRF)	Renzo Costa
10	TXT	Francesca Lazzari
10	TXT	Mattia Calabresi
15	Alpha Assembly Solutions Germany	Chris Klok
16	SAT Austrian society for systems engineering and automation	Bernd Kopacek
17	PBKIK	Szabina Paszaurek
20	BeSu Solutions	Gerrit Posselt

8 partners out of 21 attended the meeting held on the 10-11/10/2024.

4. Exploitation and Key Exploitable Results

4.1 Exploitation in Horizon Europe

Activities to disseminate and exploit results from research and innovation are an integral part of Horizon Europe. Enhanced dissemination and exploitation are strategic matters for the success of Horizon Europe, synergies with other programmes and for the achievement of impact on society at large. One of the most efficient ways of furthering dissemination and exploitation of research results is through education and training. When new discoveries and knowledge are integrated in education activities, students at all levels are able to bring state-of-the-art knowledge with them to workplaces across society.

In addition to the initiatives towards open science mentioned above, Horizon Europe introduces novelties in the way research and innovation results are disseminated and exploited, giving more **emphasis to third party uptake with private investments** and to the knowledge and **impact these results create after the end of research and innovation projects**.

Against this background, and in line with Horizon Europe's overarching objective of enhanced communication and engagement with the public, dedicated activities for the visibility, use and valorisation of research and innovation results, including mission outputs are introduced. Horizon Europe ensures support to beneficiaries for their dissemination and exploitation activities during and after their project lifetime. Furthermore, a framework for feeding consolidated outcome based on research and innovation results, into policy and decision making will be proposed.

The availability of top-quality talent and the effective circulation of knowledge between research, industry, education and training is a pre-requisite for maximising the impact of European research and innovation investments. Integrating research and innovation activities with education and training and supporting activities for knowledge exchange and transfer across sectors, for instance via Marie Skłodowska-Curie Actions and Knowledge and Innovation Communities, is a powerful method to ensure research and innovation activities are informed by and directed towards citizens' and society's needs and the results are widely disseminated, for instance through a well-educated work-force. A balanced approach between research and innovation is a central part of Horizon Europe, built in the design which spans the full range of Technology Readiness Levels (TRLs) from curiosity-driven research to commercially driven innovation and support to market deployment, and within innovation, technological, non-technological and social innovation.

4.2 Definitions

Results: Any tangible or intangible output of the action, such as device, data, knowledge and information whatever their form or nature, whether they can be protected.

Communication: the **promotion of the project and its results** to a multitude audience (including the media and the public/society) in a strategic and effective manner.

Dissemination: the **public disclosure of the results** by any appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium.

Exploitation: the **utilisation of results** – up to four years after the action:

- in further research activities other than those covered by the action concerned, or
- in developing, creating and marketing a product or process, or
- in creating and providing a service, or in standardisation activities.

4.3 Characterisation Table

The characterisation table is the tool used in the ESS to summarises the main features of a KER and to provide information on the selected exploitation route. Information summarised in the characterisation table is to be further integrated and finalised after the ESS becoming the base for the PEDR/business plan for the result. It does not focus on the scientific dimension of the KER but offers a snapshot of the most important elements to be considered when dealing with the use of a result, following a problem oriented (demand driven) approach.

During the ESS project partners discuss the characterisation table in an interactive manner and further finalised it.

In the table, each element is described in a simple way highlighting the most important features that distinguish the result from current solutions. The table contains information on:

- **The novel solution:** Description of the Result, problem solved, Unique Selling Point (competitive advantages or innovativeness introduced compared to already existing Products/Services);
- **Market:** Product/Service Market Size, Market Trends/Public Acceptance, Product/Service Positioning; Competitors/Incumbents, Prospects/Customers;
- **External factors:** Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.);
- **Go to market aspects:** Cost of Implementation (before Exploitation), Time to market, Estimated Product/Service Price, Adequateness of Consortium Staff, External Experts/Partners to be involved;
- **IPR Status:** Background (type and partner owner), Foreground (type and **partner owner**);
- **Exploitation Strategy:** Exploitation Forms (direct industrial use, technology transfer, license agreement, publications, standards, etc.), Which partner contributes to what (main contributions in terms of know-how, patents, etc.) Partner/s' expectations, Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.).

4.4 Priority map and risk matrix

The Priority Map provides at a glance a snapshot on the main risks identified by the partners. It is based on risks selected in the Risk Matrix assessment tool (Risk Matrix) and the proposed remedy actions.

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The Risk Matrix helps the partnership identifying for each KER, the type of risk, its level of importance related to the use of the concerned KER, the probability for such a risk to happen, remedy actions and their probability to succeed.

The Risk Matrix analyses the following six different categories of risks:

- **1. Partnership Risks:** internal risk factors related to the composition of the partnership or specific behaviours of the partners, conflict of interests, etc.
- **2. Technological Risks:** external factors related to the feasibility of the technology, its level of development, presence of other emerging technologies, etc.
- **3. Market Risks:** external risk factors related to fulfilment of marked needs, presence of competitors or alternative products, etc.
- **4. IPR Risks:** factors related to the presence of similar previous patents, the possibility to protect the developed technology/product, patent counterfeit, etc.
- **5. Environmental risk factors:** are external factors related to the presence or changing in legislations, standards, etc. Special attention will be given to regulatory environment and standardisation issues.
- **6. Financial risk factors:** factors related to the availability of funds for bringing the research stage to prototyping industrialisation/commercialisation.

The severity grade is scored for each risk (1 = low; 10 = high). The grade shows the importance of the risk with respect to successful exploitation. For example:

- a previous patent, on the same technology, is a severe risk (10 points) if our exploitation route is fully relying on patenting;
- the sudden change of market conditions can be a severe risk if we want to introduce a product into the market.

After scoring the severity grade, the second step is to evaluate the probability for the risk to happen (1 = low; 10 = high). In the examples above:

- in the case of the patent, if we realize (after a quick search) that there is a patent preventing us to patent as well, then the probability of happening is 100% and the related mark is 10;
- in the case of market change: the apple market will not change so dramatically in the next future (grade 1) while apps market is changing every day (grade 10).

The product of the severity and the probability grade will give the risk grade of the concerned risk factor (value on the x axis).

The risk grade coupled with the probability of success will position the risk in the Priority Map.

- A high-risk grade and a low probability of success of the intervention, identifies a situation where we may consider discussing to stop the project (Warning). Examples:
 - There is a patent interfering with the one we would like to file. As a remedy, there is the plan to ask the owner for an agreement but, it is evident, chances of succeeding are very low. The selected exploitation path is blocked and there is not any possibility to go on;
 - The market is changing regulations and the product is not compliant anymore. As a remedy, there is the re-design of the product but with a very low probability of having something that will match the customers' needs. This may lead to the decision to stop the project.

- A high-risk grade with a high probability of success for the remedy action defines a situation where there is the need for an immediate action to ensure exploitation (action). Examples:
 - There is a previous patent interfering with the one we are about to file in. An agreement with the previous patent is feasible. In this case, the exploitation of that technology, if the agreement is reached, it is still possible, but action should be taken as soon as possible;
 - The market is changing regulations and the product is not respecting the new one. The re-design of some components will fulfil both compliance to new regulations and customers' needs. Partnership should re-think our project as soon as possible.
- A low-risk grade coupled with a high probability of success of the planned remedy defines a situation where it would be preferable to keep an eye on what is happening (Control) to be ready to act. Example:
 - Regulations in the market have not changed since the last 20 years and our product is valid only with such regulations. As a remedy, we should re-design some components to continue to be on the market. We have to monitor the situation (regulatory framework) and in case it will change, we have to immediately re-design our product.
- A low-risk grade and a low probability of success for the remedy, it is a situation does not call for immediate action (no action). Examples:
 - Regulations in the market have not changed since the last 20 years and our product is valid only with such regulations. We could think to re-design our product but there are low possibilities to get good results. Under these conditions it is better not consider any intervention;
 - Regulations in the market have not changed since the last 30 years and our product is fully compliant. There is no need at the current stage to modify our product nor to be worried about any change in regulations.

4.5 Towards the exploitation plan

The ESS is just one of the first step of a structured path towards exploitation. Working with KERs calls for understanding what the actual results are (will be) and what needs to be until the end of a project (and beyond) to have a clear and actionable exploitation plan ready and agreed among partners.

In the following pages, we provide a table that illustrates how what it is discussed during the ESS is to be integrated and developed to prepare the exploitation plan. Using these tables will help project partners in better prepare and structuring the Plan for Exploitation and Dissemination of the Results (PEDR) by focusing on relevant information planning actions and ensuring resources needed for a sustainable use of the results.

Support in finalising is part of the Business Plan Development (BPD) service provided under the Horizon Results Booster ¹.

Characterisation Table

Add KER name	
Problem	<i>Describe the problem you are addressing (the problem your potential users have). Potential users are the people, companies, organisations, etc. that you expect will use the result (and generate an impact). They are your "Customers".</i>
Alternative solution	<i>Describe how your "customer" has solved the problem so far.</i>
Unique Selling Point USP - Unique Value Proposition UVP	<i>Describe the competitive advantages, the innovative aspects. What does your solution do better, what are the benefits considering what your user/customer wants, how does your solution solve his/her problem better than alternative solutions, what distinguishes the KER from the competition/current solutions?</i>
Description	<i>Describe in a few lines your result and/or solution (i.e., product, service, process, standard, course, policy recommendation, publication, etc.). Use simple wording, avoid acronyms, make sure you explain how your UVP is delivered.</i>
"Market" – Target market	<i>Describe the market in which your product/service will be used/can "compete", answering the following questions: - What is the target market? - Who are the customer segments?</i>
"Market" – Early Adopters	<i>Early adopters are the "customers" you are willing to address first. They are usually the ones that feel the problem harder than all the others (they are not the project partners).</i>
"Market" - Competitors	<i>Who are your "competitors" (note: they are the ones offering "alternative solutions")? What are their strengths and weaknesses comparing to you?</i>
Go to Market – Use model	<i>Explain what is your "use model", how the KER will be put in use (made available to "customers" to generate an impact). Examples of use models: manufacturing of a</i>

¹ <https://www.horizonresultsbooster.eu/>

	<i>new product, provision of a service, direct industrial use, technology transfer, license agreement, contract research, publications, standards, etc. Note training is a service.</i>
Go to Market - Timing	<i>What is the time to market?</i>
Go to Market – IPR Background	<i>What is the Background (type/ partner)?</i>
Go to Market – IPR Foreground	<i>What is the Foreground (type/ partner)?</i>

Exploitation Roadmap

The roadmap is a tool designed to help the consortium to identify and plan activities to be performed after the end of the project. The highest risk a consortium faces is not being able to implement the exploitation and dissemination plan and increase the TRL level or go to market, due to lack of resources. The exploitation roadmap is designed to address this risk, mitigate it and pave the way toward use and a stronger impact.

Exploitation roadmap	
Actions	<i>Briefly describe actions planned to be executed 3-6 months after the end of the project.</i>
Roles	<i>Roles of partners involved in the actions defined above.</i>
Milestones	<i>List the milestones and KPIs to be used for monitoring the implementation of the actions listed above. Add timeline.</i>
Financials Costs	<i>Cost estimation to implement planned activities (1 year, 3 years).</i>
Revenues	<i>Projected revenues and eventual profits once the KER will be used (1 and 3 years after use).</i>
Other sources of coverage	<i>Resources needed to bridge the investment needed to increase TRL and ensure the result is used.</i>
Impact in 3-year time	<i>Describe impact in terms of growth/benefits for the society.</i>

Use options

KER's Exploitation route (how the KER will be further exploited)			
Selected route		Implementing actor	Yes
DIRECT USE	Commercialisation: <i>deployment of a novel product/service (offered to the target markets)</i>	One partner ²	
		A group of partners ³	
	Contract research (<i>new contracts signed by the research group with external clients</i>)	A partner	
		A group of partners	
	A new research project (<i>application to public funded research programmes</i>)	A partner	
		A group of partners	
Implementation of a new university – course (<i>Note that a training course is a service</i>)	A partner		
	A group of partners		
	A new partnership		
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
By assignment			
	By licensing		
Other (<i>please describe</i>)			

² Partners identifies the partners of the project receiving the ESS, not third parties that may be partner in the future.

³ Provide the names of the partners.

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5. 3. CIRC-UITs

5.1 Project Main Data

TITLE	Circular Integration of independent Reverse supply Chains for the smart reUse of IndusTrially relevant Semiconductors
ACRONYM	CIRC-UITs
CONTRACT NUMBER	101091490
BUDGET	€ 5.995.026,10
COORDINATOR	Paolo Rosa
STARTING DATE	01/01/2023
ENDING DATE	31/12/2024

5.2 Project Abstract

The European Commission (EC) is addressing challenges in strategic markets, such as automotive and semiconductors, through new strategies and directives, including the European Chips Act and Digital Product Passport. Most electronic components are produced in extra-EU countries like China and Taiwan, but the EC aims to make these sectors more sustainable and resilient by boosting end-of-life (EoL) strategies (e.g., sorting, reuse, remanufacturing, recycling) and encouraging intra-EU production through innovation and investment. The goal is to reduce dependency on non-EU supplies and critical raw materials. The CIRC-UITs project will demonstrate improvements in the circularity of the automotive and mass electronics sectors by reusing semiconductors and supporting their remanufacturing into high-value components and products.

5.3 KERs considered at the ESS

The Consortium has identified 3 Key Exploitable Results to discuss at the ESS, which have been included in the Preliminary Report.

No.	Name of the KERs
1	Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs
2	Electronics Re-use marketplace module
3	Optimized Disassembly/Rework Operations

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6. Improved Exploitation Strategies for Key Exploitable Results in CIRC-UITs (D1.3)

The Characterisation Table and the Exploitation Roadmap were drafted by the beneficiaries with feedback and suggestions from the Expert. The final version is the result of several iterations, brainstorming and discussions during the webinars and coaching sessions. Some final feedback and pointers from the Expert have been included in *red and italic*.

6.1 KER No.1 – Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs (KER leading beneficiary: BESU)

6.1.1 Characterization of the result

KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Problem	Current training and educational methods in circular business model creation face critical challenges: achieving learning goals for students and coaches is becoming increasingly difficult due to the lack of practical experience and real-world application. Traditional teaching formats often struggle to meet essential impact metrics like high engagement rates and effective knowledge retention. In particular, the underrepresentation of case study data limits the depth of understanding, while the low interaction rates between learners severely undermine the effectiveness of group learning dynamics. Without the right tools, trainers and educators are finding it harder to deliver impactful, hands-on learning experiences that truly prepare students for real-world challenges. However, the solution lies within our Product-Service System : a comprehensive, ready-to-teach workshop set that integrates tangible, practical tools, rich case study data, and an interactive digital platform designed to enhance engagement and real-world learning outcomes. This system not only ensures compliance with learning and impact goals but also elevates the quality of education, making it easier for teachers and coaches to deliver meaningful, high-impact training experiences.	<i>Identifying the key problem is crucial to assure the impact of the result.</i> <i>It is advised to describe the problems rather than illustrate the proposed solution.</i> <i>Problems addressed are at the basis of the characterization of the solution and identification of customers.</i> <i>Being able to solve problems the “customers” face (regional authority) is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</i>
Alternative solution	Current solutions for teaching business model creation fall short in addressing key aspects of circularity and sustainability , which are increasingly important in meeting Green Deal requirements for	<i>Alternative solutions are important to benchmark the novel solution and to get an insight on competition.</i>

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>educational institutions. The widely used conventional business model canvas overlooks circular principles, leaving educators and students unprepared to tackle sustainability challenges. These traditional tools fail to integrate sustainability into the curriculum, resulting in a misalignment with the evolving needs of schools and universities. Furthermore, existing teaching methods are time-consuming for teachers and coaches, as they require significant preparation and customization to fit into the curriculum.</p> <p>In contrast, our solution offers a "Ready to Teach" feature, drastically reducing preparation time and seamlessly integrating circular business model creation into existing educational frameworks. This not only aligns with sustainability goals but also provides a practical, case-study-driven approach that enhances student engagement and ensures compliance with modern educational and environmental standards.</p>	<p><i>Collecting information on weaknesses and strengths of the alternative solutions helps to compare and to quantify the added value of the proposed solution and investigate who is providing them and under which conditions.</i></p>
<p>Unique Selling Point USP - Unique Value Proposition UVP</p>	<p>The USP is the "ready to teach" feature. Trainers, teachers and consultants receive a paper-based workshop set, supported by digital tutorials for their own briefing, supported by a digital representation of all tangible teaching materials on a digital whiteboard, which can be used to digitally prepare the workshops in advance without unpacking anything. Workshop utensils such as stopwatches and other handy tools are provided in a transport box. No additional materials other than pen and paper are required to run a workshop.</p>	<p><i>The UVP is crucial to ensure the use and approach the early adopters. Your strength points highlight your uniqueness compared to the alternative solutions. The UVP is the reason why your solution will be adopted. Please further validate the UVP by stressing your element of uniqueness and highlight the quality of the solution.</i></p> <p><i>Please consider linking the mentioned features to the identified problem.</i></p>
<p>Description</p>	<p>This product is a comprehensive "ready to teach" workshop set designed for trainers, teachers, and consultants. It streamlines the process of preparing and delivering engaging workshops by providing everything needed in one convenient package. The set includes a paper-based workshop kit complete with all necessary materials and tools, as well as access to digital tutorials that serve as a step-by-step guide for the trainer's preparation. A digital whiteboard tool is also included, replicating all tangible teaching materials, allowing for seamless digital preparation of the workshop in advance—without the need to unpack or organize any physical items.</p> <p>For maximum convenience, all workshop essentials like stopwatches and other handy facilitation tools come neatly packed in a transport box, making it easy to carry and set up anywhere. The simplicity of the set means that once ready, trainers need only a pen and paper to facilitate a fully equipped workshop—no need for any additional resources. With this product, workshop preparation becomes effortless, and delivering effective, engaging sessions is made simpler and more efficient.</p>	<p><i>Make sure it is clear and easy to be understood by a third party. Make sure it helps to visualise your KER.</i></p>

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
<p>"Market" – Target market</p>	<p>Our primary target market focuses on Freelance Coaches and Consultants as early adopters. These independent professionals, often working with environmentally-conscious organizations, are seeking practical, portable, and comprehensive toolkits to deliver impactful workshops on circular business models. By providing a ready-to-teach solution, we enable consultants to quickly prepare and run workshops that align with the sustainability goals of their corporate clients, particularly those working to meet Green Deal requirements and other environmental standards.</p> <p>Next in priority are Corporate Trainers and Facilitators, particularly those engaged with large companies committed to sustainability and circular economy initiatives. These professionals can leverage our solution to easily integrate circular business model training into their existing programs, helping their organizations meet environmental targets while reducing the trainer’s preparation time.</p> <p>Educators in Professional Development and Adult Learning, especially those working in universities and business schools, are another key target. As institutions increasingly aim to incorporate sustainability into their curricula, our product provides a seamless, ready-to-use platform that fits their needs for practical, hands-on learning in circular economy and business model innovation.</p> <p>By focusing on these high-impact sectors and professionals who are on the front lines of environmental transformation, our solution will help accelerate the adoption of circular business models in education and corporate training, with clear alignment to sustainability goals.</p>	<p><i>To finalise the exploitation plan and prepare the use of the KER, is needed a clear identification of the target market, with its segmentation. It should include both a qualitative and quantitative description in terms of size and features.</i></p>
<p>"Market" – Early Adopters</p>	<p>The most likely early adopters from the list would be:</p> <ol style="list-style-type: none"> 1. Freelance Coaches and Consultants: These professionals often work on tight schedules, preparing custom workshops for different clients. They feel the pain of having to repeatedly gather and organize materials, so a "ready to teach" set that saves time and simplifies preparation would be very appealing. 2. Corporate Trainers and Facilitators: Trainers who conduct workshops frequently within different departments or organizations will benefit greatly from having a pre-packaged, standardized kit. They are constantly looking for ways to streamline preparation and delivery, making them strong early adopters. 3. Learning & Development (L&D) Departments: L&D professionals are focused on delivering effective training while dealing with the pressure of limited time and resources. A plug-and-play toolkit would solve their need for easily prepared and implemented training sessions, making them potential early adopters. 	<p><i>Early adopters are the ones who feel the identified problems the most. Make sure the identification is aligned with the problem/customer fit.</i></p> <p><i>Consider integrating information on early adopters with their size, where they are located, etc.</i></p> <p><i>To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to “early majority”. Note that innovators are the ones that “use” the “alfa” version (2,5%, often partners in the R&D project); early adopters are the customers ready to “use” the “beta” version (13,5%). New initiatives fail because they are not able to reach early adopters.</i></p> <p><i>You should be as much precise as you can. Being the early adopters the first ones you would like to reach out</i></p>

KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>These groups tend to face the problem of time-consuming preparation and the need for portability and versatility in workshop delivery more acutely than others, as their business or department success depends on the efficiency and effectiveness of their training sessions.</p>	<p><i>with your innovative solution it will be important to be able to connect with them.</i></p>
<p>"Market" - Competitors</p>	<p><u>Workshop Kits and Facilitation Tool Providers</u></p> <ul style="list-style-type: none"> ▪ Examples: Thiagi Group, Gamestorming, SessionLab ▪ Strengths: <ul style="list-style-type: none"> ○ Ready-made content and frameworks for workshops. ○ Often offer a variety of tools that trainers can choose from. ○ Established brands with a customer base. ▪ Weaknesses: <ul style="list-style-type: none"> ○ Limited customization and may not cover specific workshop needs. ○ Lack a fully integrated solution for both physical and digital workshop delivery. ○ May not provide the convenience of all materials in one transportable box, leaving facilitators to gather some materials on their own. ○ Lack of content knowledge about circularity and case data <p><u>Digital Whiteboard and Workshop Tools</u></p> <ul style="list-style-type: none"> ▪ Examples: Miro, MURAL, Jamboard ▪ Strengths: <ul style="list-style-type: none"> ○ Strong digital tools for remote and hybrid workshops. ○ Intuitive, interactive platforms designed for collaboration. ○ Large library of templates and integrations with other digital tools. ▪ Weaknesses: <ul style="list-style-type: none"> ○ Purely digital—lack physical components and tangible materials for in-person workshops. ○ Learning curve for those unfamiliar with the software. ○ Require internet access and devices, which may be a barrier in some settings. ○ Lack of content knowledge about circularity and case data <p><u>Traditional Workshop Supply Stores and Stationery Providers</u></p> <ul style="list-style-type: none"> ▪ Examples: Office Depot, Staples, Amazon (for workshop supplies) ▪ Strengths: <ul style="list-style-type: none"> ○ Wide variety of supplies to create custom workshop kits. 	<p><i>Competitors are connected to the use model. Weaknesses and strengths of the competitors might be presented in order to stress the uniqueness of your solution. Take also in consideration that a collaboration with the competitors might be useful.</i></p>

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ○ Easy access to physical tools (e.g., sticky notes, flip charts). ○ Offer bulk purchasing options. ▪ Weaknesses: <ul style="list-style-type: none"> ○ Require the trainer to know what to buy and how to prepare the workshop. ○ No ready-to-use, curated sets; facilitators must assemble their own kits. ○ Lack of digital components and instructional support for workshop preparation. <p><u>Learning & Development Platforms and Courseware Providers</u></p> <ul style="list-style-type: none"> ▪ Examples: Coursera, Udemy, LinkedIn Learning (for facilitation courses), ATD (Association for Talent Development) ▪ Strengths: <ul style="list-style-type: none"> ○ Provide extensive training content, facilitation skills development, and workshop resources. ○ Some platforms offer workshops for corporate training and personal development. ○ Access to a wide network and community of trainers. ▪ Weaknesses: <ul style="list-style-type: none"> ○ Content-focused rather than providing physical tools or a complete workshop kit. ○ Lack of content knowledge about circularity and case data ○ Often do not include ready-to-use materials for running hands-on workshops. ○ Less emphasis on hybrid solutions combining both physical and digital preparation. • Potential Collaboration: <ul style="list-style-type: none"> ○ Coursera and Udemy could partner to offer specialized courses on circular business model training, leveraging our "Ready-to-Teach" kits as physical or hybrid extensions of their online courses. This collaboration would provide a unique offering combining online learning with hands-on practice. ○ LinkedIn Learning could integrate tailored circular economy modules from our system, expanding their current content library to include a more practical, ready-to-use approach for corporate and educational users. ○ ATD could collaborate to offer certified training programs focused on circular business models and sustainability, providing ready-to-use tools and real-world data to elevate their content. <p><u>Summary of Collaboration Opportunities:</u></p> <ul style="list-style-type: none"> • SessionLab, Thiagi Group, and Gamestorming could integrate circular business model content and practical case study data into their existing frameworks. 	

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> • Miro, MURAL, and Jamboard could be partners for hybrid integration, enhancing both digital and physical learning environments. • Office Depot, Staples, and Amazon could distribute sustainable, curated workshop kits through their platforms. • Coursera, Udemy, and LinkedIn Learning could offer blended learning solutions by combining our hands-on kits with their online training content. • These partnerships could help scale and differentiate our offering, enhancing value for both our platform and our collaborators. 	
<p>Go to Market – Use model</p>	<p><u>Product-Service Bundling</u> Offer a combination of tangible workshop sets and value-added services. This ensures that customers not only receive the materials but are also supported in using them effectively. Components:</p> <ul style="list-style-type: none"> ▪ The Core Product: The physical “ready-to-teach” workshop set with all necessary tools, instructions, and materials. ▪ Digital Access & Tools: A platform (app or web-based) that includes: <ul style="list-style-type: none"> ○ Digital Tutorials: Step-by-step guides and video tutorials for trainers on how to use the set effectively. ○ Whiteboard & Preparation Platform: A virtual replica of the physical materials for easy digital preparation, customizable to fit various workshop needs. ▪ Service Layer: <ul style="list-style-type: none"> ○ Training & Certification: Offer online or in-person training sessions and certifications to ensure trainers know how to best utilize the set for different contexts. ○ Facilitation Support & Community Access: A support channel (live chat, community forum, or coaching calls) where trainers can ask questions, share best practices, and receive guidance from experts or other users. ○ Subscription for Updates & New Content: A subscription model to keep users engaged and ensure they always have access to updated content, new templates, and workshop modules (both physical and digital). <p><u>Customer Journey & Onboarding Process</u> To ensure customers adopt and use the product effectively, design a clear and supportive journey from purchase to implementation.</p>	<p><i>Use model should be consistent with target market and customers’ needs.</i></p>

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>Stages:</p> <ul style="list-style-type: none"> ▪ Pre-Purchase Information & Demos: <ul style="list-style-type: none"> ○ Host webinars or offer demo sessions so potential customers can see the product in action and understand how it fits their needs. ○ Provide sample digital materials or mini-tutorials to showcase ease of use. ▪ Purchase Options: <ul style="list-style-type: none"> ○ One-Time Purchase with Basic Access: A standalone purchase of the workshop set with limited access to digital tools and tutorials. ○ Premium Package: The workshop set bundled with premium access to the digital platform, additional templates, and access to live support. ○ Subscription Model: A recurring subscription service that provides continuous updates to workshop content, access to new materials, and exclusive community events. ▪ Onboarding & Initial Training: <ul style="list-style-type: none"> ○ Once a purchase is made, guide users through a structured onboarding process that includes a welcome kit, introductory video tutorials, and personalized training. ○ Offer a “First Workshop Guide” that helps trainers conduct their first session using the set, step by step. ▪ Ongoing Support & Community Engagement: <ul style="list-style-type: none"> ○ Provide regular content updates (new workshop templates, tools) through the digital platform. ○ Create a community platform (forum, social media group) where users can share tips, ask questions, and access user-generated content. ○ Host periodic live events like webinars, Q&A sessions with experts, or workshops for trainers to continue developing their skills. <p><u>Distribution and Accessibility</u></p> <p>To maximize the product’s reach and impact, consider multiple distribution channels.</p> <ul style="list-style-type: none"> ▪ Online Store & E-Commerce Platforms: Sell the workshop set directly through an online store, with options to purchase the digital subscription or premium packages. Also, utilize platforms like Amazon for broader reach. ▪ Partner with Training Institutions & Corporate L&D Departments: Create partnerships or bulk purchasing deals with institutions and organizations that train facilitators, educators, and trainers. This can increase visibility and use within larger networks. 	

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KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ▪ Affiliate & Referral Programs: Create a network of advocates or affiliates who can recommend and demonstrate the product to their own audiences (e.g., training consultants, business coaches). Offer incentives for successful referrals. <p><u>Business Models & Revenue Streams</u> Create a diverse set of revenue streams to ensure sustainability and continuous impact.</p> <ul style="list-style-type: none"> ▪ Direct Product Sales: The physical workshop kit as the primary product for a one-time purchase. ▪ Subscription Revenue: Offer a recurring subscription for continuous digital support, updates, and access to new workshop materials and templates. ▪ Training & Certification Fees: Charge for premium training sessions, certifications, and workshops aimed at helping trainers develop their facilitation skills. ▪ Customization Services: Provide bespoke customization services for organizations that require tailored workshop materials or corporate branding. 	
<p>Go to Market - Timing</p>	<p>Prototyping & Product Development (3-4 months):</p> <ul style="list-style-type: none"> ▪ Physical Product: Develop prototypes of the workshop set and test them for usability, portability, and quality. ▪ Digital Platform: Start building the digital platform (or customizing an existing platform) for access to tutorials, digital whiteboard, and preparation tools. Include key features like onboarding, subscription management, and content delivery. ▪ Content Creation: Develop tutorial materials, onboarding guides, templates, and initial workshop content for both physical and digital use. <p>Pilot Testing & Feedback Loops (1-2 months): Conduct pilot workshops with a sample group of users (e.g., trainers, consultants) to test the product’s usability and overall experience. Gather feedback and iterate on both the physical product and digital platform.</p> <ul style="list-style-type: none"> ▪ Finalize Packaging & Production (1 month): Once feedback is incorporated, finalize the design of the physical product (materials, transport box), order inventory for the first production run, and test all service touchpoints (training, tutorials, customer support). <p>Service & Support Infrastructure (2-3 months, parallel to Development)</p> <ul style="list-style-type: none"> ▪ Training & Certification Design (1-2 months): Design and develop the training sessions, online certifications, and onboarding processes. This involves creating curricula, trainer manuals, and scheduling any live or recorded sessions. 	<p><i>During the development of the project keep a continuous attention to the market timing to be ready to adapt the exploitation and dissemination actions. Please consider that estimated time to market might affect the plan needed to timely assure proper resources for further developments.</i></p>

KER 1	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ▪ Customer Support & Community Platform Setup (1-2 months): Establish the systems for customer support (e.g., live chat, email, community forums) and create channels for community engagement. Train support staff to handle inquiries, onboard new users, and moderate community discussions. <p>Pre-Launch Activities & Go-to-Market Strategy (2-3 months)</p> <ul style="list-style-type: none"> ▪ Marketing Materials & Early Outreach (1 month): Create marketing materials (website, social media content, sales kits) and start pre-launch campaigns to build awareness and generate interest among early adopters. ▪ Sales Channel Setup & Distribution Planning (1 month): Finalize agreements with any distributors or partners, set up e-commerce platforms, and establish logistics for physical product distribution. ▪ Soft Launch & Iterative Improvement (1 month): Conduct a soft launch with a limited user base to test sales channels, support processes, and gather additional feedback. Make any final adjustments based on initial user experience. <p>Overall Estimated Timeline: 11-16 months</p> <ul style="list-style-type: none"> ▪ Best-Case Scenario (Fast TTM): ~11 months (if development proceeds smoothly, pilot feedback is minimal, and iterations are quick). 	
Go to Market – IPR Background	There is no known existing intellectual property or knowledge owned by parties before entering into the collaborative project.	
Go to Market – IPR Foreground	<p>Case study data is intellectual property generated and provided during the course of a project, to produce training materials as a result of collaborative work between BOSCH, CONTI, OFFIS and BESU.</p> <p>Considerations: Clearly define how newly created IP will be owned, shared, and exploited by the parties involved. Establish agreements on who has rights to commercialize or use the new developments.</p>	

6.1.2 Exploitation Roadmap

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Actions	<p>Service & Support Infrastructure (2-3 months)</p> <ul style="list-style-type: none"> Training & Certification Design (1-2 months): Design and develop the training sessions, online certifications, and onboarding processes. This involves creating curricula, trainer manuals, and scheduling any live or recorded sessions. Customer Support & Community Platform Setup (1-2 months): Establish the systems for customer support (e.g., live chat, email, community forums) and create channels for community engagement. Train support staff to handle inquiries, onboard new users, and moderate community discussions. <p>Pre-Launch Activities & Go-to-Market Strategy (2-3 months)</p> <ul style="list-style-type: none"> Marketing Materials & Early Outreach (1 month): Create marketing materials (website, social media content, sales kits) and start pre-launch campaigns to build awareness and generate interest among early adopters. Sales Channel Setup & Distribution Planning (1 month): Finalize agreements with any distributors or partners, set up e-commerce platforms, and establish logistics for physical product distribution. Soft Launch & Iterative Improvement (1 month): Conduct a soft launch with a limited user base to test sales channels, support processes, and gather additional feedback. Make any final adjustments based on initial user experience. 	<p><i>The roadmap helps to have a clear vision of what will happen after the end of the project to enable the use and adoption of the KER. Focus should be put on actions to be performed the first 6 months after the project ends and on what it is needed to prepare them during the last 3-6 months of the project.</i></p> <p><i>Possible actions to be taken are:</i></p> <ul style="list-style-type: none"> <i>Finalise the business model</i> <i>Define the financial strategy</i> <i>Finalisation of ownership agreements with other partners</i> <i>....</i>
Roles	<p>Main Responsible: BESU</p> <p>Internal Roles:</p> <ol style="list-style-type: none"> Product Manager: Oversees the entire product lifecycle, from concept to delivery. Coordinates between teams, ensures the product meets market needs, and manages timelines and budget. R&D/Innovation Team: Designs and develops the physical and digital components of the PSS, including creating the workshop kit, developing digital tools, and ensuring alignment with market trends. 	<p><i>Focus on who, within the partnership, will be responsible to implement the planned actions. Describe who will do what. Each role must be consistent with the actions in order to avoid any criticalities in the implementing phase. Reflect if the partners will be keen to support you in carrying out the action for a common scope.</i></p>

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>3. Supply Chain Manager: Manages procurement, production, and logistics for the physical components, ensuring timely and cost-effective manufacturing and delivery.</p> <p>4. UX/UI Designer: Designs the user interface and experience for the digital platform, ensuring the system is intuitive and user-friendly for trainers and coaches.</p> <p>5. Software Developer: Builds and maintains the digital components of the PSS, including the interactive platform and any online resources.</p> <p>6. Content Developer/Instructional Designer: Develops training materials, case studies, and tutorials for the product, ensuring they are engaging, practical, and aligned with learning goals.</p> <p>7. Quality Assurance Specialist: Ensures both physical and digital components meet quality standards through testing and validation, identifying and fixing issues before release.</p> <p>8. Sales Manager: Develops and implements sales strategies, identifying potential clients (e.g., trainers, consultants) and managing key accounts.</p> <p>9. Marketing Manager: Oversees marketing campaigns, product positioning, and branding to ensure product visibility and alignment with target markets.</p> <p>10. Customer Support Specialist: Provides post-sales support, assisting customers with setup, troubleshooting, and any technical or content-related issues.</p> <p>11. Training & Onboarding Specialist: Develops and delivers onboarding and training sessions for customers, ensuring they can effectively use the PSS.</p> <p>12. Finance Manager: Manages budgeting, pricing strategy, financial planning, and reporting to ensure the project remains financially viable.</p> <p>These roles ensure the product is effectively developed, launched, supported, and scaled to meet market demands.</p> <p>Additionally External Partners are needed: Free Trainers, Sales Partners, Distribution Partners and Legal & Compliance Partners.</p>	
Milestones	<p>Service & Support Infrastructure at Month 3 after end of project</p> <ul style="list-style-type: none"> ▪ Training & Certification Design KPI: <ul style="list-style-type: none"> ○ 1 training session is ready for access ○ 1 online certification is available as an open badge ○ 1 onboarding process (learning path) is defined and filled with sufficient content ○ 1 customer Support & Community Platform is accessible 	<p><i>The milestones focus on what is needed to be checked to monitor advancements in the implementation of the roadmap. This allows you to control if the roadmap is properly implemented. Make sure the timing is consistent and include a set of KPIs for monitoring the milestones achievement. If the timing of the actions is not defined also milestones are undetermined.</i></p>

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>Pre-Launch Activities & Go-to-Market Strategy at Month 6 after end of project</p> <ul style="list-style-type: none"> ▪ Marketing Materials & Early Outreach KPI: <ul style="list-style-type: none"> ○ A simple set of marketing materials (website, social media content, sales kits) is available for sales partners . ○ One pre-launch campaigns is online on social media to build awareness and generate interest among early adopters. ○ One sales channel is set up and a distribution plan is finalized upon the distribution partners. ○ A soft launch is conducted with a limited user base to test sales channels, support processes, and gather additional feedback. 	
Financials Costs	<p>Own staff costs: ~38.300 € Material costs incl. external suppliers: ~150-250 €/per Workshop Set External Partner costs:</p> <ul style="list-style-type: none"> ▪ Sales partner: ~5.600 € ▪ Distributor partner: ~1.500 € ▪ Trainer partner: 5.000 €. 	<p><i>It is very important that you estimate the costs to be sustained for implementing each action in the "Actions" box. If different partners are responsible for the activities, you should dedicate part of the consortium meeting for establishing the budget for the exploitation plan. Costs deal with expenses necessary for taking project research forward. These include both human resources taking part in research activities and costs for equipment, as well as internal R&D resources of some partners.</i></p>
Revenues	<p>500 € /per Workshop Set In case of that about 125 to 180 sets are sold per year.</p>	<p><i>An estimation of revenues is important for the finalisation of the exploitation plan. Estimate potential revenues according to your use/business model, early adopters, and expected customers, and include the information in the draft exploitation plan.</i></p>
Other sources of coverage	<p>Learning platform costs (yearly license per active user). Support and Service costs.</p>	<p><i>Make an estimation of the resources needed to bridge the investment needed to increase TRL and ensure the result is used. Review the action plan to make sure to obtain the funds at the right time in order to cover the costs incurred before collecting the first revenues.</i></p>
Impact in 3-year time	<p>Impacting the education for a sustainable development for a better and more sustainability-oriented teaching in high schools, universities and professional training.</p>	

6.1.3 Risks Assessment and Priority Map

No.	KER1 - Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
Partnership Risk Factors							
1	Misaligned Objectives & Expectations: Partners (e.g., suppliers, trainers, digital platform providers) may have different goals or expectations, leading to conflicts in priorities or commitments.	2	5	10	Clearly Defined Agreements & Contracts; Early Alignment & Joint Planning; Continuous Communication & Progress Monitoring; Establish a Governance Structure; Performance & Progress Monitoring; Relationship Building & Shared Culture	4	No Action'
2	Dependency on Key Partners: Over-reliance on certain partners for essential components (e.g., workshop materials, digital tools) can create bottlenecks or operational challenges if they underperform or withdraw.	2	2	4	Diversify Suppliers & Partners; Clear Contracts with Performance Clauses; Inventory & Buffer Stock Management; Contractual Flexibility & Regular Review; Develop In-House Capabilities; Risk Sharing & Incentives for Performance	9	Control.
3	Poor Communication & Coordination: Lack of clear communication channels and collaborative workflows can lead to misunderstandings, delays, and misaligned efforts during the development and production phases.	3	2	6	Establish Clear Communication Channels; Regular Meetings & Check-Ins; Defined Roles & Responsibilities; Project Management Tools & Workflows; Documentation & Information Sharing; Clear Feedback Loops & Issue Resolution Process; Alignment Workshops & Kick-Off Meetings	5	Between Control & No Action
4	Non-compliance by Partners: Partners may fail to comply with quality standards, timelines, or legal obligations, risking the delivery and reputation of the PSS.	4	6	24	Comprehensive Contracts & Agreements; Regular Monitoring & Performance Reviews; Service Level Agreements (SLAs) & KPIs; Onboarding & Training for Partners; Implement a Risk Management Framework; Foster Open Communication & Feedback Loops; Partner Selection & Due Diligence; Joint Governance & Accountability Structures; Insurance & Legal Safeguards; Exit Strategy & Transition Plans	6	Control.
Technological Risk Factors							
5	Platform Development & Integration Issues: Challenges in building or integrating the digital	8	2	16	Detailed Scope Definition: Clearly define the scope, features, and functionality of the platform (e.g.,	7	Control.

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No.	KER1 - Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
	whiteboard tool, tutorials, and user interface could lead to delays, cost overruns, or suboptimal user experience.				whiteboard tool, tutorials, user interface) before development starts. Ensure all stakeholders align on expectations to avoid scope creep and costly changes later.		
6	Cybersecurity & Data Privacy Concerns: The digital platform may face vulnerabilities, risking unauthorized data access, breaches, or loss of sensitive user information, leading to potential legal implications.	5	2	10	Implement strong encryption, regular security audits, access controls, compliance with data protection regulations (e.g., GDPR), and incident response plans to safeguard against data breaches and unauthorized access.	9	Control.
7	Rapid Technological Changes: New technologies or software solutions may quickly make the platform or tools outdated, necessitating continuous updates, upgrades, or replacements.	2	1	2	adopt a modular and flexible platform architecture that allows for easy updates, monitor industry trends, and maintain partnerships with technology providers to ensure timely integration of new innovations and tools.	6	Control.
8	Usability & Accessibility Challenges: Poorly designed user interfaces or platform features may affect user experience, leading to low adoption or dissatisfaction among trainers and users.	6	3	18	Conduct user-centred design processes, including regular usability testing and accessibility audits, while involving trainers and users early in the design phase to ensure the platform meets their needs and preferences.	8	Control.
Market Risk Factors							
9	Uncertain Demand & Market Fit: There may be insufficient demand or an incorrect understanding of market needs, leading to poor sales and adoption of the PSS.	10	4	40	Thorough conducting market research, pilot the PSS with early adopters, gather feedback, and iterate on the product to ensure alignment with customer needs and preferences before a full-scale launch.	8	Control.
10	Competition & Market Saturation: Established competitors or new entrants with similar products may reduce your market share, especially if they have greater brand recognition, better pricing, or additional features.	10	3	30	Focussing on differentiating our product through unique features, superior customer service, and targeted marketing, while continuously innovating and offering competitive pricing or added value to maintain a strong market position.	9	Control.
11	Changing Customer Preferences: The target market's preferences for training and facilitation tools may shift (e.g., move towards fully digital	3	3	9	Continuously monitor market trends, gather customer feedback, and maintain the flexibility to adapt the PSS by incorporating new features, such	5	Between Control & No Action

No.	KER1 - Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
	solutions), impacting the relevance and appeal of the PSS.				as fully digital or hybrid solutions, to stay aligned with evolving customer needs.		
12	Economic & Political Instability: Market disruptions due to economic downturns, regulatory changes, or political uncertainty could impact purchasing decisions or access to certain markets.	8	4	32	Diversify our market presence across regions, develop flexible pricing models, and build strong relationships with local partners to adapt quickly to regulatory changes and economic shifts.	10	Control.
IPR/Legal Risk Factors							
13	IP Infringement & Ownership Disputes: Potential disputes over background and foreground IPR ownership with partners, contributors, or case study data providers may lead to legal challenges or restrictions on product use.	2	1	2	Establishing clear and detailed contracts that define ownership, usage rights, and licensing for both background and foreground IP, and consult legal experts to ensure proper IPR management and dispute resolution mechanisms are in place.	10	Control.
14	Licensing & Compliance Issues: Failure to properly secure or license the use of third-party software, tools, or content could lead to breaches of terms, penalties, or restricted functionality.	4	3	12	Thorough conducting due diligence on all third-party software and content, secure appropriate licenses, and regularly review compliance with licensing agreements to avoid breaches and ensure uninterrupted functionality.	8	Control.
15	Data Protection & Privacy Regulations: Non-compliance with data privacy laws (e.g., GDPR) when handling case study data or user information could result in legal action, fines, and reputational damage.	6	1	6	Implementing strict data handling protocols, ensure compliance with relevant privacy laws (e.g., GDPR), conduct regular audits, and provide staff training on data security and privacy best practices.	8	Control.
16	Product Liability & Safety Concerns: If the physical workshop materials have safety issues or fail to meet regulatory standards, it could lead to product recalls, liability claims, and damage to brand reputation.	1	1	1	Ensuring rigorous testing of workshop materials, comply with all relevant safety and regulatory standards, and maintain product liability insurance to cover potential claims and recalls.	10	Control.
Financial/Management Risk Factors							
17	Cost Overruns & Budget Constraints: Unforeseen expenses during product development, digital platform creation, manufacturing, or distribution could exceed the budget, reducing profitability.	4	2	8	Implementing a detailed project budgeting with contingency funds, closely monitor expenses through regular financial reviews, and adjust scope or timelines as needed to stay within budget.	7	Control.

No.	KER1 - Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
18	Insufficient Funding or Cash Flow Issues: Challenges in securing funding for scaling the PSS, covering operational costs, or managing cash flow effectively could hinder development, production, and distribution.	8	2	16	Diversifying funding sources through a mix of investment, grants, and revenue streams, maintain a solid cash flow forecast, and implement cost control measures to ensure financial stability during scaling and operations.	4	No Action'
19	Pricing & Revenue Model Challenges: Finding the right pricing strategy for the PSS (e.g., subscription vs. one-time purchase) that aligns with market expectations and covers costs may be difficult, leading to potential financial losses.	7	3	21	Conducting market research and pricing experiments to understand customer willingness to pay, test different pricing models (e.g., subscription, tiered, or one-time purchase), and continuous refinement based on customer feedback and financial performance analysis.	6	Control.
20	Return on Investment (ROI) Uncertainty: The expected ROI may not be achieved if sales targets, subscription renewals, or long-term customer retention do not meet projections.	7	4	28	Setting realistic sales and retention targets based on market research, continuously track performance metrics, and implement customer retention strategies such as personalized support, product improvements, and loyalty programs to drive long-term engagement and renewals.	6	Control.
Environmental/Regulation/Safety risks:							
21	Sustainability & Material Sourcing: Use of non-sustainable or environmentally unfriendly materials for the physical workshop set could negatively impact brand perception, especially among environmentally conscious consumers.	8	3	24	Prioritizing sourcing environmentally friendly and sustainable materials, work with certified suppliers, and promote eco-friendly practices in our marketing to align with consumer values and enhance brand reputation.	10	Control.
22	Waste & Disposal Issues: Improper disposal of physical workshop materials or transport boxes could contribute to waste and environmental impact, potentially facing criticism or regulatory issues.	4	2	8	Designing the workshop materials and transport boxes to be recyclable or reusable, provide clear disposal and recycling instructions to users, and explore partnerships with recycling programs to minimize environmental impact and ensure regulatory compliance.	10	Control.
23	Carbon Footprint & Transportation: Shipping physical products, especially internationally, may result in a high carbon footprint, contributing to environmental concerns and possibly affecting sustainability ratings.	4	3	12	Optimizing packaging to reduce weight and volume, partner with eco-friendly logistics providers, consolidate shipments, and consider offering digital-only versions or local production to	9	Control.

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No.	KER1 - Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
					minimize the environmental impact of international shipping.		
24	Regulatory Compliance for Environmental Standards: Failure to comply with environmental regulations related to production, packaging, and disposal could lead to fines, restrictions, or the need to redesign product components.	2	2	4	Staying updated on relevant environmental regulations, conduct regular compliance audits, and design our products using certified materials and processes that meet or exceed regulatory requirements.	10	Control.



Legend:

Nr. 2 "No Action" Risks

Nr. 20 "Control" Risks

Nr. 2 Risks Between Control & No Action

The analysis founds 24 risks and all of them but two present a low risk grade and a high probability of success of the planned remedy. Due to that, the risks are concentrated in the *Control* areas. Only two risks present a low risk grade with a low probability of success and are located in the *No Action* area.

6.1.4 Use options

KER 1 – CIRC-UIITS Demonstrator & CIRC-UIITS-like payload - Exploitation route (how the KER will be further exploited)			
	Selected route	Implementing actor	Yes
DIRECT USE	Commercialisation: <i>deployment of a novel product/service (offered to the target markets)</i>	One partner⁴ BESU	X
		A group of partners ⁵	
	Contract research (<i>new contracts signed by the research group with external clients</i>)	A partner	
		A group of partners	
	A new research project (<i>application to public funded research programmes</i>)	A partner	
		A group of partners	
	Implementation of a new university – course (<i>Note that a training course is a service</i>)	A partner	
A group of partners			
A new partnership			
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
A group of partners			
By assignment			
	By licensing		
	Other (<i>please describe</i>)		

⁴ Partners identifies the partners of the project receiving the ESS, not third parties that may be partner in the future.

⁵ Provide the names of the partners.

6.2 KER No. 2 - Electronics Re-use marketplace module (KER leading beneficiary: TXT)

6.2.1 Characterization of the result

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Problem	Currently, the reusability of electronic components is largely restricted to a few small-scale initiatives, with minimal involvement from OEMs in the reuse process. The lack of clear criteria for value recognition results in the loss of valuable materials and potentially reusable components across various process streams. Moreover, OEMs are now required to meet ambitious European targets for recycling critical raw materials (CRMs) and precious materials found in electronics. This includes compliance with the new CRM Act and other relevant regulations.	<p><i>Identifying the key problem is crucial to assure the impact of the result.</i></p> <p><i>It is advised to describe the problems rather than illustrate the proposed solution.</i></p> <p><i>Problems addressed are at the basis of the characterization of the solution and identification of customers.</i></p> <p><i>Being able to solve problems the “customers” face (regional authority) is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</i></p>
Alternative solution	For the time being, the reuse of components from domestic appliances is limited to some small-scale business cases of certain operators refurbishing for the second market. In terms of marketplace, there exist several of them for second-hand sell/purchase, but non for electronical components coming from WEEEs; moreover, they normally connect end users/customers, and do not target the connection between beginning of life and end of life actors of the value chain.	<i>Alternative solutions are important to benchmark the novel solution and to get an insight on competition. Collecting information on weaknesses and strengths of the alternative solutions helps to compare and to quantify the added value of the proposed solution and investigate who is providing them and under which conditions.</i>
Unique Selling Point USP - Unique Value Proposition UVP	<p>The RE-PLACE Marketplace’s application is to connect manufacturers and EoL operators to achieve a more secure supply of spare parts, driving the interest also in the design for repair/reuse/refurbish since the manufacturers are getting the used parts back.</p> <p>As marketplace, it can be applied to any other industrial/manufacturing sector to enhance circularity along the whole value chain, potentially creating new revenue streams from end of life towards beginning of life for objects/components reuse.</p> <p>Thanks to its blockchain-based approach to the traceability of PCB components flowing throughout the platform, the RE-PLACE Marketplace can address the needs for EoL actors</p>	<p><i>The UVP is crucial to ensure the use and approach the early adopters. Your strength points highlight your uniqueness compared to the alternative solutions. The UVP is the reason why your solution will be adopted. Please further validate the UVP by stressing your element of uniqueness and highlight the quality of the solution.</i></p> <p><i>Please consider linking the mentioned features to the identified problem.</i></p>

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<p>for transparency towards components reuse, allowing those to meet the rigorous European regulations in terms of CRMs and critical materials lifecycle.</p> <p>In this context, the RE-PLACE Marketplace possesses significant competitive advantages over its competitors, further enriching its unique value proposition among other generalist marketplace solutions. These are:</p> <ul style="list-style-type: none"> ▪ A strong focus on market needs, specifically from BoL, EoL and intermediary consortia. The Marketplace has been designed and built with their needs as the baseline foundation, ensuring the final product perfectly matches the needs of such actors in such a way that the competitor markets struggle to fulfil. ▪ A consequence to the experts-driven design is the inherit trust that each participant in the RE-PLACE Marketplace can have when interacting with the tool, knowing that every aspect of the loop has been curated by domain experts. As an example, descriptions, photos, and all the relevant information concerning an electronic board have been inserted either by the manufacturer itself, or by expert dismantling facilities operating exclusively in the electronics sector, ensuring that the data provided and shared are always accurate and trustworthy. Furthermore, since product information is inserted in a standardized way for all actors, this ensures that every PCB insertion is consistent with one another, allowing users to fully compare products in all of its aspects. Such behaviour, on the other hand, is not always guaranteed when it comes to generalist marketplaces, where the accuracy on the information provided heavily depends on a case-by-case basis. 	
Description	<p>The RE-PLACE Marketplace serves as the centralized solution that enables EoL actors such as recycling plants, WEEE treatment plants, consortia, and BoL actors including appliance manufacturers in the consumer electronics field to come in contact in the scope of objects/components reuse for re-manufacturing. The Marketplace tool enables BoL actors to obtain back used components related to consumer electronic appliances from recycling facilities to be re-included in the manufacturing loop, reducing the impact of EoL recycling activities and enabling circularity among the whole value chain. On the other hand, the RE-PLACE Marketplace enables EoL recycling plants to reduce the amount of component designated to smelting facilities, boosting reuse in a profitable way.</p>	<p><i>Make sure it is clear and easy to be understood by a third party. Make sure it helps to visualise your KER.</i></p>

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
<p>"Market" – Target market</p>	<p>The initial target market for the RE-PLACE Marketplace mainly consists in the automotive and mass electronics sector at European level, focusing on players of any size and including SMEs, as well as large enterprises. In such scenario, the RE-PLACE Marketplace mainly targets the following categories of actors:</p> <ul style="list-style-type: none"> ▪ Beginning of life actors (OEMs, Manufacturers, suppliers): can exploit the RE-PLACE Marketplace to recover precious objects/components from EoL to re-introduce in the manufacturing process. ▪ EoL actors (EPR systems, treatment plants): can exploit the RE-PLACE marketplace to sell recovered objects/components to manufacturers at BoL, creating a new revenue stream and reducing the number of objects/components designated for smelters. ▪ Intermediaries that act as aggregators of other interested actors' instances: can mediate each party to propose more favourable exchange conditions by offering mediation services directly on the RE-PLACE Marketplace on behalf of the actors represented. 	<p><i>To finalise the exploitation plan and prepare the use of the KER, is needed a clear identification of the target market, with its segmentation. It should include both a qualitative and quantitative description in terms of size and features.</i></p>
<p>"Market" – Early Adopters</p>	<p>The early adopters for the RE-PLACE Marketplace in the alpha version have been identified in the actors involved within Pilot #4 of the CIRC-UIITS project. In particular:</p> <ul style="list-style-type: none"> ▪ BEKO: uses the RE-PLACE Marketplace as a buyer actor, publishing advertisements for spare components of interest to be recovered from end of life. ▪ ERION: uses the marketplace as intermediary on behalf, in turn, of both buyer and seller. On the buyer side, by aggregating various interests for components to be recovered and publishing relative advertisements on the marketplace, leveraging favorable conditions for the group it represents. On the seller side, ERION acts on behalf of the recycling and treatment plants, aggregating components to be reused and negotiating favorable conditions with buyers leveraging negotiation on the marketplace. ▪ ERION's network of partners from EoL, recycling plants, etc. (e.g. TRANSISTOR company has been involved in project activities): use the marketplace acting as sellers of object/components and interacting directly with BoL via the marketplace to create a new circularity link between them. <p>A second round of validation will then be carried out exploiting, once again, the sectorial connections offered by ERION's network of independent actors that will become the early adopters of the beta version of RE-PLACE. This second group of adopters mainly aims at gathering feedback directly from the market without any prior knowledge or connection as for the "alpha" early adopters that already have context over the RE-PLACE Marketplace</p>	<p><i>Early adopters are the ones who feel the identified problems the most. Make sure the identification is aligned with the problem/customer fit.</i></p> <p><i>Consider integrating information on early adopters with their size, where they are located, etc.</i></p> <p><i>To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to "early majority". Note that innovators are the ones that "use" the "alfa" version (2,5%, often partners in the R&D project); early adopters are the customers ready to "use" the "beta" version (13,5%). New initiatives fail because they are not able to reach early adopters.</i></p> <p><i>You should be as much precise as you can. Being the early adopters the first ones you would like to reach out with your innovative solution it will be important to be able to connect with them</i></p>

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	thanks to their involvement in the design and realization phases within the CIRC-UITs Project.	
"Market" - Competitors	<p>Identifying a specific B2B marketplace for selling and purchasing of second-hand PCB components for reuse can be challenging as it represents a niche market and not many solutions currently exist addressing all the needs of EoL and BoL. Some platforms exist related to components selling and purchasing that can be loosely compared to the RE-PLACE Marketplace, even if they don't offer the same functionalities:</p> <ul style="list-style-type: none"> ▪ Alibaba: A vast B2B marketplace that includes a dedicated section for electronic components selling and purchasing (including PCBs), however it doesn't focus on used/refurbished components, even though it is possible to find them in small quantities. ▪ Direct Industry: A professional marketplace for industrial products that includes electronics and electrical components such as PCBs. Again, the focus is not on reused/refurbished PCBs even though some retailers offer such option. <p>Nonetheless, the competitors identified above lack focus on circularity, as the connection between end-of-life and beginning-of-life in the component's manufacturing process is not the main focus of those platforms.</p> <p>The scope of RE-PLACE and differentiating aspect is focused on the high level of automation and minimal or no involvement of humans to minimize the costs on such "second hand" products.</p> <p>By looking at the competitor's category as a whole, it's easier to spot strengths and weaknesses of their alternative offerings compared to the RE-PLACE Marketplace. In particular, when it comes to already established players the main advantages over RE-PLACE consist in all the value-added services they can offer, including:</p> <ul style="list-style-type: none"> ▪ A wider variety of services, thanks to the fact that they are long established in the market, giving them time to expand over their core offering ▪ Dedicated customer service lines and assistance via dedicated support sections on their websites ▪ More data to empower their services, thanks to their longer establishment in the market that allowed to gather buying and selling information for a longer time frame. ▪ A well established and trusted brand identity, potentially attracting more customers who relies on online reviews, word of mouth and higher rankings in search results. 	<p><i>Competitors are connected to the use model. Weaknesses and strengths of the competitors might be presented in order to stress the uniqueness of your solution. Take also in consideration that a collaboration with the competitors might be useful.</i></p>

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ▪ A wider userbase, again thanks to the fact that these players are present in the market for a long time. <p>On the other hand, the potential competitors of the RE-PLACE Marketplace expose some weak points related to the target audience and the capability of addressing specific users' needs. This is mostly coming from the fact that such alternatives, which are mainly profit-driven rather than born from innovation and sustainability incentives, tend to generalize their offering to address a wider customer base to attract profits, losing the ability to focus on specific market gaps dictated, for example, by reuse and circularity needs expressed from manufacturers and recyclers. In this context, the RE-PLACE Marketplace competitors suffer critical weaknesses:</p> <ul style="list-style-type: none"> ▪ Lack of focus on specific market needs, specifically from those coming from BoL, EoL and intermediary consortia. RE-PLACE competitors haven't been designed thoroughly considering their individual needs, reducing the alignment between the platform goals and recycling/circularity needs from manufacturers, recyclers and consortia. ▪ The absence of experts-driven design also denotes a lack in inherited trust when it comes to interacting with the tool and other participants, as data provided and shared might not always be represented in an optimal way for the expert utilizing the tool. This aspect is evident on both sides of the interaction (buying and selling), as the accuracy on the information provided heavily depends on a case-by-case basis, not allowing the expert to fully trust the process and its participants. 	
Go to Market – Use model	The RE-PLACE Marketplace will be commercialized as a PAAS (Platform-As-A-Service) solution, leveraging a pay-per-advertise fee for component manufacturers/BoL actors and transactional fees for selling and purchasing activities among all involved parties.	<i>Use model should be consistent with target market and customers' needs.</i>
Go to Market - Timing	1-2 years	<p><i>During the development of the project keep a continuous attention to the market timing to be ready to adapt the exploitation and dissemination actions.</i></p> <p><i>Please consider that estimated time to market might affect the plan needed to timely assure proper resources for further developments.</i></p>

KER 2	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Go to Market – IPR Background	No pre-existing background for this IPR. The basis of the RE-PLACE Marketplace relies on Open-Source Software (OSS) which doesn't impact ownership rights and publication.	
Go to Market – IPR Foreground	The IPR for the RE-PLACE Marketplace is exclusively owned by TXT under closed-source software licensing.	

6.2.2 Exploitation Roadmap

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
<p>Actions</p>	<p>Because of the low TRL of the business, producing a business plan at the end of the project would be premature. Activities should focus on further research, both technical and market research, to identify products in which the realized solutions can be applied. This should be accompanied by scientific dissemination work to expand and transfer know-how.</p> <p>Several actions need to take place at different levels and scales:</p> <p><u>Technical path:</u></p> <ul style="list-style-type: none"> ▪ Allocate R&D technical unit. ▪ Consolidation & industrialization of the product. ▪ Intense test campaign including: <ul style="list-style-type: none"> ○ oSource code static analysis and refactoring to harmonize and optimize the code. ○ oDynamic code analysis including performance and load tests. ○ oDeep assessment of cyber security mechanisms. ▪ Allocate DevOps unit. ▪ Sizing and deployment on cloud. ▪ Bug fixing activities. ▪ Release candidate RC1. ▪ Version 1 launch. <p><u>Business path:</u></p> <ul style="list-style-type: none"> ▪ Market positioning & differentiation points. ▪ Update of business plan. ▪ Allocate sales/pre-sales unit. ▪ Create sales package (e.g.: price list, presentation slides deck, etc.). ▪ Teach salesforce. ▪ Pre-sales meetings with potential customers (prioritize features, offer awareness, lead generation, etc.). ▪ Sales meetings with interested customers (present the solution, onboarding, etc.). 	<p><i>The roadmap helps to have a clear vision of what will happen after the end of the project to enable the use and adoption of the KER. Focus should be put on actions to be performed the first 6 months after the project ends and on what it is needed to prepare them during the last 3-6 months of the project.</i></p> <p><i>Possible actions to be taken are:</i></p> <ul style="list-style-type: none"> ▪ <i>Finalise the business model</i> ▪ <i>Define the financial strategy</i> ▪ <i>Finalisation of ownership agreements with other partners</i> ▪ <i>....</i>

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Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ▪ Allocate customer support unit (post-sales support to customers). <p><u>Communication plan:</u></p> <ul style="list-style-type: none"> ▪ Define brand identity (logo, brand colours, etc.). ▪ Create website landing page. ▪ Create marketing material (brochure, flyers, rollup, ad videos, social media posts, etc.). 	
Roles	Product owner & service provider: TXT.	<i>Focus on who, within the partnership, will be responsible to implement the planned actions. Describe who will do what. Each role must be consistent with the actions in order to avoid any criticalities in the implementing phase. Reflect if the partners will be keen to support you in carrying out the action for a common scope.</i>
Milestones	<p>List the milestones and KPIs to be used for monitoring the implementation of the actions listed above. Add timeline.</p> <p><u>M1-M3:</u></p> <ul style="list-style-type: none"> ▪ Allocate R&D technical unit. ▪ Consolidation & industrialization of the product. ▪ Market positioning & differentiation points. ▪ Update of business plan. ▪ Define brand identity (logo, brand colours, etc.). <p><u>M4-M10:</u></p> <ul style="list-style-type: none"> ▪ Intense test campaign including: <ul style="list-style-type: none"> ○ Source code static analysis and refactoring to harmonize and optimize the code. ○ Dynamic code analysis including performance and load tests. ○ Deep assessment of cyber security mechanisms. ▪ Allocate DevOps unit. ▪ Sizing and deployment on cloud. ▪ Bug fixing activities. ▪ Release candidate RC1. ▪ Create website landing page. ▪ Create marketing material (brochure, flyers, rollup, ad videos, social media posts, etc.). 	<i>The milestones focus on what is needed to be checked to monitor advancements in the implementation of the roadmap. This allows you to control if the roadmap is properly implemented. Make sure the timing is consistent and include a set of KPIs for monitoring the milestones achievement. If the timing of the actions is not defined also milestones are undetermined.</i>

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	<ul style="list-style-type: none"> ▪ Allocate sales/pre-sales unit. ▪ Create sales package (e.g.: price list, presentation slides deck, etc.). ▪ Teach salesforce. ▪ Pre-sales meetings with potential customers (prioritize features, offer awareness, lead generation, etc.). <p><u>M11</u></p> <ul style="list-style-type: none"> ▪ Allocate sales/pre-sales unit. ▪ Create sales package (e.g.: price list, presentation slides deck, etc.). ▪ Teach salesforce. ▪ Pre-sales meetings with potential customers (prioritize features, offer awareness, lead generation, etc.). <p><u>M12</u></p> <ul style="list-style-type: none"> ▪ Allocate customer support unit (post-sales support to customers). ▪ Version 1 launch. 	
Financials Costs	<p>Major item costs are:</p> <ul style="list-style-type: none"> ▪ Software productization (test, bug fixing, software robustness, cyber security). ▪ Operation Costs (cloud hosting and services). ▪ Allocate R&D technical unit – Allocate DevOps unit – Allocate customer support unit - Sales costs (sales package, salesforce training, landing page, etc.). 	<p><i>It is very important that you estimate the costs to be sustained for implementing each action in the “Actions” box. If different partners are responsible for the activities, you should dedicate part of the consortium meeting for establishing the budget for the exploitation plan. Costs deal with expenses necessary for taking project research forward. These include both human resources taking part in research activities and costs for equipment, as well as internal R&D resources of some partners.</i></p>
Revenues	<p>Major revenue streams are:</p> <ul style="list-style-type: none"> ▪ Pay-per-use costs for advertising objects/components on the platform. ▪ Recurring costs for each successful transaction performed through the platform. 	<p><i>An estimation of revenues is important for the finalisation of the exploitation plan. Estimate potential revenues according to your use/business model, early adopters, and expected customers, and include the information in the draft exploitation plan.</i></p>
Other sources of coverage	<p>It will be based on product owner own budget, in addition to financial support from the early adopters which will be the launching customers.</p>	<p><i>Make an estimation of the resources needed to bridge the investment needed to increase TRL and ensure the result is used. Review the action plan to make sure to obtain the funds</i></p>

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
		<i>at the right time in order to cover the costs incurred before collecting the first revenues.</i>
Impact in 3-year time	In 3 years' time the project will impact on: <ul style="list-style-type: none"> ▪ New jobs created for the new product (R&D, delivery, and salesforce) which will be added to the company software product portfolio. ▪ Increase of components reuse in Italy first and then Europe, decreasing the dependency form third countries. ▪ increasing TXT revenues thanks to the sales of the new product and company positioning in the blockchain market. 	

6.2.3 Risks Assessment and Priority Map

No.	KER2 - Electronics Re-use marketplace module	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
Partnership Risk Factors							
1	Disagreement on ownership rules.	3	2	6			No Action'
2	Exploitation disagreement: partners with divergent interests.	3	2	6			No Action'
3	No manufacturer available to produce the solution (or components of it) - Industrialization at risk.	1	1	1			No Action'
4	Not being able to find a suitable partner to go to market.	2	2	4			No Action'
5	Partner not willing to share data as planned (Lack of sharing data between partners).	4	3	12	Set up a binding agreement between parties to bound them in the data sharing process.	2	No Action'
Technological Risk Factors							
6	It could be difficult for the users to trust the automated agent-based negotiation algorithm fairness.	6	4	24	Users always have the final choice over the list of negotiation results provided by the algorithm (it doesn't replace user choice). By design of the platform, it won't be possible for users to interact with the algorithm, and it won't be possible to sponsor/highlight search results in any way. Project partners and domain experts (e.g. BEKO, ERION and TRANSISTOR) can advocate for the algorithm fairness and trustworthiness.	3	No Action'
7	Performances are lower than market needs - Worthless result: performance lower than market needs.	6	2	12	The RE-PLACE Marketplace has been designed and developed leveraging domain experts and end-users' knowledge from the beginning, to ensure the requirements and performance values are fully aligned with the domain needs. Recurrent market	3	No Action'

No.	KER2 - Electronics Re-use marketplace module	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
					analyses performed to ensure performance stay consistent with the initial value.		
8	Significant dependency on data availability by third parties.	6	4	24	Possibility to target other data sources present in the recycling and mass electronics sector, leveraging experts' networks involving treatment plants and distribution plants.	4	No Action'
9	Nobody buys the product: not perceived as a problem yet, standards to make it compulsory don't yet exist.	6	4	24	Present success cases from the CIRC-UIITS Project (BEKO, ERION, TRANSISTOR), highlighting the fact that the marketplace allows adopters to be compliant with the most recent EU regulations in terms of reuse and sustainability KPIs.	4	No Action'
Market Risk Factors							
10	Low presence of reusable PCBs in waste stream.	7	7	49	Possibility to target other sources of reusable PCBs other than treatment plants (distribution for example).	6	Control.
11	It could be difficult to get onboard the targeted customers as they are very fond of their traditional processes and supply sources.	5	7	35	Dissemination and study on pilot plant on revenues/new possibilities to be promoted.	6	Control.
IPR/Legal Risk Factors							
12	Competitors replicate technology.	4	2	8			No Action'
13	IP Infringement & Ownership Disputes: Potential disputes over background and foreground IPR ownership with partners, contributors, or case study data providers may lead to legal challenges or restrictions on product use.	2	1	2			No Action'
14	Data Protection & Privacy Regulations: Non-compliance with data privacy laws (e.g., GDPR) when handling case study data or user	4	1	4			No Action'

No.	KER2 - Electronics Re-use marketplace module	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
	information could result in legal action, fines, and reputational damage.						
Financial/Management Risk Factors							
15	Inadequate communication flow within the partnership.	3	1	3			No Action'
16	Cost Overruns & Budget Constraints: Unforeseen expenses during product development, digital platform creation, manufacturing, or distribution could exceed the budget, reducing profitability.	3	2	6			No Action'
Environmental/Regulation/Safety risks:							
17	N/A			0			Not Filled

Please complete the description and rank the 'Scope of intervention' and the 'Success of intervention'.



Legend:

Nr. 5 "No Action" Risks

Nr. 2 "Control" Risks

The analysis founds 7 risks and most of them present both a low risk grade and probability of success of the planned remedy. Due to that the risks are distributed in *No Action* and *Control* areas.

6.2.4 Use options

KER2 - Spatial Light Modulator (SLM)			
Selected route		Implementing actor	Yes
DIRECT USE	Commercialisation: <i>deployment of a novel product/service (offered to the target markets)</i>	One partner ⁶ TXT	X
		A group of partners ⁷	
	Contract research (<i>new contracts signed by the research group with external clients</i>)	A partner	
		A group of partners	
	A new research project (<i>application to public funded research programmes</i>)	A partner	
		A group of partners	
Implementation of a new university – course (<i>Note that a training course is a service</i>)	A partner		
	A group of partners		
	A new partnership		
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
By assignment			
	By licensing		
	Other (<i>please describe</i>)		

⁶ Partners identifies the partners of the project receiving the ESS, not third parties that may be partner in the future.

⁷ Provide the names of the partners.

6.3 KER No. 3 Optimized Disassembly/Rework Operations (KER leading beneficiary: POLIMI)

6.3.1 Characterization of the result

KER 3	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Problem	Ability to repair or remanufacture PCBs and or electronic components by extending the useful life of such products on an industrial scale. Potential users are OEMs. the problem is mainly due to possible shortages of key components for creating PCBs. The trend of such criticality can be considered cyclical and specific to a particular subcategory of electronic components-for example, very expensive and long-lived assets that are on the market for many years. The lifespan of such assets means that there is a need and convenience in some cases to repair specific electronic components. If we also consider that usually product-specific electronic components are produced for an average of 2-3 years it becomes clear that at the end of this period, the procurement of new replacement components can be critical.	<i>Identifying the key problem is crucial to assure the impact of the result. It is advised to describe the problems rather than illustrate the proposed solution. Problems addressed are at the basis of the characterization of the solution and identification of customers. Being able to solve problems the “customers” face (regional authority) is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</i>
Alternative solution	Currently focus on a few product families, and the process is mainly carried out manually by highly trained personnel. By addressing the problem in this way, the process lacks repeatability and efficiency and exposes the operator to possible health risks since especially in dated boards toxic elements may be present in the solder paste such as lead.	<i>Alternative solutions are important to benchmark the novel solution and to get an insight on competition. Collecting information on weaknesses and strengths of the alternative solutions helps to compare and to quantify the added value of the proposed solution and investigate who is providing them and under which conditions.</i>
Unique Selling Point USP - Unique Value Proposition UVP	Possibility of automating the procedure by making it independent of the presence of highly skilled personnel and enabling economy of scale in the process by taking advantage of innovative Industry 4.0 technologies. The UPV lies in the ability to simultaneously increase process speed, operator safety and repeatability. In addition, such an automated system would acquire data during the process phase that could be used to enable further processes.	<i>The UVP is crucial to ensure the use and approach the early adopters. Your strength points highlight your uniqueness compared to the alternative solutions. The UVP is the reason why your solution will be adopted. Please further validate the UVP by stressing your element of uniqueness and highlight the quality of the solution. Please consider linking the mentioned features to the identified problem.</i>
Description	The concept is to study manual disassembly processes and carry out feasibility studies, related to specific components, to test the possibility of automating the process using	<i>Make sure it is clear and easy to be understood by a third party. Make sure it helps to visualise your KER.</i>

KER 3	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
	automatic actuators. The process mode may vary depending on the specific target components, but the output remains to repair/reuse certain components.	
"Market" – Target market	The target market will be OEMs that have complex and long-lived assets that may need repairs on the electronic componentry. Although the identified market could be considered a niche the profitability would be very high provided a sufficiently cost-optimized process is built.	<i>To finalise the exploitation plan and prepare the use of the KER, is needed a clear identification of the target market, with its segmentation. It should include both a qualitative and quantitative description in terms of size and features.</i>
"Market" – Early Adopters	Research institutions engaged in similar research contexts.	<i>Early adopters are the ones who feel the identified problems the most. Make sure the identification is aligned with the problem/customer fit. Consider integrating information on early adopters with their size, where they are located, etc. To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to "early majority". Note that innovators are the ones that "use" the "alfa" version (2,5%, often partners in the R&D project); early adopters are the customers ready to "use" the "beta" version (13,5%). New initiatives fail because they are not able to reach early adopters. You should be as much precise as you can. Being the early adopters the first ones you would like to reach out with your innovative solution it will be important to be able to connect with them.</i>
"Market" - Competitors	Mainly OEMs who manually repair and remanufacture then those who offer alternative solutions. The strength would be in automating the process by decreasing costs and increasing productivity. The weakness is that technologically to date it is moto complex to automate these procedures and, in some cases, it is not possible to do so. Competitors' strengths are the expertise possessed by those who manually engage in these activities. Weaknesses, on the other hand, lie in the low throughput of processed material and poor repeatability due to the manually performed process. Competitors need to be analysed to better understand market strategies. For OEM we can cite Apple that has invested in his remanufacturing lines. Research institution that is working on this topic are RVTH Aachen University. Lastly the third world market where repairing of electronics is already a reality, but on consumer side.	<i>Competitors are connected to the use model. Weaknesses and strengths of the competitors might be presented in order to stress the uniqueness of your solution. Take also in consideration that a collaboration with the competitors might be useful.</i>

KER 3	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Go to Market – Use model	Initially knowledge about it will be disseminated using mainly publications and standards and then move to technology transfer resulting in direct industrial use. The business model would then be built as pay per use in the case of building disassembly lines or as a service through consultancy e to system integrators. The overall model can be viewed as a FABLAB dedicated to the remanufacturing of electronic components.	<i>Use model should be consistent with target market and customers' needs.</i>
Go to Market - Timing	Due to a low TRL is expected to be five years.	<i>During the development of the project keep a continuous attention to the market timing to be ready to adapt the exploitation and dissemination actions. Please consider that estimated time to market might affect the plan needed to timely assure proper resources for further developments.</i>
Go to Market – IPR Background	Information present and agreed in the Consortium Agreement, in Annex I.	
Go to Market – IPR Foreground	Information present and agreed in the Consortium Agreement, in Annex I.	

6.3.2 Exploitation Roadmap

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Actions	Because of the low TRL of the business, producing a business plan at the end of the project would be premature. Activities should focus on further research, both technical and market research, to identify products in which the realized solutions can be applied. This should be accompanied by scientific dissemination work to expand and transfer know-how. In addition, it will be necessary to work in the direction of achieving the milestones and KPIs given in the section below.	<i>The roadmap helps to have a clear vision of what will happen after the end of the project to enable the use and adoption of the KER. Focus should be put on actions to be performed the first 6 months after the project ends and on what it is needed to prepare them during the last 3-6 months of the project.</i> <i>Possible actions to be taken are:</i> <ul style="list-style-type: none"> ▪ Finalise the business model ▪ Define the financial strategy ▪ Finalisation of ownership agreements with other partners ▪
Roles	<ul style="list-style-type: none"> ▪ Industrial partners: Provide specific know-how on the products to be processed and provide access to testing of disassembled components. ▪ POLIMI: Increase process knowledge and study methodologies for market entry. 	<i>Focus on who, within the partnership, will be responsible to implement the planned actions. Describe who will do what. Each role must be consistent with the actions in order to avoid any criticalities in the implementing phase. Reflect if the partners will be keen to support you in carrying out the action for a common scope.</i>
Milestones	<ul style="list-style-type: none"> ▪ Success at lab scale of at least two case studies of the CIRC-UIITS project. (1 year) ▪ Ensuring valid material for drafting new proposal on EU project at the end of CIRC-UIITS project. (1 year) ▪ Reach technological feasibility. (2 years) ▪ Ability of guarantee expected lifespan of reman of electronic components (5 years). 	<i>The milestones focus on what is needed to be checked to monitor advancements in the implementation of the roadmap. This allows you to control if the roadmap is properly implemented. Make sure the timing is consistent and include a set of KPIs for monitoring the milestones achievement. If the timing of the actions is not defined also milestones are undetermined.</i>
Financials Costs	Development costs will be absorbed by European project funding.	<i>It is very important that you estimate the costs to be sustained for implementing each action in the "Actions" box. If different partners are responsible for the activities, you should dedicate part of the consortium meeting for establishing the budget for the exploitation plan. Costs deal with expenses necessary for taking project research forward. These include both human resources taking part in research activities and costs for equipment, as well as internal R&D resources of some partners.</i>

Exploitation roadmap	Input from the Beneficiary	Output and comments/suggestions for improvement by the Expert
Revenues	N/D	<i>An estimation of revenues is important for the finalisation of the exploitation plan. Estimate potential revenues according to your use/business model, early adopters, and expected customers, and include the information in the draft exploitation plan.</i>
Other sources of coverage	N/D	<i>Make an estimation of the resources needed to bridge the investment needed to increase TRL and ensure the result is used. Review the action plan to make sure to obtain the funds at the right time in order to cover the costs incurred before collecting the first revenues.</i>
Impact in 3-year time	Due to low TRL the impact will be considered in 6 years. The impact will be mainly due to the increased percentage of used components sold consolidating a market that to date is very underdeveloped in Europe.	

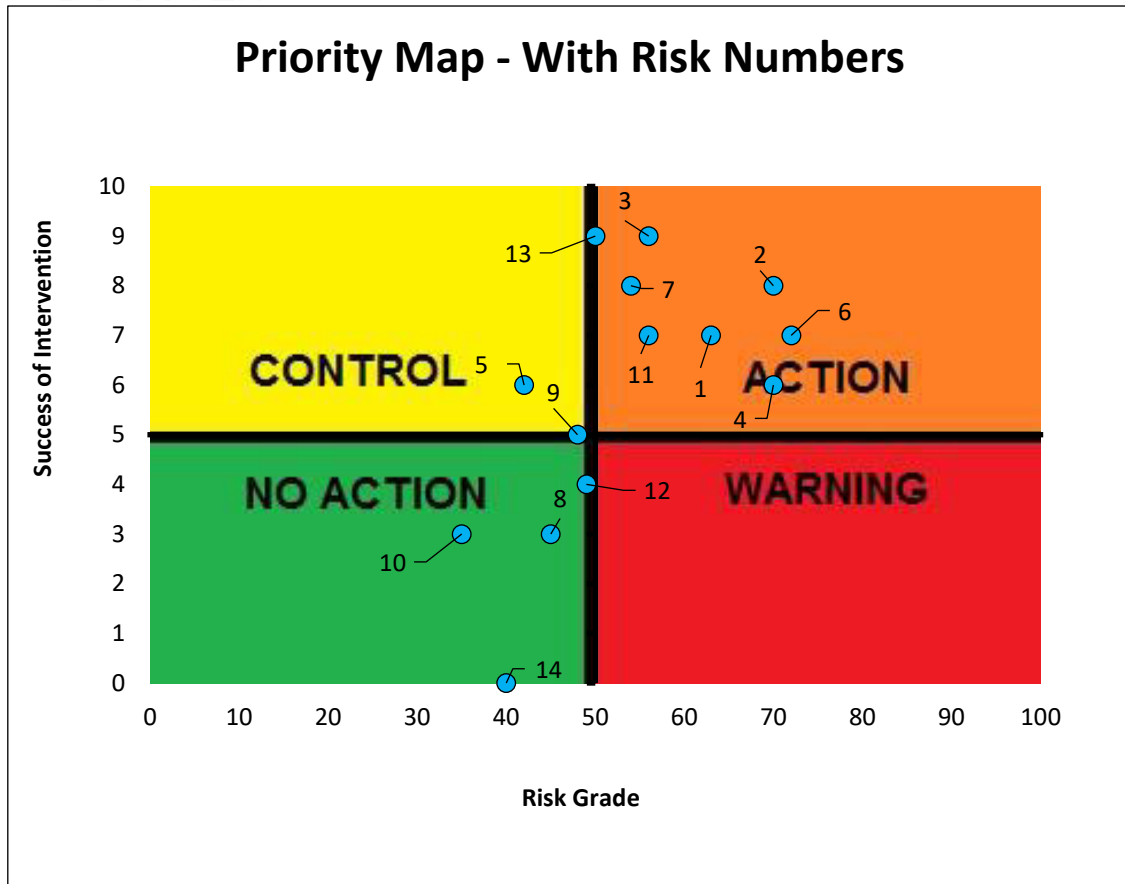
6.3.3 Risks Assessment and Priority Map

No.	KER 3 – Errore. L'origine riferimento non è stata trovata.	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
Partnership Risk Factors							
1	Disagree of further investments: some partners may leave	7	9	63	Make remanufacturing processes economically feasible so as to bring profit to industry partners	7	Action!
2	Industrialization risk: no manufacturer for exploitable result	7	10	70	Dissemination of the results	8	Action!
3	Partner not willing to share data as planned (Lack of sharing data between partners)	7	8	56	Increase data sharing in the value chain	9	Action!
Technological Risk Factors							
4	Worthless result: the task is not possible to automate	10	7	70	Further investment in research and development	6	Action!
5	Worthless result: better methodology exists	6	7	42	Further investment in research and development	6	Control.
6	Significant dependency on data availability by third parties	9	8	72	Increase data sharing in the value chain	7	Action!
7	Solution to rework the Microprocessor once flashed and locked by Cybersecurity protocol	6	9	54	Develop new standard / protocol for rework / re-flash the micro.	8	Action!
Market Risk Factors							
8	exploitation disagreement: Partners on the same market	5	9	45	Focus on very different families of product	3	No Action'
9	Nobody buys the product: nobody needs it	8	6	48	Increase revenues from the process.	5	Between Control & No Action
10	Nobody buys the product: too expensive	5	7	35	Further investments in research and development	3	No Action'
11	Uncertainty in the prediction of the evolutions of market	7	8	56	Focus on specific family of product for reman activities	7	Action!
IPR/Legal Risk Factors							

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No.	KER 3 – Errore. L'origine riferimento non è stata trovata.	Importance of the risk (1 low- 10 high)	Probability of risk happening (1 low - 10 high)	Risk Grade	Scope and type of potential intervention	Feasibility/Success of Intervention (1 low- 10 high)	Priority Level
12	Know-how risks: a counterfeit cannot be proved	7	7	49	Increase technological competitiveness of the product	4	No Action'
Financial/Management Risk Factors							
13	Multiple changes to original objective	5	10	50	Increasing communication between partners	9	Between Control & Action
14	Inadequate definition of the business plan - not a bankable business plan	5	8	40	ND	0	No Action'
Environmental/Regulation/Safety risks:							

Please verify if there are no Environmental/Regulation/Safety risks involved



Legend:

- Nr. 4 "No Action" Risks
- Nr. 1 "Control" Risks
- Nr. 7 "Action" Risks
- Nr. 1 Risks Between Control & No Action
- Nr. 1 Risks Between Control & Action

The analysis finds 14 risks and all of them present both a distributed risk grade and probability of success of the planned remedy. Due to that the risks are distributed in all four areas.

The Partnership risk factors present a situation between moderate to high-risk grade with low or high probability of success. The attention has to be concentrated in make remanufacturing processes economically feasible so as to bring profit to industry partners and increase data sharing in the value chain. The Technological Risk Factors risk factors present a situation of moderate-risk grade and a moderate probability of success of the planned remedy. Is defined a situation where it would be preferable to keep an eye on what is happening (Control) to be ready to act or to take Actions. A potential intervention could be to have further investment in research and development.

The Market Risk Factors present a medium risk grade coupled with a medium probability of success of the planned remedy. It is a situation does not call for immediate action but to keep under control.

6.3.4 Use options

KER 3 – Target Scanning System (TSS) - Exploitation route (how the KER will be further exploited)			
	Selected route	Implementing actor	Yes
DIRECT USE	Commercialisation: <i>deployment of a novel product/service (offered to the target markets)</i>	One partner ⁸	
		A group of partners⁹	X
	Contract research (<i>new contracts signed by the research group with external clients</i>)	A partner	X
		A group of partners	
	A new research project (<i>application to public funded research programmes</i>)	A partner	
		A group of partners	X
A new partnership		X	
INDIRECT USE	Assignment of the IPR	A partner	X
		A group of partners	
	Licensing of the IPR	A partner	X
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	X
Spin- off	A partner		
	A group of partners	X	
	By assignment		
	By licensing		
	Other (<i>please describe</i>)		

⁸ Partners identifies the partners of the project receiving the ESS, not third parties that may be partner in the future.

⁹ Provide the names of the partners.

7. Recommendations

Issues	Recommendations
Characterisation of KERs	<p>Three KERs were considered at the online ESS. The discussion was very participative, with all the partners contributing. The seminar helped to focus on the main aspects to be considered in the future elaboration of Final PEDR due at the end of the project's life.</p> <p>After the virtual seminar, the partnership has identified no other Key Exploitable Result which have been presented in this Final Report.</p> <p>Considering that there is still some time to address exploitation, it is recommended that the Exploitation Leading Partner makes sure that what was discussed during the seminar is further developed, validated and integrated in the exploitation plan.</p>
Discussing Exploitation at Consortium Meetings	<p>Exploitation is an important component of a project. At every Consortium meeting, there should be a session to discuss practical and strategical aspects of exploitation as it was exercised during the ESS. This will allow to update KERs characterisation and risks analysis and contribute to the further development of the technologies and approaches to be showcased at the demo plants. The project should consider the Exploitation Plan as a living document and:</p> <ul style="list-style-type: none"> ▪ Update the plan according to the progress and emerging results of the project; ▪ Consider reviewing the UVP and the use model during the project lifetime; ▪ Involve the advisory board and colleagues from marketing and business development departments in the finalisation of the plan. ▪ Discuss and finalise, at consortium meetings, exploitation roadmap.
Exploitation Plan-Planning	<p>When addressing Exploitation (and Dissemination) Plans, it is suggested to:</p> <ul style="list-style-type: none"> ▪ Keep it flexible enough and in line with the economic, environmental, societal and legal context in which the project has been set up; ▪ Use the lean canvas to better define early adopters, current solutions, unique value proposition and commercialisation channels; ▪ Identify KPIs and milestones to define a roadmap, with all the activities needed to pave the way for use of the selected KERs; ▪ Take into consideration the time and resources needed for implementing the next steps after the end of the project, considering that most of the partners have guidelines and procedures for spin-offs, joint ventures, licencing that require time. ▪ Consider consistency among the selected route to market, competition, early adopters, proposed exploitation actions and the expected impact of the project; ▪ Highlight the value chain dimension of the project and make sure this is considered to find the best set up in terms of future collaboration as partnership and as individual entities.
Monitoring Risk Analysis	<p>When analysing the current results of the Risk Analysis at the project level, pay great attention on the evaluation of the <i>Feasibility/Success of Intervention</i> score. In fact, in the case of Risk Grade from moderate to high (several cases) an incorrect or superficial evaluation could change from an <i>Action</i> to a <i>Warning</i> situation (e.g. KER3 risks 4).</p>

	It is recommended to continue to address these risks and discuss them at the level of each Partner, first, to improve the impact of mitigation actions, then, to take the opportunity at consortium meetings to discuss them at Consortium level.
IP ownership and partnerships for exploitation	If any KER will be jointly exploited by two or more partners, joint owners of KERs have to agree amongst themselves as soon as possible upon the detailed terms of exercising ownership and protection of such results in accordance and in proportion with the agreed intellectual contribution to its development. If relevant, bilateral/multilateral Memorandum of Understanding agreements should be signed among relevant partners.
Horizon Results Platform	It is strongly suggested for Dissemination purposes to upload each key Exploitable result on the EC Horizon Results Platform https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform Detailed step-by-step instructions here: https://webgate.ec.europa.eu/funding-tenders-opportunities/display/IT/Managing+Project+Results+in+the+Horizon+Results+Platform Please note that to be authorised to upload you should have granted one of the following roles for the project: PCoCo (Primary Coordinator Contact), CoCo (Coordinator Contact) or PaCo (Participant Contact) roles in the project. This is all explained in the instructions in the link above.

8. Annex 1: Related information

This chapter reports the results of specific project related to specified key words on the Internet, also a list of projects (found on Cordis) of similar interest with a brief description and related patents.

8.1 Related Links

Key Words: Circular Economy, Sustainability, Life Cycle Assessment, Disassembly.

- Towards a Circular Economy: Exploring Routes to Reuse for Discarded Electrical and Electronic Equipment
Internet Link: <https://www.sciencedirect.com/science/article/pii/S2212827116314032>
- Reuse of electronic equipment and software installed on them—an exploratory analysis in the context of circular economy
Internet Link: <https://www.ceeol.com/search/article-detail?id=680551>
- A life-cycle assessment for eco-redesign of a consumer electronic product
Internet Link: <https://www.tandfonline.com/doi/abs/10.1080/09544820902916597>
- Life cycle analysis of electronic products for a product-service system
Internet Link <https://www.sciencedirect.com/science/article/abs/pii/S0959652621021442>
- Service-oriented disassembly sequence planning for electrical and electronic equipment waste
Internet Link: <https://www.sciencedirect.com/science/article/abs/pii/S1567422316300552>.

8.2 Related projects

- **ORIENTING: “Operational Life Cycle Sustainability Assessment (LCSA) Methodology”**

Objective:

The European Green Deal for the EU and its citizens resets the European Commission’s commitment to tackling climate and environmental-related challenges. As a new growth strategy, it aims to transform the EU into a resource-efficient economy where there are no net emissions of greenhouse gases by 2050. With this in mind, the EU-funded ORIENTING project will work to strike a balance between environmental, economic and social benefits. It will develop a methodology for a comprehensive life cycle sustainability assessment of products and services in a way that considers all the variables (economic, environmental and social). This will allow practitioners to implement possible trade-offs. New tools to simplify the methodology application will be developed and tested in five industrial case studies. Internet link: <https://cordis.europa.eu/project/id/958231>.

8.3 Related patents

- E-waste Recycling: An Overview of Hydrometallurgical Processes Used to Metals Recovery — Nallely Picazo and others
No. MX391678 B
- Mini-kiosk for Recycling Electronic Devices — Bowles Mark Vincent
No. US-9881284-B2

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9. Annex 2: Memorandum of Understanding (MoU)

1. Valorisation and exploitation of ... (please refer to the specific KER)

1.1 Agreement between partner, partner, partner

1.2 The following Memorandum of Understanding is made on the dd/mm/yyyy by and between

- **Partner a**, VAT ..., registered in ..., hereinafter referred to as ...
- **Partner b**, VAT ..., registered in ..., hereinafter referred to as ...
- **Partner c**, VAT ..., registered in ..., hereinafter referred to as ...
-

Individually referred to as a “Party” or collectively as the “Parties”.

1.3 Background of the Agreement

During the [name of the project] project’s life the KER was developed... *(clearly describe the KER)*

As per consortium agreement of the Project signed by the Parties, [number of Section]: Results, ... Results are owned by the Party that generates them.

Partner a, b, c, x, y and z contributed to the generation of the KER. Each one contributed in the following way:

- **Partner a**, ...
- **Partner b**, ...
- **Partner c**, ...
- **Partners x**, ...
- **Partner y**, ...
- **Partner z**, ...

Upon successful conclusion of the project activities, Parties agreed to jointly define the best way to exploit and valorise the KER.

Partners a, b, c, ... expressed the willingness to further valorise and exploit the above-mentioned KER, securing the needed resources, while partners x, y, and z agreed to give to partners a, b, c, ... the full right to exploit declaring to have nothing to claim.

Given the uniqueness and further impact potential of KER/s above mentioned, all Parties through this agreement aim to define clear roles and modalities to exploit the programme beyond the grant received from the European Commission.

1.4 Purpose of the Agreement

The agreement is therefore aimed at clarifying and regulating

- A. Scope and objectives of KER
- B. Use of the brand *(example)*
- C. Use of the data collected via the platform *(example)*
- D. Use of the DB (software) *(example)*
- E. Procedures and Roles of the Parties *(example)*

2. Scope and objectives of KER

The Parties agree that KER is ...(KER description)

The KER is built around... and it is implemented through:

- A. A network(s)-based outreach approach; (*example*)
- B. ...;
- C. ...;
- D.

3. Use of the brand

....

...

4. Use of the data collected

...The registered data are the property of each of the Parties, who can use them for other activities in respect of GDPR and only for non-competing purposes with the current agreement (to be finetuned by partners legal offices).

5. Use of the

5.1 Procedures and Roles of the Parties

All Parties shall appoint 1 person within their respective organisation as the first and foremost contact point for ensuring swift and clear communication between the Parties and for implementation of the exploitation plan for this KER as approved by [name of the project] and annexed to this MoU.

The initial persons responsible for being the contact point are:

- Partner a: Name, email address, telephone number
- Partner b: Name, email address, telephone number
- Partner c: Name, email address, telephone number
- Partner

All partners will be informed of changes in the contact points in a timely fashion, not exceeding 5 working days from the moment the appointment from the organisation.

Partners a, b, c, ... who expressed the willingness to further valorise and exploit the KER will proactively look for potential business development opportunities. Each time one of the Parties is clearly informed by a potential customer, the Party must inform the other Parties' relevant contact points and receive organisational approval (X out of X) to proceed.

It is the responsibility of each Party to ensure the contact points of the other Parties are informed using, if necessary, more than one communication channel (e.g., email, WhatsApp, phone, etc). It is the responsibility of the other Parties to ensure the approval to proceed (or denial thereof) is communicated back to the Party in a timely fashion, not exceeding 1 working week (5 working days) from the moment the latter's communication has reached them.

5.2 Dedicated KER management (in the case of a horizontal governance set-up – to be finetuned according to the governance set up chosen by the concerned partners, before the end of the project))

The Party in charge of any new contract will inform all partners about the client, the scope of the contract and foreseen role for each partner (if possible and to different degrees). In order to progress with a new programme, partners must agree on its relevance and viability. Parties have 5 working days to register non-agreement, otherwise the proposal will be considered suitable.

When the contract is finalised, agreed by all Parties and service sold to the client, the Party in charge will act as main contract manager and coordinator, responsible and liable for the smooth implementation of the envisaged activities throughout all phases.

The partner who secures the contract should also perform a “client financial check” and all Parties will be paid promptly upon payment from the client according to the payment schedules agreed upon.

The Party will be the interface between the client and the Parties and will also be responsible for proposing the allocation of resources among partners.

5.3 Promotion and marketing

Parties **a, b, c, ...** who expressed the willingness to further valorise and exploit the KER will ensure the proper outreach, using their networks and contacts (social media, newsletters, websites) to promote the KER toward the target markets and early adopters initially identified in the exploitation plan annexed to this MoU.

The most suitable party to deliver the communication activities will be decided on the basis of the scope of the contract and the main target audience.

Cost of marketing and sales activities will be split among partners according to the provisions of the exploitation plan for the current KER.

5.4 To summarise:

<i>Activity</i>	<i>Party responsible</i>	<i>Cost split between parties (%)</i>
<i>Programme management and coordination</i>	<i>Party who secured a contract</i>	
<i>KER and methodology management</i>	<i>...</i>	
<i>Innovation and IPR management</i>		
<i>KER update</i>		
<i>Outreach and communication</i>	<i>...</i>	
<i>...</i>	<i>...</i>	

6. Intellectual Property Rights and NDA

The Parties acknowledge that nothing in this Agreement shall affect any pre-existing (background) and future (foreground) ownership of any intellectual property rights.

Dedicated NDA will be developed and signed between Parties and customers every time needed.

7. Miscellaneous

In the event of further participation in call for proposals covering actions that fall in the scope of this Agreement, the parties mutually recognize a first right of information and best effort to bid together

This Agreement is at-will and may be modified by mutual consent of all the Parties. This Agreement shall become effective upon signature by the authorised officials and will remain in effect until modified or terminated by any one of the Party by mutual consent. In the absence of mutual agreement by the Parties this Agreement shall remain in force for twenty-four months.

Any dispute that might arise concerning this Agreement shall be settled amicably.

8. Date & Signatures

FOR [please insert name of participant or potential or current partner]

Partner a: Name, Position

Partner b: Name, Position

Partner c: Name, Position

Partner x: Name, Position

Partner y: Name, Position

Partner z: Name, Position

10. Annex 3: The Lean Canvas

10.1 How to approach the business model

The Business Model is the plan for the successful operation of any “business”, identifying, the intended “customer” base, products/services, sources of revenue and details of financing. It describes the way in which “value” can be extracted from an exploitable R&D result.

When working on the “business” model it is important to focus on the following elements:

<p>Your ultimate goal</p> <ul style="list-style-type: none"> • Why am I doing this thing? • Which are my goals? (Best and worst scenario) • Am I really better? 	
<p>Global market</p> <ul style="list-style-type: none"> • Competitors • Incumbents • Investors (geography matters) • Level of investment 	<p>Local market</p> <ul style="list-style-type: none"> • Competitors • Incumbents • Investors • Peculiarities
<p>6-12-18 months plan</p> <ul style="list-style-type: none"> • KPI • Product roadmap • Cashflow • Valuation target • Next step 	

Every customer has a problem, every problem has a solution

When working on the business model, it is crucial to start from the problem not from the solution. New initiatives, including spin-off, fail because their offer (a product, a service, a license) is not designed for the customers. Every customer has a problem; every problem has a solution. Vice versa, not every solution has a problem, not every problem has a customer. Brainstorm and identify the problem (forget the solution) focus on the problem, identify a common definition.

Early Adopters

To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to “early majority”. Innovators are the ones that “use” the “alfa” version (2,5%, often the industrial partner in an R&D project); early adopters are the customers ready to “use” the “beta” version (13,5%). Next step is to reach the “early majority” (34%). New initiatives fail before reaching out the early majority and this is connected with the capability to reach early adopters.

Identify the “customers”, who will pay, focus on the riskier ones and describe them in the most specific way. Why that customer has that problem is the way to select the assumptions (how they deal with the

problem, what are they looking for). Focus on the most important one, the one that, if not validated, will make everything fall down.

UVP

The Unique Value Proposition, or Unique Selling Proposition (USP), is a clear statement describing the benefits of the novel offer, how you solve your customer's needs and what distinguishes you from the competition. It is clearly related to the customers' needs and how their problems are solved so far.

In defining the UVP you do not want a "point of parity" when your features are similar to the ones of the competitors". What counts are the points of difference, what you do, that the others do not and that matters to the customers. You do not want to be better than your competitors, you want to be better for your customers. Do not imitate/mirror competitors. Keep in mind customers, not competitors.

10.2 How to approach the Lean Canvas

For preparing the Exploitation Plan (your business plan) of a R&D result it is useful to use the Lean Canvas. The Lean Canvas is an adaptation of Business Model Canvas by Alexander Osterwalder which Ash Maurya¹⁰ created in the Lean Startup spirit (Fast, Concise and Effective startup). Lean focuses on problems, solutions, key metrics and competitive advantages.

The canvas is a good tool to focus on the exploitation model and start collecting information for the exploitation plan. Among the different type of canvas, the lean business model canvas, by Ash Maurya, is the most suited for R&D projects. It is a powerful tool to be used by the partners to further develop the characterization of their KERs, prepare the materials to be discussed at consortium meetings and draft the exploitation/business plan for a KER.

The lean canvas helps to fine-tune and develop the exploitation strategy for a KER having in mind four questions:

- 1) Who is "my customer"?
- 2) What is "her/his" problem?
- 3) How does "She/he" solve the problem now?
- 4) Is our solution more efficient than the current one?

10.3 How to fill out a Lean Canvas for a KER

The end goal of the lean canvas is that an unknowing third-party will be able to review it from start to end and, and through this revision, understand what your KER is about. They will understand the problem in focus, the customer groups that you target, the solution you provide, how it differentiates from competitors, how you intend to create value, etc. Due to this, it is very important to avoid the use of highly technical language, abbreviations etc. They can result in third parties not understanding the nature of your KER.

Below a description of the main steps to draft the canvas.

- 1) **PROBLEM** - find 3 main problems you are addressing.

¹⁰ For more information about this canvas, please refer to the blogpost explaining Lean Canvas and the ideas behind it on his website: <http://www.ashmaurya.com/2012/02/why-lean-canvas/>

Explain: **What** is the problem and **why** is it a problem.

Additionally, attempt to add numbers or quantifiable measures that will clearly highlight the scale of the problem.

Describe EXISTING ALTERNATIVES - Find out how they are solving the problem now (today's alternatives)

- 2) **CUSTOMER SEGMENT** - identify who has the problem, define target customers (do not confuse with users).

Be clear on explaining the geographic location of your customers, the industry in which they are operating in, as well as connecting them to the problem in question.

EARLY ADOPTERS - find a small niche that is having the biggest problem, the ones that suffer the most (early adopters).

These will be the first customers of your solution; Be sure to find as much information about these as possible. Explain the geographic location, connect them to the problem, explain exactly why these will be the first adopters, clarify your current connection to them etc.

- 3) **UNIQUE VALUE PROPOSITION**

Define your UVP based on the today's alternative, what makes your product/service more efficient for your customers, a single and compelling sentence that makes everybody understand why you are far better (your features need to be compelling to the customers' needs, otherwise are irrelevant to clients).

Ensure that you clearly define how you differentiate from alternative solutions, and why the customer will come to you; Explain the **uniqueness** of your solution.

Provide facts and data, explaining the performance of your product compared to alternative solutions (efficiency increase of 20%, decreased energy consumption of 10%, 30% fewer development costs etc.).

- 4) **SOLUTION** – outline the main features of your solution.

When your features are similar of the ones of the competitors, this is an equality. What matters are the points of difference! What you do, that the others do not do and are what matters to the clients.

Be sure to explain the format of your solution (is it a machine, an equipment, a software, a service, a process, etc.), what it does, and how it does it.

- 5) **UNFAIR ADVANTAGE** – what is it that gives you an advantage in front of the competition? Something that can't be easily copied or bought.

This could be IPR, being first movers on new technology that takes years to develop etc. Be sure to explain, **why** the listed points provide you with an advantage. It can be difficult for third parties to understand if they do not have a wide array of knowledge regarding your industry.

- 6) **CHANNELS** – How will you reach your customers?

Be sure to investigate whether the chosen channels are suitable for your choice of customers and consider whether they will be enough to establish the needed reputation on the market.

- 7) **REVENUE STREAMS**

Which will be the main revenue streams when the solution is ready for the market. Explain how each of them will generate revenue and how much you expect to generate from each stream.

Estimate revenues for seed stage after 6 months and after 3 years. Quantify amounts and prices by detailing, for example, the expected number of services provided and paid, number of licenses sold at which prices etc.

- 8) **KEY METRICS** – key activities you will measure to track the success (e.g. units sold, users registered, retaining users, paying customers, number of complaints ...)

- 9) **COST STRUCTURE** – which will be the main costs when the solution is ready for the market (e.g. customer acquisition costs, distribution costs, hosting, people etc). As with revenues, estimate the total costs issued after 6 months and 3 years along with the estimated cost of each “cost-entity”. This will connect your revenues to your costs.

After you finish the exercise, test your hypothesis “out the lab”, with at least 2 to 3 real potential customers.

Validate the following assumptions:

- Are the problems you assume really the ones? Is your solution to solving their problem?
- Are the features your solution is offering the ones the market needs and looks for?
- Are the explanations provided in the canvas enough to provide the customer with an understanding of your project?

Write down the feedbacks and update, revise, iterate the Canvas accordingly.

Lean Canvas by Ash Maurya

<p>Problem 1) Top 3 problems</p> <p>His main problem Which job has to accomplish</p> <p>What and why?</p> <p>4) Existing alternatives to address the same problems</p>	<p>Solutions 6) Top 3 features Based on the VP (why it is better than others) Use MVP to test assumptions</p> <p>Remember: the first sentence should clarify what it does, how it does it.</p>	<p>Unique Value proposition 5) Why you are different and worth buying (How you help customer doing his job, accomplish his mission Improve his position better than others. Provide</p> <p>Explain how you differentiate from alternative solutions and thus the uniqueness of your solution. Provide numbers to the performance of your solutions (see earlier explanation).</p>	<p>Unfair Advantage 7) Can it be easily copied or brought? What is the customer retaining costs? Acquisition costs Switching costs</p> <p>See the earlier explanation for clarification.</p>	<p>Customer segment 2) Who are they?</p> <p>Distinguish between users and customers (customers buy, users “use”) Split into vertical segments Pick the strongest customer segment</p> <p>Remember geographic location, Industry and connection to the problem.</p> <p>3) Early adopters</p> <p>Remember geographic location, Industry and connection to problem. + why are they early adopters? What is your relation to these etc.</p>
	<p>Key Metrics 9) Key aspects/activities you need to measure for a feedback</p>		<p>Channels 8) How you contact your customers/early adopters, How you deliver value How you promote value</p>	
<p>Cost structure 11) Prototyping HR costs, Eng. costs, MFG costs, marketing costs etc. Estimate costs for each “cost-entity” Estimate costs after seed stage 6 months and 3 years.</p>		<p>Revenue Streams 10) The different revenue streams How each stream generates revenue Estimation of how much each stream will generate Estimation of revenue at seed stage 6 months and 3 years.</p>		

11. Annex 4: Commercialisation options and examples of contracts

11.1 Licensing

Exclusive:

Only the licensee can use the licensed IP or technology (the licensor cannot use or license it);

Sole:

The licensor agrees not to grant any additional licenses but retains the right to make use of the licensed IP.

Non-Exclusive License:

The licensee and the licensor can both use the licensed intellectual property or technology. The licensor is also allowed to negotiate further non-exclusive licenses with other companies.

11.2 Franchising

While on the one hand, franchising helps franchisors to expand their business with the need for less investment, on the other hand, it enables franchisees to enter into a market more easily since the business is based on an established brand and/or on a proven business model. Franchising means less risk and low costs for both parties with higher chances of surviving within the first years of business.

In Europe, the regulation of franchising is not harmonized. Also, in most EU Member States there are no independent codes establishing all the rules for this particular partnership. However, this sector has the particularity of being self-regulated in the EU through the European Code of Ethics for Franchising establishing a set of guidelines and principles for both franchisors and franchisees. Therefore, it is important for potential franchisors and franchisees to get to know the requirements that they must meet under their national law and become familiar with the European Code of Ethics for Franchising.

Due diligence: potential franchisees should carry out a due diligence to detect potential risks, which may arise during the franchise. Such an audit may include verification of the related IP, financial and business information about the franchisor, sufficiency of the goods/services, training and assistance to be provided by the franchisor, etc.

11.3 Joint ventures (JVs)

JVs are business alliances of two or more independent organisations (ventures) to undertake a specific project or achieve a certain goal by sharing risks. IP has an important role in the creation of such collaborations, since venture bring their own intellectual assets for the success of a JV and they should agree on their initial contributions, responsibilities and obligations within the alliance as set out in JV agreements.

Advantages

- Gives opportunity to exploit and share IP assets with reduced financial investment.
- Allows companies to access new markets by sharing risks.
- Creates possibilities to leverage existing technologies and patents developed by each venture.
- Provides companies with the chances to develop new IP with less investment.
- Allows utilization of unused IP assets.

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Disadvantages

- There may be an imbalance in expertise, intellectual assets and investment brought into the JV by the ventures.
- Coping with different management cultures in IP management may be difficult.

Key terms in the JV agreements: Background, foreground and access rights

In JVs, the ventures bring into the project their previously owned IP assets - which are known as background - and they should decide on the access rights to their background for other ventures. Furthermore, the project implementation will also generate IP, which is referred to as IP foreground or results. The ownership of foreground/results and determination of access rights should be clarified before entering a JV partnership together with compensation of IP registration and/or maintenance costs.

11.4 Spin-off (newco)

A Spin-off (or newco) is a separate legal entity created by a parent organisation (PO) to bring its IP assets into the market. It is generally an efficient solution for the parent organisations, who may not be fully capable of commercialization of their own IP assets, such as for universities and research institutions. Spin-offs are an important means of technology transfer since they are acting as an intermediary between the research environment and industries while putting research results into the commercial market with a marketable product. Moreover, through spin-offs, research organisations can focus on their main task of “research” instead of “marketing”, which is the main task of commercial companies (spin-off).

A spin-off company can be formed by a person external to the PO for the exploitation of the IP asset created by the parent organisation. In this type of spin-off, as the new company is owned by an external professional, the IP assets to be exploited by the new company (spin-off) are generally transferred by licensing, to allow the PO to keep control over them. The external professionals can also be venture capitalists, who foresee a market potential in commercialisation of IP.

Conducting due diligence

A due diligence study allows the investors to ascertain the ownership of the IP to be transferred and any obligations affecting the transfer.

11.5 Material Transfer Agreements (MTAs)

MTAs are used when exchanging tangible materials between parties to secure the IP rights of the material provider against possible disclosure by the recipient party. The material exchanged can take many forms, such as product samples, prototypes, software, chemical compounds or biological materials etc. Generally, such a transfer occurs during:

- feasibility studies to check whether the material is compatible with the recipient facilities,
- research activities on the material in R&D partnerships,
- provision of samples or prototypes to future clients for trials, etc.

12. Annex 5: Follow-up funding opportunities

12.1 European Investment Project Portal (EIPP)

The European Investment Project Portal (EIPP) is the EU matchmaking portal, enabling EU-based project promoters – public or private – to reach potential investors worldwide. The Portal is a free service offered by the European Commission and is part of the Investment Plan for Europe, which aims to mobilise investment, boost economic growth and create jobs across the EU.

For more information check here: <https://ec.europa.eu/investeuportal/desktop/en/index.html>

12.2 The InvestEU Programme

The InvestEU Programme builds on the successful model of the Investment Plan for Europe, the Juncker Plan. It will bring together, under one roof, the European Fund for Strategic Investments and 13 other EU financial instruments. Triggering more than €372 billion in additional investment over the period 2021-27, the InvestEU Programme aims to give an additional boost to sustainable investment, innovation and job creation in Europe.

The Programme consists of:

- The InvestEU Fund which aims to mobilise more than €372 billion of public and private investment through an EU budget guarantee of €26.2 billion that backs the investment of implementing partners such as the European Investment Bank (EIB) Group and other financial institutions.
- The InvestEU Advisory Hub which provides technical support and assistance to help with the preparation, development, structuring and implementation of investment projects, including capacity building.
- The InvestEU Portal which brings together investors and project promoters on a single EU-wide platform, by providing an easily accessible and user-friendly database of investment opportunities available within the EU.

https://europa.eu/investeu/home_en

12.3 CASCADING GRANTS

Cascade Funding, also known as Financial Support for Third Parties (FSTP), is a European Commission mechanism to distribute public funding in order to assist beneficiaries, such as start-ups, scale-ups, SME and/or mid-caps, in the uptake or development of digital innovation.

This funding method aims at simplifying the administrative procedures, creating a light, SME-friendly application scheme, by allowing that some EU-funded projects may issue, in turn, open calls for further funding.

This scheme is based on the model of Erasmus students and was first introduced by the European Commission in Horizon 2020, the Framework Programme for Research and Innovation (2014-2020). It will be used also in the new Horizon Europe Framework Programme for Research and Innovation (2021-2027).

More information and open calls available here: <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/competitive-calls>

12.4 Access to finance in Europe

University technology transfer offices (UTTOs) often perform the function of transferring technology and commercialising innovations emerging from the University sector to the market place.

For more information check here:

http://europa.eu/youreurope/business/funding-grants/access-to-finance/index_en.htm

This site can help to apply for loans and venture capital supported by the European Union.

Click on your country to locate banks or venture capital funds that provide finance supported by the EU.

12.5 Ad hoc grants for EIC Pathfinder and EIC Transition grant holders

The grant holders of EIC Pathfinder projects (including grants resulting from certain EIC pilot Pathfinder, FET-Open and FET-Proactive calls) and of EIC Transition projects are eligible to receive ad hoc grants with fixed amounts of up to EUR 50 000, as specified in the relevant call sections of the EIC work programme.

In line with Article 47(3)(b) of the Horizon Europe Regulation, the ad hoc grants are not subject to any call. They reflect the necessity and hence the possibility for the EIC to proactively support, at any stage of a project implementation, the assessment of any potentially innovative lead stemming from a EIC Pathfinder project, or reinforce the coordination and management of a Portfolio where needed.

These ad hoc grants fund either complementary activities to explore potential pathways to commercialisation (for EIC Pathfinder grant holders) or portfolio activities (for EIC Pathfinder and EIC Transition grant holders).

These ad hoc grants do not fund research or activities that were already foreseen in the original project. A maximum of three ad hoc grants can be awarded for each EIC Pathfinder project and more than three may be awarded in exceptional and duly justified cases. A maximum of one ad hoc grant can be awarded for each EIC Transition project. Any such ad hoc grant can be awarded to an individual grant holder or a group of grant holders. EIC grant holders, after discussion with a EIC Programme Manager or following a project review, can apply for such an ad hoc grant.

12.6 Fast Track scheme to apply for the EIC Accelerator

The 'Fast Track' scheme is a novelty under Horizon Europe and a specific process applicable to the EIC Accelerator. It provides for a specific treatment of applications that result from existing Horizon Europe or Horizon 2020 projects.

Under the Fast Track scheme, applicants do not apply directly to the EIC Accelerator call. Instead, a project review is carried out by the responsible funding body to assess the innovation or market deployment potential of an existing project, to decide whether the project is suitable for support under the EIC Accelerator.

The responsible funding body can submit the outcome of the projects review to the EIC Accelerator, if the project review concludes that the following conditions are met:

- the proposal meets the two first criteria of the EIC Accelerator (excellence and impact),
- there is no duplication of funding of activities to be supported under the EIC Accelerator with the existing grant, and
- the applicant meets the eligibility criteria for the EIC Accelerator.

The applicant will then be invited to prepare a full application for the EIC Accelerator to one of the cut-off dates within the next 12 months following initial review. They will receive support through the EIC artificial intelligence-based IT platform and coaching.

12.7 EIC Transition

The EIC Transition funding scheme builds on promising research results to demonstrate and mature the technology and develop business plans.

EIC Transition funds innovation activities that go beyond the experimental proof of principle in laboratory to supports both:

- the maturation and validation of your novel technology in the lab and in relevant application environments
- the development of a business case and (business) model towards the innovation's future commercialisation.

Grants of up to €2.5million and more are available to validate and demonstrate technology in application-relevant environment and develop market readiness.

EIC Transition has open funding for projects in any field of science or technology as well as challenge driven funding on specific strategic fields.

Single applicants (SMEs, spin-offs, start-ups, research organisations, universities) or small consortia (max 5 partners) may apply.

https://eic.ec.europa.eu/eic-funding-opportunities/eic-transition_en

12.8 EIC Accelerator

The EIC Accelerator supports individual Small and Medium Enterprises (SMEs), in particular Startups and spinout companies to develop and scaleup game-changing innovations. In some cases, small mid-caps (up to 500 employees) are supported.

The EIC Accelerator provides substantial financial support with:

- grant funding (non-dilutive) of up to €2.5 million for innovation development costs,
- investments (direct equity investments) of up to €15 million managed by the EIC Fund for scale up and other relevant costs.

In addition, EIC selected companies receive coaching, mentoring, access to investors and corporates, and many other opportunities as part of the EIC community.

Applications can be submitted at any time through the EIC platform. Applicants have to submit a video pitch, a slide deck and respond to a short set of questions about their innovation and their team.

Applications that meet all the criteria at the remote evaluation stage and are assessed positively by the EIC jury but not recommended for funding, will be awarded a Seal of Excellence to help them secure funding from other sources. Companies with a Seal of Excellence can also get support from EIC Business Acceleration Services.

https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator_en

12.9 EIC Prizes

The EIC Prizes are awarded to whoever can most effectively meet a pre-defined challenge, without prescribing how that challenge should be solved. These will boost breakthrough innovation across sectors by fostering cutting-edge solutions which bring major benefits to citizens and society.

In 2021 the following challenges are defined:

- EU Prize for Women Innovators (3 prizes of €100k, 1 prize for 'Women Innovators' main category, 1 prize of €50k for 'Rising Innovator' category)
- The European Capital of Innovation Awards (iCapital) (total budget €1,8 million, European Capital of Innovation winner €1 million)
- The European Innovation Procurement Awards (total budget €300k)
- The European Social Innovation Competition (total budget €200k)

12.10 EUREKA and Eurostars funding

Eurostars supports international innovative projects led by research and development- performing small- and medium-sized enterprises (R&D-performing SMEs). With its bottom-up approach, Eurostars supports the development of rapidly marketable innovative products, processes and services that help improve the daily lives of people around the world. Eurostars has been carefully developed to meet the specific needs of SMEs. It is an ideal first step in international cooperation, enabling small businesses to combine and share expertise and benefit from working beyond national borders.

Eurostars applies a decentralized funding procedure; participants do not receive funding directly from the EUREKA Secretariat or the EU. All funding to participants in approved projects is managed by their respective funding body and according to their national funding rules and procedures. These rules and procedures are dependent on the member countries involved in the project. Project partners are strongly advised to contact their National Project Coordinators (NPCs) and browse on the Eurostars in each country. <https://www.eurostars-eureka.eu/>

12.11 Entrepreneurship and Small and medium-sized enterprises (SMEs)

The dedicated section on EU portal offers a wide focus dedicated to information on possible EU funding opportunities for SMEs and in general on what EU does for SMEs: <https://ec.europa.eu/growth/smes>

Furthermore, to know if a programme is relevant to your particular case, we strongly suggest that you contact your local Enterprise Europe Network partner, who can give you one-to-one advice and support in applying for EU funding.

Contact details of the Enterprise Europe Network members: <http://een.ec.europa.eu/about/branches/>

12.12 Seal of Excellence – EuroQuity Initiative

This initiative is dedicated to those companies who have received the Seal of Excellence from the EU Horizon 2020 SME Instrument Programme. Matchmaking activities and support services will be provided in order to facilitate

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their access to risk finance and enhance their visibility, through a specific on-line community based on the EuroQuity platform.

Each “Seal of Excellence” SME will gain in this way instant visibility among different actors: the main EU business angels’ networks, VCs, corporate investors, and new business partners, at the same time investors will be guarantee on the quality of SMEs’ projects and their innovation potential. Free services will also be offered to these companies allowing them to grow on a European level:

- Visibility and access to European investors
- Possibility to pitch online in front of investors during e-pitch sessions
- Connections with National Contact Points of your Country

More information available here <https://www.euroquity.com/fr/community/Access4SMEs--Seal-of-Excellence-5bb56459-4f88-4d3c-a2eb-8e4b6e865ea5/>

12.13 Contracts and grants - access to business opportunities

Several different contracts and grants are regularly made available for companies or organisations who want to work with Directorate General (DG) for Internal Market, Industry, Entrepreneurship, and SMEs or apply for funding.

In the framework of public procurement contracts, DG Internal Market, Industry, Entrepreneurship, and SMEs regularly organizes calls for tenders. Calls for tenders are special procedures to generate competing offers from different businesses looking to obtain works, supply, or service contracts.

Those tenders/calls also give an insight in competitors’ activities as well as ideas for partnerships and stakeholders. Furthermore, there are possibilities for winning contracts.

12.14 Tenders Electronic Daily

TED provides free access to business opportunities from the European Union, the European Economic Area and beyond.

Every day, from Tuesday to Saturday, a further 2,000 public procurement notices are published on TED.

You can browse, search and sort procurement notices by country, region, business sector and more.

Information about every procurement document is published in the 24 official EU languages. All notices from the EU's institutions are published in full in these languages. For more information check here:

<http://ted.europa.eu/TED/search/search.do>

12.15 Innovaccess - Intellectual Property Portal

Innovaccess aims to enhance Intellectual Property (IP) support services to Small and Medium-sized Enterprises (SMEs) to turn their Intellectual capital into commercial values and competitiveness.

The portal helps to protect IP rights and to understand IP security rules. For more information check here:

<http://www.innovaccess.eu/>

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12.16 European Green Deal

Background

On 11 December 2019, the Commission presented the European Green Deal, with the ambition of becoming the first climate-neutral bloc in the world by 2050. Europe's transition to a sustainable economy means significant investment efforts across all sectors: reaching the current 2030 climate and energy targets will require additional investments of €260 billion a year by 2030.

The success of the European Green Deal Investment Plan will depend on the engagement of all actors involved. It is vital that Member States and the European Parliament maintain the high ambition of the Commission proposal during the negotiations on the upcoming financial framework.

A swift adoption of the proposal for a Just Transition Fund Regulation will be crucial.

The Commission will closely monitor and evaluate the progress on this transition path. As part of these efforts, every year the Commission will hold a Sustainable Investment Summit, involving all relevant stakeholders, and it will continue to work for promoting and financing the transition. The Commission invites the investment community to make full use of the enabling regulatory conditions and ever-growing needs for sustainable investments, and authorities to take an active role in identifying and promoting such investments.

The Just Transition Mechanism

The Just Transition Mechanism (JTM) is a key tool to ensure that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind. While all regions will require funding and the European Green Deal Investment Plan caters for that, the Mechanism provides targeted support to help mobilise at least €100 billion over the period 2021-2027 in the most affected regions, to alleviate the socio-economic impact of the transition. The Mechanism will create the necessary investment to help workers and communities which rely on the fossil fuel value chain. It will come in addition to the substantial contribution of the EU's budget through all instruments directly relevant to the transition.

The Just Transition Mechanism will consist of three main sources of financing:

- 1) **A Just Transition Fund**, which will receive €7.5 billion of fresh EU funds, coming on top of the Commission's proposal for the next long-term EU budget. In order to tap into their share of the Fund, Member States will, in dialogue with the Commission, have to identify the eligible territories through dedicated territorial just transition plans. They will also have to commit to match each euro from the Just Transition Fund with money from the European Regional Development Fund and the European Social Fund Plus and provide additional national resources. Taken together, this will provide between €30 and €50 billion of funding, which will mobilise even more investments. **The Fund will primarily provide grants to regions. It will, for example, support workers to develop skills and competences for the job market of the future and help SMEs, start-ups and incubators to create new economic opportunities in these regions. It will also support investments in the clean energy transition, for example in energy efficiency.**
- 2) A dedicated **just transition scheme under InvestEU** to mobilise up to €45 billion of investments. It will seek to attract private investments, including in sustainable energy and transport that benefit those regions and help their economies find new sources of growth.

- 3) **A public sector loan facility with the European Investment Bank** backed by the EU budget to mobilise between €25 and €30 billion of investments. It will be used for loans to the public sector, for instance for investments in district heating networks and renovation of buildings.

The Commission will come with a legislative proposal to set this up in March 2020. **The Just Transition Mechanism is about more than funding: relying on a Just Transition Platform, the Commission will be providing technical assistance to Member States and investors** and make sure the affected communities, local authorities, social partners and non-governmental organisations are involved. **The Just Transition Mechanism will include a strong governance framework centred on territorial just transition plans.**

More information available here https://ec.europa.eu/info/research-and-innovation/strategy/european-green-deal/call_en

12.17 European Institute of Technology and Innovation

Under EIT's Knowledge and Innovation Communities (KICs) are partnerships that bring together businesses, research centers and universities. Through the KICs, EIT strengthen cooperation among businesses (including SMEs), higher education institutions and research organisations, form dynamic pan-European partnerships, and create favourable environments for creative thought processes and innovations to flourish. These partnerships are called Innovation Communities and each is dedicated to finding solutions to a specific global challenge, from climate change and sustainable energy to healthy living and food.

There are 8 Innovation Communities and each focuses on a different societal challenge:

- EIT Climate-KIC
- EIT Food
- EIT Health
- EIT Digital
- EIT Manufacturing
- EIT Innoenergy
- EIT Urban Mobility
- EIT Raw Materials

12.18 LIFE Programme

LIFE programme is the EU's funding instrument for the environment and climate action. The programme is divided into two sub-programmes, one for environment (representing 75% of the overall financial envelope) and one for climate action (representing 25% of the envelope).

- The programme includes large scale demos/pilots with focus on Environment and Climate Action; with clear impact aims during the project; and clear environmental/climate problem baseline (de-risk).
- Projects start at TRL 6-7 aiming up to 9 to bridge valley of death (income allowed – end-user important).
- The funding programme uses bottom-up approach (call-topics are broad) allowing proposers to define their solutions needed for their environmental context/problem.

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- Focus is on making Environmental impacts in the EU.
- Even proposals from single EU beneficiaries are allowed.
- Proposers can apply in their own language.
- There is no set proposal budget limit.

12.19 Dealflow

Dealflow is sponsored by the European Commission to support EU-funded innovations with fundraising, venture building and networking. It supports EU-funded projects from H2020.

Three typologies of support are foreseen:

- Venture-building: giving tailored support on challenging business topics (e.g. sales strategy, market sizing & research, organizational structure, and pitching);
- Fundraising (preparation): preparing investor materials and providing access to investor networks;
- Networking: introductions to industry experts, potential clients and new partners through their matchmaking platform, community & events.

<https://dealflow.eu/>

12.20 Accelerators and Incubators

If you have the intention to create a startup/spinoff, you are suggested to check Accelerators/Incubators in your area.

Here below there is a non-exhaustive list of international and pan-European Accelerators/Incubators networks:

- Startup Bootcamp: founded in 2010, Startup Bootcamp is a well-known global network of startup accelerators that offer an intense 3-month program. After Selection Days, 10 startups join diverse accelerator programs (Amsterdam, Istanbul, London, Barcelona, Copenhagen, Berlin, Eindhoven and Haifa) where they receive mentoring, free workspace, great networking opportunities, and pitching opportunities to over 400 investors on Investor Demo Day.
- Startup Weekend: Startup Weekend brings together developers, designers, product managers, aspiring entrepreneurs, marketers and tech enthusiasts to launch a startup in 54 hours. These weekend-long events are focused on learning through creating, building professional relations and networking.
- StartupBus Europe: is a unique project founded in 2010. It is a hackathon for European tech entrepreneurs (“buspreneurs”) where they compete over the course of a 3-day bus ride on the way to Vienna.
- IMPACT Accelerator: (Internet Mobile Projects Accelerator) offers premium acceleration services for European mobile start-ups and small and medium-sized business for a period of six months. It operates in several locations in Spain and Italy and given it is one of the 16 consortia selected by the European Commission within the framework of the Seventh Framework Programme, the selected start-ups in the extended phase can count on the Buongiorno Headquarters in 14 countries.
- Wayra: launched in 2011, Wayra is a startup accelerator financially backed by Telefonica, one of the biggest telecommunication companies in the world.

Here below a non-exhaustive list of Accelerators/Incubators in Member States:

- Austria: i5invest, INiTS, Up to Eleven, Kubator
- Belgium: Telenet Idealabs, NEST’Up

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- Bulgaria: 3Challenge, Eleven, LAUNCHub
- Croatia: Zip
- Czech Republic: StarCube, Startup Yard
- Denmark: Accelerace
- Estonia: GameFounders, Garage48, Startup Wise Guys
- Finland: Startup Sauna
- France: TheFamily, Numa (Le Camping)
- Greece: OpenFund
- Germany: Axel Springer Plug & Play, hub:raum
- Hungary: iCatapult
- Italy: H-Farm, LuissEnLabs
- The Netherlands: Rockstart
- Norway: betaFACTORY
- Lithuania: StartupHighway
- Portugal: The Lisbon Challenge
- Poland: Gamma Rebels
- Romania: SeedForTech, Innovations,
- Spain: SeedRocket, Tetuan Valley

12.21 Innovfin

InnovFin – EU Finance for Innovators is a joint initiative launched by the European Investment Bank Group (EIB and EIF) in cooperation with the European Commission under Horizon 2020. InnovFin aims to facilitate and accelerate access to finance for innovative businesses and other innovative entities in Europe.

Innovfin makes available specific instruments for different typologies of financing.

Start-up and SME financing

- InnovFin Equity provides equity investments and co-investments to or alongside funds focusing on early-stage financing of enterprises operating in innovative sectors covered by Horizon 2020, located or active in the EU or Horizon 2020 Associated Countries. InnovFin Equity is available via four products: InnovFin Technology Transfer, InnovFin Business Angels, InnovFin Venture Capital, InnovFin Fund-of-Funds.
- InnovFin Guarantee SME guarantee provides guarantees and counter-guarantees on debt financing between EUR 25 000 and EUR 7.5 million, in order to improve access to loan finance for innovative small and medium-sized enterprises (SMEs) and small mid-caps (up to 499 employees).

Corporate finance

- InnovFin Emerging Innovators offers a range of tailored products which provide financing in support of R&I by small, medium-sized and large companies and the promoters of research infrastructure. It provides loans or guarantees directly or indirectly via financial intermediaries.
- InnovFin MidCap Guarantee provides guarantees and counter-guarantees on debt financing of up to EUR 50 million, in order to improve access to finance for innovative midcaps (up to 3 000 employees) which are not eligible under the InnovFin SME Guarantee.
- InnovFin Corporate Research Equity (in collaboration with EFSI) increases the supply of equity-type financing under the European Fund for Strategic Investments (EFSI) to large research and innovation (R&I)

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programmes and to innovative large mid-caps and small or medium-sized enterprises (SME). It addresses the market gap for large equity-type investment in the form of contingent loans, in particular with mid- to long-term repayments profile that are directly linked to product development cycles.

Science

- InnovFin Science (for research institutions and universities) aims at supporting research and innovation (R&I) investments by public or private research institutes/organisations and universities, including the financing of buildings and other infrastructure directly related to R&I activity. It provide different forms of debt or equity-type financing.

Thematic financing

- InnovFin Energy Demo Projects provides loans, loan guarantees or equity-type financing to innovative demonstration projects in the fields of energy system transformation, including but not limited to renewable energy technologies, smart energy systems, energy storage, carbon capture and storage or carbon capture and use, helping them to bridge the gap from demonstration to commercialisation. The product is deployed directly by the EIB.
- InnovFin Infectious Diseases provides financial products ranging from standard debt to equity-type financing for amounts typically between EUR 7.5 million and EUR 75 million, to innovative players active in developing innovative vaccines, drugs, medical and diagnostic devices or novel research infrastructures for combatting infectious diseases. The product is being made available directly through the European Investment Bank.

12.22 Startup Europe

STARTUP Europe is an initiative of the European Commission to connect high tech startups, scale-ups, investors, accelerators, corporate networks, universities and the media. The 4 main objectives of Startup Europe are to:

- Connect people
- Connect local start up ecosystems
- Help start-ups soft land in other market
- Celebrate entrepreneurs' success

In order to help build a strong European ecosystem where startups can thrive, Startup Europe is empowering 7 projects, funded under Horizon 2020, that are connecting local ecosystems across Europe. These projects will connect deep tech startup ecosystems and support cross-border activities for startups and scale-ups. The cross-border activities include the following: connecting tech entrepreneurs with potential investors, business partners, accessing skills, and services helping startups soft land in new international markets.

- Scaleup4Europe: The Scaleup Labs will provide deep tech start-ups with a structured open innovation approach in which they can achieve cross-border market success, through first successful collaborations with corporate customers, investors and/or public institutions.
- B-HUB FOR EUROPE: Will target deep tech vertical startups in the blockchain domain. The initiative is aimed at: discovering high-potential innovations, shaping suited proof of concepts and business models, providing specialised acceleration services to overcome current market barriers and assist the go-to-market process, unlocking new market channels with potential private/public customers, scaling up innovative businesses across five startups ecosystems in Europe: IT (Rome), FR (Paris), DE (Berlin), LT (Vilnius) and RO (Cluj-Napoca).

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- The Scale-up Champions: Project builds on the premise of equalising opportunities of scaling up for startups across five countries represented through the partners of the consortium: Estonia, Lithuania, Poland, Denmark and Spain. Main activities targeting: corporate-startup collaboration, investment readiness and internationalization
- STARTUP 3: Will scout for top founding teams to identify (uptake) breakthrough innovations from deep tech verticals (i.e., built on tangible scientific discoveries or engineering/ technical advances). Then STARTUP3 will help them fine tune (upgrade) their technologies/ business models and align their value proposition to the actual market demand (the so-called Key Performance Areas – KPAs). Finally, STARTUP3 will bring together top deep tech startups/ SMEs and the most prominent corporate innovators – CVC arms, incubators and accelerators, and innovation labs (facilitated by clusters and digital innovations hubs – DIHs) with the aim of catalysing productive interaction (upscale).
- X-Europe: Brings together leading training, acceleration, events, and media companies from across Europe. Through the delivery of training, matchmaking & promotional services X-Europe will support 150 deeptech startups and help them to internationalize, grow across borders, and into developing frontiers.
- INNODEC - (Innovation Radar Data-based Identification & Commercialisation): Aims to close the gap between investors and research projects from both sides. On the one hand, this is achieved through placing investors/partners in contact with the research projects with the highest potential, and then on the other, to coach the projects on raising capital, identifying a business model and developing a sound go-to-market strategy. This approach will ensure scalability while simultaneously catering to the large diversity between projects and their needs.
- MediaMotorEurope: Will boost solutions that can address challenges. Its goal is to nurture high-potential European deep tech innovators, solving today's most prominent media industry challenges and support them in building the media solutions of tomorrow such as misinformation, accessibility, user interfaces and use of data. A large focus will be on deep tech solutions, such as AI and machine learning, and their potential application in the domain of media and creative industries.

12.23 INTERREG EUROPE

Interreg Europe can help in the following ways:

- **Financial support** – funding is available for interregional cooperation projects, which have the potential to lead to longer-term collaborations and partnerships
- **Expand your network** – meet new like-minded partners, stakeholders, and business colleagues across Europe.

The DG also gives the opportunity to organisations to get some grants through calls for proposals. These are invitations for suppliers to submit a proposal on a specific commodity or service. A grant or a subvention is a direct financial contribution from the European Commission to support a specific action or project of a non-commercial nature, to cover eligible costs directly incurred by the beneficiaries.

For more information check here: <http://www.interregeurope.eu/>

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www.horizonresultbooster.eu



Final Report
for
«CIRC-UITs»

Service pack: Support and guidance for
Intellectual Property Rights

Beneficiary projects: CIRC-UITs

Case ID: 101091490

Training delivered on 04.10.2024
Coaching delivered on 08.10.2024

Provided by:

MICHELE ELIO DE TULLIO



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1 Executive summary

This report summarises the process followed for the Horizon Results Booster Training and Coaching (T&C).

The two activities were conducted from remote (online).

It presents the T&C, the agendas of the days, the participants. It then introduces the terminology used, and the presentations used during the T&C.

Main outcomes achieved during the T&C are then illustrated as discussed and explained during the meeting. Finally, this report provides recommendations from the expert on how to follow up with the preparation of the Final Plan for Dissemination & Exploitation Strategy and Dissemination & Communication Strategy.

The Expert was appointed on July 4th, 2024.

On September 13th, 2024, a kick-off conference call with the Beneficiary was organised to discuss expectations, get a first insight on the state of the art, present the service and introduce preparatory activities, it was agreed to have T&C of two hours each in two different days.

The CIRC-UITs project is focused on demonstrate the improvement to the circularity of automotive and mass electronics sectors by reuse of semiconductors from different sources, as well as support the reuse & remanufacturing of semiconductors into new (high added-value) components and products in these sectors. More info on CIRC-UITs can be found on the following website:

<https://cordis.europa.eu/project/id/101091490>.

The Beneficiary specified that no preliminary activities or assessments on IPRs related to the analysis of the state of the art have been already performed.

The Beneficiary's expectation in the Training/Coaching is to get a deeper knowledge in this field of IPRs, so the state of the art can be better investigated, and the results of the research can be probably protected and exploited in exclusivity.

So, the Training was focused on trying to explain and present the Basics of IPRs – with special attention to Trademarks, Patents and Technology Transfer, describing the importance of patent and trademark searches, *i.e.*, not only of the extraction and collection of data – that can be made to some extent by the Beneficiary independently – but also of the interpretation of data.

The interpretation of data – that it is usually carried out by a qualified Patent Attorney or an Attorney-at-Law expert in the field – is very useful not only to collect and retrieve reliable data, but also in order to identify the “closest prior art”, studying and analyzing the claims of each single patent retrieved, identifying possible interferences with prior patents already published and valid, assessing the novelty and inventive step of an invention, studying the best approach for drafting the patent application, planning the best strategy to extend the protection internationally in a cost-effective way, etc.

A preliminary patent search on the relevant results of the project was offered to the Beneficiary as training on the use of free patent and trademark database, in order to show how to retrieve preliminary results independently.

All the above aspects were covered during the Training and the Coaching Sessions of October 4th and October 8th, 2024.

After the Training, all the presentations used during the session were sent to the beneficiaries in PDF format. From the Expert's perspective, some quick preliminary remarks that will be better detailed in the Recommendations section are provided below. Project Partners need to carefully consider the following remarks:

- a. During the Training, it emerged clearly that it is crucial to protect the IPR of the Beneficiaries, even assessing possible issues related to secrecy, disclosure of results of the research activity, dissemination of confidential information and co-ownership of IPRs.
- b. It was suggested to involve a qualified Patent and /or Trademark Attorney or an Attorney-at-Law expert in order to carry out proper patent and trademark searches and receive indications about the best patent and trademark strategy to protect the names of the projects, the results of the research and assess possible registrability of trademarks (i.e. novelty and distinctive capacity) and patentability of the invention (i.e. novelty and inventive step), with cost-effective solutions in terms of IPRs.

2 Introducing the Horizon Results Booster Training

2.1 The Training

The aim of this service is to strengthen the capacity of projects in using their research results enhancing partners' capacity to improve their exploitation strategy.

The Training was aimed at providing beneficiaries of basic information and knowledge about IPRs, with particular attention to the importance of preliminary searches, procedure for filing and prosecuting patent application with extended coverage, preliminary disseminations of information and negotiations in trade-secrets, technology transfer agreements and related exploitation of IPRs.

The Expert presented the main tools useful to carry out preliminary patent searches, i.e., Patentscope and Espacenet, as well as the two tools about patent classification: International Patent Classification (IPC) and Cooperative Patent Classification (CPC). Moreover, it was presented a case study, carrying out a basic search on the specific sector in which the project will operate and have an impact, in order to identify similar projects/technologies and know more about the closest prior art.

The following presentations were used:

2.1.1 Intro

Managing know-how and intangible assets through Intellectual Property Rights (IPR) is a fundamental part of the overall management of projects. IP questions may arise, specifically, with regard to the safeguard and protection of the intangible assets, their execution, and potential exploitation of their results. All these concepts were analysed as intro.

2.1.2 IP Functions

The second part of the PPT presentation highlighted the effective ways to safely disclose knowledge and ideas; the concept of ownership and, eventually, how to prove it; the best practices on how profiting from the commercial exploitation of the products as well as ways on how to prevent or discourage third parties from unauthorised uses.

2.1.3 Patents & Trademarks

The correct managing of patents and trademarks is crucial for a successful project. Therefore, the third part of the PPT presentation entailed the patent and trademarks legal framework. Above all, the conditions under which an invention can be granted a patent. Hints were also suggested on how to assess the state-of-the-art, which is fundamental for a positive evaluation of the project, in its initial stage. Finally, different patent filing

and granting procedures were subject of the analysis. Moreover, additional information on trademark searches, filing and prosecuting trademark applications, obtaining registrations and licensing trademarks were also part of the training session.

2.1.4 Technology Transfer & Trade Secrets

The fourth part of the PPT presentation was dedicated to the technology transfer processes and trade secrets legislative frameworks. The main aspects of national and international technology transfers were depicted. More specifically, subject of analysis were also the main contracts for concluding safe technology transfers. Trade secrets and confidential business information are also valuable assets for the development of the projects. Hence, the best ways to protect them were analysed. Finally, the presentation focussed on the trade secrets enforcement regime and its challenges. More particularly, the discussion concerned the definition of trade secrets and its consistency around the globe; exceptions were highlighted concerning the protection and defences against unlawful uses. The remedies (cessation, seizure, damages) were also described and found to be similar despite some countries' peculiarities. Those challenges were also taken into consideration.

2.1.5 Conclusions

The final chart presented some tips and tricks on how to be prepared for protecting the outcomes of the project in foreign markets, how to better manage and exploit the results of the research activities, also considering other parties' rights, and what are the main aspects to take care of when negotiating and concluding technology transfer agreements with third parties.

2.2 Agenda of the day

11,00 – 11,15, Introduction (Elio)

Welcome, presenting the Training agenda.

11,15 – 12,00, Basics of IPRs (Intro, IP Functions, Patents & Trademarks, Tech-Transfer & Trade Secrets, Conclusions (Elio)

Introducing the main elements connected to protection and exploitation of IPRs.

12,00 – 12,15, Q&A (Elio)

12,15 – 12,45 – Patent and Trademark searches and filing (Astrid)

Introducing the main elements connected to the filing of patent and trademark applications.

12,45 – 13,00, Wrap-up and Conclusions (Astrid)

Working to further develop, fine-tune and final remarks.

2.3 List of Participants

First name	Last name
Stephan	Harkema
Maarten	Bakker
Claudio	Travi
Chris	Klok
Philippe	Lopez
Renzo	Costa
Corne	Rentrop
Mattia	Calabresi
Matteo	Rubes
Lorenzo	Gandini
Laura	Pomo
Julien	van Damme
Bernd	Kopacek

3 Introducing the Horizon Results Booster Coaching

3.1 The Coaching

The Coaching was delivered on: October 8th, 2024.

The aim of this service is to prepare stakeholders on the EU funded support services and to inform them on how to better orient themselves throughout the various options. Therefore, the coaching provided a deep analysis of each of the services as well as scope, typologies, and modalities to access them. The first part of the webinar was focused on Patent issues. Since the application has been already published, it was possible to retrieve the relevant documents independently. The second part was focused on Legal issues, in particular on the possible partnership and co-ownership agreements in EU funded project between different beneficiaries (companies and partner institutions), related to the research results.

Hence, at the end of the presentations, the beneficiaries became aware of the best IPR strategies to put in practice. This was achieved also thanks to a tailored-made approach, which was given by the IPR experts during the Q&A sessions. During the Coaching session the Expert provided the Beneficiary with all information, documents and references related to IPR services publicly available at EU level - in particular, the projects EUIPO SME Fund 2024 and EUIPO Pro Bono, as well as the EU IPR Helpdesk and IPR Hub in connection with the protection and exploitation of IPRs.

For the purposes above, the following PPT presentations were used:

3.1.1 The EU funded support services

The European IPR Helpdesk, funded under the Horizon 2020 programme, supports at an EU level cross-border SMEs to manage, diffuse, and valorise their intangible assets, through various initiatives involving some relevant IP Organisation at regional level. Those initiative were analysed, including:

- a. *The Pro-Bono Service: The EUIPO pro bono hub entails a match between providers and SMEs for them to receive a free of charge intellectual property (IP) legal representation and advice. The service was introduced and explained by the IPR experts.*
- b. *The SME Fund of EUIPO (Ideas Powered)*

3.1.2 Wrap-up

The last part of the Coaching on October 8th, 2024, was dedicated to a wrap-up about the main topics presented during the Training and Coaching Sessions, the main sources of information about IPRs and possible EU funding programme available for SMEs and research projects in 2024 and subsequent years.

3.2 List of Participants

First name	Last name
Maarten	Bakker
Claudio	Travi
Matteo	Rubes
Karin	Saemann
Simonetta	Cota
Alexandra	Pehlken
Lorenzo	Gandini
Daniele	Perossa
Paolo	Rosa
Bernd	Kopacek

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Entry Level Consultation (ELC) – Final Report

for

Circular Integration of independent Reverse supply Chains
for the smart reUse of IndusTrially relevant
Semiconductors - CIRCUITS

101091490

Provided by:

MATTEO BOEMI

EYLUL AKSEKILI



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1 List of abbreviations

Abbreviation	Definition
BPD	Business plan development
BOM	Bill of Materials
CE	Circular Economy
CRM	Critical Raw Materials
DIY	Do it yourself
ECU	Electronic Control Unit
EOL	End-of-Life
EPR	Extended Producer Responsibility
ESP	Electronic Stability Program
HMI	Human Machine Interface
IP	Intellectual Property
IPR	Intellectual Property Rights
KER	Key Exploitable Result
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
SLCA	Social Life Cycle Assessment
TPMS	Tire Pressure Monitoring Sensor
WEEE	Waste from Electrical and Electronic Equipment

2 Executive summary

This report summarises the process followed for the ELC service delivered to CIRCUITS and the main outcomes achieved at the two ELC calls.

It presents the calls, the agendas of the calls, the participants, terminology used, and the main tools presented and exercised:

- Readiness Assessment tool;
- Service Roadmap.

The Mentors were appointed on 8.11.2024 and the Applicant(s) was/were contacted on 18.11.2024. The applicant(s) informed the Mentors that the two calls would have taken place on 28.11.2024 and 5.12.2024.

On 28.11.2024, the first call with Applicant(s) was organised to introduce the D&E ecosystem, align expectations with Booster services, assess Key Exploitable Results (KERs), and identify involved Research Teams. Any relevant documents, such as business or exploitation plans, were also requested. On the same day, the Mentors sent the Applicant all the info and the "Readiness Assessment" tool to be shared with Partners and filled.

On 5.12.2024, a second call with the Applicant was organised to review the "Readiness Assessment" tool, ensuring the Applicant's information accurately reflects their actual readiness. As an outcome of this call, the Service Roadmap was also finalised, outlining the appropriate Booster services to be provided.

2.1 Agenda of the First Call with Applicant(s) and Participants

24.11.2024

9:00 – 10:10, Introduction

Welcome, introduction on the D&E ecosystem and additional opportunities other than the Booster.

9:10 – 10:15, Expectation Alignment

Aligning on expectations about the support offered by the Booster services.

9:15 – 10:25, Identify the KERs to be supported

9:25 – 10:45, Wrap-up

Request further documents that could be useful for the delivery of the services.

Organisation	Name and Surname
SAT RESEARCH	Bernd Kopacek
POLIMI	Paolo Rosa

2.2 Agenda of the Second Call with Applicant(s) and Participants

5.12.2024

16:00 – 16:10, Ice breaking

Welcome, introduction the second call agenda. Introducing main elements to be discussed in the call.

16:10 – 16:30, Review the “Readiness Assessment” tool

Verify if information provided by the applicant(s) corresponds to their actual readiness level

16:30 – 16:40, Definition of the “Service Roadmap”

Propose and agree with participants on a Service Roadmap and the most suitable set of Booster services.

16:45 – 17:00, Wrap-up

Final remarks, guidance on next steps.

Organisation	Name and Surname
SAT RESEARCH	Bernd Kopacek
POLIMI	Paolo Rosa

3 Readiness Assessment

As a main output of this service, on the one hand, a readiness assessment was carried out evaluating the Applicant(s) and proposing the best Booster services, based on their readiness and needs. On the other hand, based on the previous readiness assessment, a Service Roadmap was developed detailing all the most suitable set of Booster services for the Project(s)/Organization(s) needs. In this chapter, the mentioned outputs are shown in detail.

3.1 Readiness Assessment Tool

What is the projects' stage of development?

- Early-stage (within the first 6-12 months)
- Middle (approaching mid - term review)
- Late stage (last 6 months)
- Closed

KER

KER Name/Description	Technology	Service	Policy	Standard	Infrastructure	Other (please specify)
Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics	X					
Digital Twin with advisory functions	X					
Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs		X				

KER Name/Description	TRL current	TRL at end of the project	Business/use model for the other results? (in case some results are not commercialized)	teams/partners that are interested in the exploitation	Activities planned (even after the end of the project) to secure use/adoption of the results
Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics	3	3/4	Processes, Prototypes, Skills and Knowledge	TRACXON, ALPHA, CRF, POLIMI, CONTINENTAL	ALPHA: Supply of suitable reversible (low-T) interconnect materials that are essential for repair activities CRF: Support of activities using test facilities of interior car parts POLIMI: Controlled COBOT removal of semiconductor components from IME parts TRACXON: Development and fabrication of IME and thermoforming parts. Upscaling systems are created to show market potential. Disassembly systems and protocols are created. TNO: Technology development for disassembly and repair of IME parts Prototype development, design-rules set up and Thermoform systems CONTI: Technology development for disassembly of HW component with 2 PCB technologies (JIVA and AT&S) on different automotive applications.
Digital Twin with advisory functions	3	5-6	Software, Data, Services, Design Recommendations, Educational Material	OFFIS, SUPSI, MARAS	SUPSI: The DT can connect with GRETA and assess the environmental impact. GRETA output is generated by SUPSI and is owned by SUPSI MARAS: If the recyclability is assessed, the data is provided by MARAS
Serious games aimed at both students and professionals to	4	7	Software, Products, Skills and Knowledge,	BESU, POLIMI, BOSCH, OFFIS	BOSCH: Delivery of scientific and technical content in relation to closed-loop processes based on pilot data on break control systems and

<p>raise awareness of the transition to a circular economy and to upskill employees for future CE jobs</p>			<p>Educational Material</p>		<p>required skill sets for CE job profiles</p> <p>OFFIS: Delivery of scientific and technical content about closed-loop processes based on in-house information and experience / Statistics and recycling numbers</p> <p>POLIMI: Delivery of data and information about circular economy business models</p> <p>CONTINENTAL: Delivery of scientific and technical content about closed-loop processes based on pilot data on tire pressure monitoring sensor and required skill sets for CE job profiles.</p>
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- Have you estimated their Technology Readiness Level¹ at the end of the project?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics: 3-4

Digital Twin with advisory functions: 5-6

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs: 7

- Can you provide your self-estimation of the current levels?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics: 3

Digital Twin with advisory functions: 3

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs: 4

¹ TRL1 Basic principles observed, TRL2 Technology concept formulated, TRL3 Experimental proof of concept, TRL4 Technology validated in lab, TRL5 Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies), TRL6 Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies), TRL7 System prototype demonstration in operational environment, TRL8 System complete and qualified, TRL9 Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space).

<https://horizoneuropencportal.eu/sites/default/files/2022-12/trl-assessment-tool-guide-final.pdf>

EXPLOITATION INTENTIONS AND ROADMAP

- Which is the use model for the other results? (in case some results are not commercialized).

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

- Use for further research
- License IP rights

Digital Twin with advisory functions

- Use for further research
- Spin-off activity

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs

- Use for further research
- Cooperation Agreement / Joint venture

- Who are the teams/partners that are interested in the exploitation of the results?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

The design-for-recycling principles applied to printed electronics and related topics were patented by TNO at Holst Centre and forms the basis for reparability. With a license to IP rights, commercialization may be possible. Implementation of this technology would require approximately 2-3 years.

Digital Twin with advisory functions

It is likely that 3-5 years after the project the product might be commercial.

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE Jobs

It is likely that 1-2 years after the project the product might be commercial.

- Which activities have you planned (even after the end of the project) to secure use/adoption of the results?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

The KER developed by TNO will be embedded in an individual exploitation performed by TRACXON, which is a TNO's spin-off dedicated to the production of reusable and recyclable IMEs. A business model has been developed to support TRACXON activities in the next years. Indeed, right now, IMEs market is not big enough to manage an economically sustainable circular business model centred on this kind of product. Nonetheless, TRACXON is aiming at being ready for when IMEs market will likely enlarge in the future, and the demand for more sustainable (i.e. repairable, and recyclable IMEs) will increase.

Digital Twin with advisory functions

In the context of CIRC-UITs project, OFFIS is developing a digital twin supporting product design. The mentioned KER is part of a digital toolbox and part of the related joint exploitation. Besides being part of the joint exploitation and the related business model described above, KERs developed by OFFIS will also be exploited to create a spin-off, providing digital tools supporting users in decision-making related to CRMs.

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE Jobs

AsBESU is developing within CIRC-UITs project serious games dedicated to educating and training stakeholders and people about circular economy practices. In particular, two different games are currently under development: a cards game and a web-based videogame. Since the value proposition and customer targets of the two games are slightly different, two separated business models have been developed for each of them.

INTELLECTUAL ASSET MANAGEMENT

KER Name/ Description	What about the IP related to the results? Is there a specific legal agreement in place? Legally speaking, who is the owner	activities planned (even after the end of the project) to secure use/adoption of the results	Intellectual assets: activities (if relevant) to protect your result?	Intellectual assets - Background/foreground: Specific agreements between partners in case of joint results
Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics	TNO has existing IP on this topic. CONTINENTAL is ongoing to release IP base on ME concept of recyclable TPMS. (Allowing circular economy)	Possible license to IP rights	Trade secret, patent Trade secret, patent	TRACXON has an option agreement of taking over 9 IME patents. TRACXON has 6 patents on HPE.

Digital Twin with advisory functions	GRETA is SUPSI's intellectual property even before the project. Recycling simulation tools/models and their application are MARAS's IP before the project.	Activities are not defined currently since they depend on the market and also on the final results of the project	Activities are not defined currently since they depend on the market and also on the final results of the project	-
Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	No existing IP at the moment	No activities are currently planned	Copyright, Trademark	-

- What about the IP related to the results? Is there a specific legal agreement in place? Legally speaking, who is the owner?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics: TNO has existing IP on this topic.

Digital Twin with advisory functions: GRETA (SUPSI), recycling tool (MARAS)

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs: No existing IP at the moment

- Have you planned any activity (if relevant) to protect your result?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics: Trade secret, Patent

Digital Twin with advisory functions: activities are not planned yet

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs: IP activities are not planned yet

- Are there specific agreements between partners in case of joint results?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

TRACXON has an option agreement of taking over 9 IME patents.

TRACXON has 6 patents on HPE.

Digital Twin with advisory functions

GRETA (SUPSI), recycling tool (MARAS)

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs

There are no agreements currently.

UNIQUE VALUE PROPOSITION²

- Could you please tell me what your unique value proposition is?

Knowledge of circularity in printed electronics and integration of circularity concepts in structural electronics

Increase life span of an IME product by facilitating repairing, thereby preventing e-waste. This is a crucial point for the market adaption of IME. The technology allows manufacturing with less products. Including recycling, and repair will support the technology as a sufficient method for PCB replacement and with that reduce e-waste. Current state-of-the-art IME does not include improved recyclability or repairability.

TNO at Holst Centre has experience in eco-designing IME. In the context of CIRC-UIITS, the application of design-for-recycling principles are relevant as they also enable repairing. Also, upscaling is a big need in the market. Automotive industry (e.g. RCF) is requesting the technology implementation but suppliers/manufacturers (Tier 1 and 2) are scarce. TRACXON is a potential upscaling partner. Finally soldering of the components is needed to introduce a reliable alternative. This is supplied by Alpha.

Specific advantages:

- Unique design features
- Form/ design freedom
- Potential low pricing
- Improves circularity
- Extremely sustainable production processes
- Potential to repair
- No mechanical stress when product is assembled

CONTINENTAL has experience in electronic automotive industry validation and quality requirements. With the target to propose solutions suitable in short or midterm comparable to current multi layers PCB FR4 technologies but also allowing circular economy and component recovery.

Continental is evaluating within an automotive environment 2 PCB solutions of sustainable solution available on the market (AT&S and JIVA) having the specific advantages: same design and technologies of the current product currently in production, equivalent performances in temperature and manufacturing, recyclable, low carbon footprint, potentially component recovery at the end of the PCB / product life thank to the support of Alpha for low temperature soldering past.

Digital Twin with advisory functions

The digital twin combined with the advisory tool function within the CIRC-UIITS project has two purposes: on the one hand, it helps pilots to redefine their product design and, on the other hand, it aims to help manage the future end of life of a product's components to optimise circularity either by repair and/or recycling (or the most optimal/circular combination). Both purposes are intertwined and are thus represented as such in the advisory tool.

In the first context, the Advisory function guides pilots in the optimisation of their product designs by exploiting different analyses of the existing product. Subsequently, relevant data collected and calculated from these analyses help decision-makers to formulate new designs. Advisory further reinforces this decision-making process by providing an illustrative dashboard summarising the collected and calculated data/results based on the digital twin. This dashboard facilitates the comparison of previous and future design, allowing the decision maker to have an insight into the results of the analyses performed on both iterations on the basis of a range of KPIs addressing various aspects of circularity and sustainability. It will allow the user to use interactive optimization and multi-criteria decision support methodologies. This facilitates the choice of the optimal product design direction.

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs

Creation of attractive and diverse target group-oriented serious learning games, trainings, and game-related workshops to raise awareness and impart knowledge about circular economy, eco-design, and sustainable strategies and future job profiles within a CE:

- to provide information to a broad range of target-groups
- to provide interactive and immersive, gamified learning to increase learning experiences
- to elevate intrinsic motivation
- to show the point-of-views of many roles e.g., stakeholders, customers/citizens and academical partners
- to create closed-loop business models instead of linear business models
- to understand given boundary conditions and restrictions but also possibilities and chances of a circular economy
- to reinforce positive learning behaviours and providing guidance via gamification elements and feedback mechanisms

Serious games offer a diverse range of information and complexity levels, which can be utilised for the enhancement of innovative skills. The utilisation of specific methods, such as simulation games, allows target groups to gain insight into complex processes, the functioning of these processes and the ability to solve various scenarios based on specific cases. This is achieved through a hands-on approach. Innovative blended learning systems integrate different stages of learning processes, providing various target groups with the opportunity to unite theory and practice while becoming acquainted with modern technologies and methods.

MARKET

- Have you performed an in-depth market analysis on your adopters, competitors, etc.?

Yes

- Have you identified who is willing to use/buy such results (customers/adopters)?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

Target customers are represented by Structural electronic device manufacturers and other (Tier) suppliers OEMs and automotive brand owners

As far as competitors are concerned potentially IME companies may pick-up the topic, such as Symbiose, WALTERPACK, TACTOTEK, however, this is not very likely as these companies are either tech or product suppliers, rather than repair firms. TRACXON however is a manufacturing company for printed electronics that is focussed on IME and automotive and has a strong relation with Tier 1 suppliers.

Digital Twin with advisory functions

Target customers:

- Manufacturers and product designers
- Suppliers

The major players in the community of the digital product passport will be competitors, but our services could complement each other

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs

The use of immersive environments in serious games is becoming increasingly prevalent, with the aim of creating realistic scenarios for learning. This approach is particularly evident in the field of healthcare, where virtual simulations are employed for training purposes, as well as in emergency response and technical skills

Competitors:

- Kahoot! is a well-known platform that employs the use of gamification techniques to facilitate learning through the administration of quizzes, surveys, and discussions. It has gained significant traction in educational settings and corporate training (LMS).
- Classcraft employs the use of game elements, such as avatars, points, and quests, to gamify the classroom experience. This approach has been shown to enhance student engagement, particularly in the context of 2D learning games.
- SimVenture provides a diverse range of business simulation games for the purpose of entrepreneurship and management education. Players are afforded the opportunity to commence and oversee the operations of their virtual businesses, with the capacity to make decisions pertaining to financial management, marketing, and operational processes. (Business Simulation Games)

- Are there other target groups/audiences that are part of your exploitation strategy? Who are they?

Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

- Domestic applications appear on e.g. touch panel and lighting applications
- Medical systems

Digital Twin with advisory functions

- Manufacturers and product designers
- Suppliers
- Consultants
- EoL actors
- Policy actors

Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs

- General citizens
- Pre-professional user target groups: (young students (school), university / college students (academic areas), trainees / apprenticeships etc.)
- Professional user target groups: (production employees, specialized staff, executives,

- Which indicators have you set to verify that you effectively reached them out?

To verify effective outreach to stakeholders, the project will set indicators such as the number of interactions or meetings held with key contacts, feedback received during workshops or discussions, and the extent of stakeholder engagement in project activities (e.g., participation in events, use of provided tools, or collaboration on deliverables). Tracking these metrics will help assess the success of our engagement efforts.

- (if adopters/customers are identified) Did you start the interaction with the early adopters? Were there positive reactions?

As far as the 3 KERs are concerned, the market commercial interaction still requires 2-5 years

SINERGIES AND OUTREACH

- Are you joining forces with other projects to better reach out dissemination target groups?

Workshops and clustering activities have already been initiated across similar projects.

- Are you already part of relevant networks to reach out early adopters and relevant stakeholders?

Stakeholders and clustering are already somewhat managed; no need for heavy external support.

- (in case of a valid Unique Value Proposition) Have you planned activities to present your KERs to relevant groups (early adopters, investors, etc.)?

Not defined yet.

- Are you prepared to publish your results on the Horizon Results Platform?

The project is willing to public the results on the platform.

D&E NEEDS

- What is your main need at the moment to move on with the D&E activities?

Business planning, intellectual asset management, coaching, audio-visual support

- Identification of relevant targets
- Planning and strategic improvement
- Review of the D&E/D/E plan
- Execution
- Additional Funding (post project)
- Support in meeting the enablers
- Other

D&E Building blocks	
Key Exploitable Results (KERs) have been appropriately identified	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
An Exploitation plan and/or a Business plan is available	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Early adopters/customers are identified	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
A Communication and Dissemination plan is available	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Channels to reach adopters/customers are identified	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
KPIs for dissemination are identified	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>Decision on:</p> <p><input type="checkbox"/> 2.1 Dissemination</p> <p><input type="checkbox"/> 2.3 Go to market:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Module A: kick-off <input type="checkbox"/> Module B: Unique Value Proposition & Key Exploitable Result(s) <input type="checkbox"/> Module C: Exploitation Strategy <input checked="" type="checkbox"/> Module D: Business Plan <input checked="" type="checkbox"/> Module E: Access to other funding & entrepreneurship support <input checked="" type="checkbox"/> Module F: Reporting <p>Why:</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> • The Partners exploiting the Digital Twin with advisory functions are interested in service 2.3 Go To Market, especially in Module D Business Plan, which was already requested within HRB, and in Module E to receive support in accessing additional funding. During the Kick off activity (Module A) the Expert will evaluate if BESU partner, who will be exploiting the Serious games KER, is ready to receive Module D support as well. </div>	
Add-on	
Applicants interested/committed in collaborating in a Project Group to increase critical mass through joint D&E	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Presence/availability of structured networking databases	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Presence/availability of structured intellectual asset management plan or similar	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Activities related to public speaking to different audiences are foreseen in the project	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Presence of activities related to the development of audio-visual materials (<i>only for the purpose of uploading the video on Horizon Result Platform</i>)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Decision on:</p> <p><input checked="" type="checkbox"/> 3.1 Networking</p> <p><input type="checkbox"/> 3.2 Portfolio Analysis</p> <ul style="list-style-type: none"><input type="checkbox"/> Module A: kick-off and portfolio creation<input type="checkbox"/> Module B: Clustering activities<input type="checkbox"/> Module C: Reporting <p><input checked="" type="checkbox"/> 3.3 Intellectual Assets Management</p> <p><input checked="" type="checkbox"/> 3.4 Coaching for Public Speaking</p> <p><input checked="" type="checkbox"/> 3.5 Audio Visual Support</p>	
<p>Why:</p> <div style="border: 1px solid black; padding: 10px;"><ul style="list-style-type: none">• The partners interested in the exploitation of the KER focusing on Knowledge on circularity in printed electronics, and several other partners, are interested in service 3.3 Intellectual Assets Management. The partners had already a general IPR seminar in HRB1 but are interested in a more specific support on their specific case.• In addition, several partners are interested in service 3.4 Coaching for Public Speaking and 3.5 Audio-Visual Support and in service 3.1 Networking after the delivery of service 2.3.• All partners are interested in receiving networking support as well.</div>	

3.2 Service Roadmap

Booster Service(s)	Timing
2.3 Go-To-Market Support Modules A, B, C, D, E, F (Partners exploiting Digital Twin with advisory functions) ³	QI 2025 with Kick off in January 2025
3.4 Coaching for Public Speaking (All partners)	QII 2025 with Kick off in April 2025
3.5 Audio-Visual Support (All partners)	QII 2025 with Kick off in April 2025
3.3 Intellectual Assets Management (Partners exploiting KER about Knowledge of circularity in printed electronics and integration of circularity concepts in structural electronics)	QII 2025 with Kick off in April 2025
3.1 Networking (All partners)	QIII 2025 with Kick off in July 2025

³ The 2-3 Go to market support – Module B - Key Exploitable results and Unique Value Proposition¹ service is only meant in this case to kick off the Business plan activities (Module D) since the project has already identified KER's and UVP in detail.

4 D&E ecosystem

In addition to Booster support, there are plenty of other opportunities for D&E support, which we present in this annex. These include both financial and non-financial opportunities.

4.1 Horizon Results Platform

A tool for beneficiaries in disseminating their Key Exploitable Results, for stakeholders to engage with beneficiaries, directly or through NCP, and for the EC to learn from project results. <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform>

4.2 European Institute of Innovation and Technology's Knowledge and Innovation Communities

Under EIT's Knowledge and Innovation Communities (KICs) are partnerships that bring together businesses, research centers and universities. Through the KICs, EIT strengthen cooperation among businesses (including SMEs), higher education institutions and research organisations, form dynamic pan-European partnerships, and create favourable environments for creative thought processes and innovations to flourish.

There are 9 Innovation Communities and each focus on a different societal challenge:

- EIT Climate-KIC <https://eit.europa.eu/our-communities/eit-climate-kic>
- EIT Creativity <https://eit.europa.eu/eit-community/eit-culture-creativity>
- EIT Food <https://eit.europa.eu/our-communities/eit-food>
- EIT Health <https://eit.europa.eu/our-communities/eit-health>
- EIT Digital <https://eit.europa.eu/our-communities/eit-digital>
- EIT Manufacturing <https://eit.europa.eu/our-communities/eit-manufacturing>
- EIT Innoenergy <https://eit.europa.eu/our-communities/eit-innoenergy>
- EIT Urban Mobility <https://eit.europa.eu/our-communities/eit-urban-mobility>
- EIT Raw Materials <https://eit.europa.eu/our-communities/eit-rawmaterials>

For more information check here: <https://eit.europa.eu/>

4.3 InvestEU Portal

It is the EU matchmaking portal, enabling EU-based project promoters – public or private – to reach potential investors worldwide. The Portal is a free service offered by the European Commission and is part of the Investment Plan for Europe, which aims to mobilise investment, boost economic growth and create jobs across the EU.

<https://ec.europa.eu/investeuportal/desktop/en/index.html>

4.4 Enterprise Europe Network

The Enterprise Europe Network (EEN) helps businesses innovate and grow on an international scale. It is the world's largest support network for small and medium-sized enterprises (SMEs) with international ambitions.

The Network is active worldwide. It brings together experts from member organisations that are renowned for their excellence in business support.

Member organisations include:

- chambers of commerce and industry
- regional development organisations
- universities and research institutes
- innovation agencies
- Individual businesses can't become Network members, but they can enjoy the many services offered.

<https://een.ec.europa.eu/>

Furthermore, to know if a programme is relevant to your particular case, we strongly suggest that you contact your local Enterprise Europe Network partner <http://een.ec.europa.eu/about/branches/>, who can give you one-to-one advice and support in applying for EU funding.

4.5 The EU Innovation Radar Platform

The Innovation Radar is a European Commission initiative to identify high potential innovations and innovators in EU-funded research and innovation projects. The goal is to allow every citizen, public official, professional and businessperson to discover the outputs of EU innovation funding and give them a chance to seek out innovators who could follow in the footsteps of companies such as Skype, TomTom, ARM Holdings, all of whom received EU funding in their early days.

This platform is a first step to achieving such ambitions. It will make information about EU-funded innovations from high-quality projects visible and accessible to the public via the Innovation Radar platform.

Moreover, by providing greater access to such information the aim is to encourage the development of a dynamic ecosystem of incubators, entrepreneurs, funding agencies and investors that can help get EU-funded innovations faster to market.

<https://innovation-radar.ec.europa.eu/>

4.6 Incubators and Accelerators

Incubators and accelerators provide support and training on entrepreneurial skills through workshops, mentorships, and ongoing support, but also through opening up a network of investors, customers, potential partners and more. Some of these aspects come together in their investor-events (or 'demo-days'). This is of great value for the founders and truly 'accelerates' the development and growth of their startup, especially for first-time founders.

For more information check here: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/eu-valorisation-policy/knowledge-valorisation-platform/thematic-focus/role-incubators-and-accelerators-knowledge-valorisation_en

4.7 Scalable Cities Initiative

Scalable Cities is an initiative of the European Commission to create an innovative, sustainable and city-led community of smart and climate-neutral cities in Europe. Scalable Cities represent 124 unique cities involved in 20

Smart Cities and Communities (SCC) projects funded by the Horizon 2020 and Horizon Europe programmes that are working in consortia with academia, industry, associations and consultants.

Together, they have implemented more than 550 demonstrations of technological and social innovations in the areas of mobility and logistics, buildings, urban data and ICT infrastructure, citizen engagement as well as urban governance.

Available services:

- The City Coordinators Group brings together cities to share knowledge, facilitate collaboration and lead advocacy actions.
- The Peer-to-Peer Learning programme is offered to cities to build capacity in public administrations.
- The Action Grant offers financial support to replicate already proven measures.
- The Task Groups bring together practitioners to work on issues related to smart cities.
- The Experts Group offers technical advice to support the work of Scalable Cities.
- The Roadshow offers a financial capacity-building program is designed to help cities acquire the knowledge needed to scale up energy transition projects.

For more information: <https://smart-cities-marketplace.ec.europa.eu/scalable-cities>

4.8 EuroQuity

Euroquity is a web service created by Bpifrance in partnership with KfW to put growth companies in contact with development partners and with investors in particular.

It makes available several labels or communities to allow users being more visible and increase their value in the eyes of other EuroQuity users.

The web service has 3 main typologies of users:

- Companies looking for new partners for growth, particularly investors. Obtaining recommendations from current partners, expressions of interest from other users and belonging to one or several labels enables a more effective promotion to future contacts and facilitates deals.
- Investors: professionals, Business Angels and private individuals looking for investment opportunities. EuroQuity provides access to significant sourcing, qualified by the marketplace (crowdrating) and by company membership in one or more labels.
- Business support, organisations working in company advisory and support (consultants, incubators, accelerators, competitiveness centres, CCI, etc.) can assist companies, be included in their project presentations and recommend them.

Labels

A label proves company membership in a programme, a selection or a qualifying certification. Each label brings together the member companies of an accelerator, incubator, competition centre, innovation programme, etc. A community can have one or more labels. Belonging to a label provides a clear indication of your company's value and potential. Membership is important for the EQ Score calculation, which will highlight the company on EuroQuity.

Communities

Communities bring together groups of EuroQuity users, primarily companies, around specific interests or themes. They enable the companies leading them to provide their members with premium information and special offers and privileges.

4.9 Access to EU Finance

http://europa.eu/youreurope/business/funding-grants/access-to-finance/index_en.htm

This site can help to apply for loans and venture capital supported by the European Union.

Select your country to search for financial opportunities.

4.10 Tenders Electronic Daily

TED (Tenders Electronic Daily) is the online version of the 'Supplement to the Official Journal' of the EU, dedicated to European public procurement.

TED provides free access to business opportunities from the European Union, the European Economic Area and beyond.

Every day, from Monday to Friday over 3 000 public procurement notices are published on TED.

You can browse, search and sort procurement notices by country, region, business sector and more.

Information about every procurement document is published in the 24 official EU languages.

For more information check here: <https://ted.europa.eu/en/index>

4.11 Dealflow

Dealflow is sponsored by the European Commission to support EU-funded innovations with fundraising, venture building and networking. It supports EU-funded projects from H2020.

Three typologies of support are foreseen:

- Venture-building: giving tailored support on challenging business topics (e.g. sales strategy, market sizing & research, organizational structure, and pitching);
- Fundraising (preparation): preparing investor materials and providing access to investor networks;
- Networking: introductions to industry experts, potential clients and new partners through their matchmaking platform, community & events.

<https://dealflow.eu/>

4.12 EIC Transition

The EIC Transition funding scheme builds on promising research results to demonstrate and mature technology, as well as to develop business plans.

EIC Transition funds innovation activities that go beyond experimental proof of concept in the laboratory and supports both the maturation and validation of your novel technology in the lab and in relevant application environments.

The development of a business case and business model for the innovation's future commercialisation.

Grants of up to €2.5 million and more are available to validate and demonstrate technology in application-relevant environments and to develop market readiness.

EIC Transition offers open funding for projects in any field of science or technology, as well as challenge-driven funding in specific strategic fields.

Single applicants (SMEs, spin-offs, start-ups, research organisations, universities) or small consortia (maximum 5 partners) may apply.

For more information check here: https://eic.ec.europa.eu/eic-funding-opportunities/eic-transition_en

4.13 EIC Accelerator

The EIC Accelerator supports individual Small and Medium Enterprises (SMEs), in particular Startups and spinout companies to develop and scaleup game-changing innovations. In some cases, small mid-caps (up to 500 employees) are supported.

The EIC Accelerator provides substantial financial support with:

- grant funding (non-dilutive) of up to €2.5 million for innovation development costs,
- investments (direct equity investments) of up to €15 million managed by the EIC Fund for scale up and other relevant costs.

In addition, EIC selected companies receive coaching, mentoring, access to investors and corporates, and many other opportunities as part of the EIC community.

Applications can be submitted at any time through the EIC platform. Applicants have to submit a video pitch, a slide deck and respond to a short set of questions about their innovation and their team.

Applications that meet all the criteria at the remote evaluation stage and are assessed positively by the EIC jury but not recommended for funding, will be awarded a Seal of Excellence to help them secure funding from other sources. Companies with a Seal of Excellence can also get support from EIC Business Acceleration Services.

For more information check here: https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator_en

4.14 EIC Prizes

The EIC Prizes are awarded to whoever can most effectively meet a pre-defined challenge, without prescribing how that challenge should be solved. These will boost breakthrough innovation across sectors by fostering cutting-edge solutions which bring major benefits to citizens and society:

- EU Prize for Women Innovators https://eic.ec.europa.eu/eic-prizes/european-prize-women-innovators-powered-eic-eit_en
- The European Capital of Innovation Awards https://eic.ec.europa.eu/eic-prizes/european-capital-innovation-awards_en
- The European Innovation Procurement Awards https://eic.ec.europa.eu/eic-prizes/european-innovation-procurement-awards_en
- The European Social Innovation Competition https://eic.ec.europa.eu/eic-prizes/european-social-innovation-competition_en

For more information check here: https://eic.ec.europa.eu/eic-prizes_en

4.15 Fast Track and Plug In schemes to the EIC Accelerator

The Fast Track scheme (the 'Fast Track') and the Plug In scheme (the 'Plug In') are two novelties under Horizon Europe. They allow funding bodies managing other parts of the Horizon Europe and Horizon 2020 programmes (the Fast Track) and funding bodies managing certified national/regional programmes (the Plug In) to submit projects from their portfolio directly to the full application stage of the EIC Accelerator.

To do so, eligible programmes must first perform a dedicated project review of an ongoing (or recently terminated) project and the proposal stemming from such project.

Therefore, with the Fast Track and the Plug In, applicants do not apply directly to the EIC Accelerator call. Instead, it is the eligible programmes that decide, through a project review, whether a project is suitable for support under the EIC Accelerator.

The project review must be conducted using award criteria equivalent to the ones set out for the 'short application stage' of the EIC Accelerator (and therefore centred on the underlying idea of that potential new action) and using an evaluation process that guarantees an independent assessment of proposals in compliance with Horizon Europe legislation.

For more information check here: https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator/fast-track-and-plug-schemes-eic-accelerator_en

4.16 The InvestEU Programme

The InvestEU Programme supports sustainable investment, innovation and job creation in Europe. With the EU budget guarantee provided to International and National promotional banks, the InvestEU programme aims to trigger more than €372 billion in private investments to high EU policy priority areas.

It provides the European Union with crucial long-term funding by leveraging private and public funds in support of Europe's sustainable recovery. It helps to mobilize private investments for the EU's top policy priorities, such as the green, and digital transition, innovation and social investments and skills.

It also supports the REPowerEU plan – the Commission's response to the global energy market disruption caused by Russia's war of aggression against Ukraine.

The InvestEU programme brings together the multitude of earlier EU financial instruments, making access to finance and investments in European companies and projects simpler, more efficient and more flexible.

The Programme consists of:

- The InvestEU Fund which aims to mobilise more than €372 billion of public and private investment through an EU budget guarantee of €26.2 billion that backs the investment of implementing partners such as the European Investment Bank (EIB) Group and other financial institutions.
- The InvestEU Advisory Hub which provides advisory support and technical assistance including capacity building to project developers and entities – private and public - helping with the preparation, development, structuring and implementation of investment projects.
- The InvestEU Portal which brings together investors and project promoters on a single EU-wide platform, by providing an easily-accessible and user-friendly database of investment opportunities available within the EU and matchmaking and networking opportunities between projects and companies and their potential investors..

For more information check here: https://investeu.europa.eu/investeu-programme_en

4.17 INTERREG EUROPE

Interreg Europe is an interregional cooperation programme, co-funded by the European Union. The European Union strives to reduce disparities in the levels of development, growth and quality of life in and across Europe's regions. The programme contributes to this objective and runs from 2021 to 2027. Interreg Europe can help in the following ways:

- **Financial support** – funding is available for interregional cooperation projects, which have the potential to lead to longer-term collaborations and partnerships
- **Expand your network** – meet new like-minded partners, stakeholders, and business colleagues across Europe.

For more information check here: <http://www.interregeurope.eu/>

4.18 Eurostars funding

Eurostars is part of the European Partnership on Innovative SMEs. The partnership is co-funded by the European Union through Horizon Europe.

Eurostars is the largest international funding programme for SMEs wishing to collaborate on R&D projects that create innovative products, processes or services for commercialisation. Your consortium must spotlight an innovative SME as the main project participant.

Choose project partners from SMEs, universities and research centres from any of the programme's 37 participating countries. Organisations in non-participating countries can still join a Eurostars consortium.

For more information check here: <https://eurekanetwork.org/programmes/eurostars/>

4.19 CASCADING GRANTS

Cascade Funding, also known as Financial Support for Third Parties (FSTP), is a European Commission mechanism to distribute public funding in order to assist beneficiaries, such as start-ups, scale-ups, SME and/or mid-caps, in the uptake or development of digital innovation.

This funding method aims at simplifying the administrative procedures, creating a light, SME-friendly application scheme, by allowing that some EU-funded projects may issue, in turn, open calls for further funding.

For more information check here: <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/competitive-calls>

4.20 European Green Deal – Just Transition Mechanism

The Just Transition Mechanism (JTM) is a key tool to ensure that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind. It provides targeted support to help mobilise around €55 billion over the period 2021-2027 in the most affected regions, to alleviate the socio-economic impact of the transition.

The Just Transition Mechanism consists of three main sources of financing:

- 1) **Just Transition Fund**, of €19.7 billion in current prices, is expected to mobilise around €7.3 billion of national co-financing, amounting to a total of €27 billion https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/just-transition-fund_en
- 2) **InvestEU "Just Transition" scheme**, a budgetary guarantee under the InvestEU programme across the four policy windows and an InvestEU Advisory Hub that will act as a central entry point for advisory support requests. It is expected to mobilise €10-15 billion in mostly private sector investments.

- 3) **Public Sector Loan Facility**, combines €1.5 billion of grants financed from the EU budget with €10 billion of loans from the European Investment Bank, to mobilise €18.5 billion of public investment.

The Just Transition Mechanism is about more than funding: relying on a Just Transition Platform. It consists of a single access point and helpdesk. It provides comprehensive technical and advisory support. Authorities and beneficiaries can access it to find all they need to know about the funds, including opportunities, relevant regulatory updates or sector specific initiatives. The Platform also promotes actively the exchange of best practices among all stakeholders involved, including through regular physical and virtual gatherings.

For more information check here: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en#:~:text=InvestEU%20%22Just%20Transition%22%20scheme,in%20mostly%20private%20sector%20investments.

4.21 Programme for the Environment and Climate Action (LIFE)

LIFE programme is the EU's funding instrument for the environment and climate action. The programme is divided into two sub-programmes, one for environment (representing 75% of the overall financial envelope) and one for climate action (representing 25% of the envelope).

- The programme includes large scale demos/pilots with focus on Environment and Climate Action; with clear impact aims during the project; and clear environmental/climate problem baseline (de-risk).
- Projects start at TRL 6-7 aiming up to 9 to bridge valley of death (income allowed – end-user important).
- The funding programme uses bottom-up approach (call-topics are broad) allowing proposers to define their solutions needed for their environmental context/problem.
- Focus is on making Environmental impacts in the EU.
- Even proposals from single EU beneficiaries are allowed.
- Proposers can apply in their own language.
- There is no set proposal budget limit.

For more information check here: https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/programme-environment-and-climate-action-life_en

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Go to Market (G2M) Service for

**Circular Integration of independent Reverse supply Chains for the smart
reUse of IndusTrially relevant Semiconductors - CIRC-UITs
101091490**

**POLITECNICO DI MILANO
OFFIS EV
OSTERREICHISCHE GESELLSCHAFT FUR SYSTEM- UND
AUTOMATISIERUNGSTECHNIK
ASOCIACION DE EMPRESAS TECNOLOGICAS INNOVALIA
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST
NATUURWETENSCHAPPELIJK ONDERZOEK TNO
CENTRO RICERCHE FIAT SCPA
ROBERT BOSCH GMBH
ALPHA ASSEMBLY SOLUTIONS GERMANY GMBH
CONTINENTAL AUTOMOTIVE FRANCE SAS
MATERIAL RECYCLING AND SUSTAINABILITY (MARAS) BV
BEKO EUROPE MANAGEMENT SRL
BESU.SOLUTIONS GMBH
POLLINI LORENZO E FIGLI SRL
TRACXON B.V.**

**ERION COMPLIANCE ORGANIZATION SCARL
DIN DEUTSCHES INSTITUT FUER NORMUNG EV
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1 List of Abbreviations

Abbreviation	Definition
AI	Artificial Intelligence
ESPR	Ecodesign for Sustainable Products Regulation
FTO	Freedom to Operate
HMI	Human-Machine Interface
HPE	Hybrid Printed Electronics
IME	In-Mould Electronics
IPR	Intellectual Property Rights
LCA	Life Cycle Assessment
OEM	Original Equipment Manufacturer
TRL	Technology Readiness Level

2 The service

2.1 Executive Summary of the Service

This report summarises the process followed and the main outcomes of the Go to Market (G2M) service for the beneficiaries involved in the CIRC-UIITS.

It presents the different Modules and sessions carried out during the service delivery along with the agenda of each meeting and the related participants. It then introduces the terminology used, and the 12 main tools presented and exercised:

- Exploitation Intentions table
- Characterisation Table
- Market Definition Canvas
- Value Proposition Canvas
- Presentation sheet
- Use Options
- Lean Canvas
- Risk Matrix and Risk Map
- Exploitation Roadmap
- BOSAT
- Business Plan
- Commercialisation Plan

It also includes a template for a Memorandum of Understanding, useful for project partners to progress in agreeing on exploitation rights, building on what was signed as the Consortium Agreement (Annex 1); an overview of the overall methodology and approach used during the delivery (Annex 2); as well as general suggestions on financial and non-financial tools to be used along the go-to-market pathway (Annexes 3 and 4).

The Expert was appointed on 14/01/2025 and the following Modules were included in the G2M service:

- Module A: Kick-off (G2M-A)
- Module B: Unique Value Proposition & Key Exploitable Result(s) (G2M-B)
- Module C: Exploitation Strategy (G2M-C)
- Module D: Business Plan (G2M-D)
- Module E: Access to other funding & entrepreneurship support (G2M-E)
- Module F: Reporting (G2M-E)

The Beneficiaries were contacted on 14/01/2025.

On the 23/01/2025 an introductory call with the Beneficiaries was organised to discuss expectations, get a first insight on the state of the art, present the service and introduce preparatory activities, and agree on a first service delivery

plan, based on the Modules activated within the G2M. On the same day, the Expert sent to the Beneficiaries all the information and the “Exploitation Intentions” table to be shared with Participants and filled before the delivery of the “Exploitation Pillars Training”.

Drafts of the “Exploitation Intentions” tables filled in by Beneficiaries have been returned on 26/02/2025.

The “Exploitation Pillars Training” took place on 07/03/2025 where the basic concepts of exploitation were introduced by the expert, with particular attention to the concepts of KERs, use/adoption of KERs and impact generation. During the session the main discussion was held on the “Exploitation Intentions” table.

During the training, participants and experts aligned on the definitive list of KERs to be supported during the service, which is:

- Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics as KER1
- OFFIS Digital Twin as KER2

Finally, the expert introduced the main tools to be used during the next session: the Market Definition Canvas and Value Proposition Canvas. At the end of the training, the Expert agreed with participants to hold the UVP workshops on 28/03/2025 for KER1 and 26/03/2025 for KER2 and asked them to fill in the tools presented during the training in order to provide initial comments/suggestions before the UVP workshops.

During Module B, 2 Unique Value Proposition workshops were organised and delivered according to the timing and agenda described in Section 2.2. Participants reviewed and completed the Market Definition Canvas and Value Proposition Canvas enabling them to better focus on target markets, identify early adopters and customers and clearly present the added value of their innovative solutions for the identified early adopters and customers. In the end, they were also able to create an effective statement expressing the Unique Value Proposition of the KERs. Some elements related to intellectual assets founded in the KERs were also discussed. Finally, the expert introduced and asked to fill in the tools to be used in the Exploitation Strategy Seminars (The Characterisation Table, the Risk map and the Exploitation Roadmap).

During Module C, 2 Exploitation Strategy Seminars were organised and delivered according to the timing and agenda described in Section 2.2. The expert focused on the detailed development of the Characterisation Table and the Exploitation Roadmap as the main pillars of the participants’ exploitation strategies. This allowed to better focus on the definition of the most appropriate business/use model for the successful exploitation of their KERs, detail next steps to successfully exploit the KERs, including strategic governance, technical, commercial and financial aspects, identification of relevant stakeholders and potential business partners to interact with, an estimation of time to market, etc. Different exploitation risks were discussed to better identify factors that could hamper the exploitation of KERs. At the end of the ESS, experts suggested participants to summarize their use models using the Lean Canvas. Finally, the Expert introduced the Business Plan template, explaining how to assemble all tools used so far to start preparing a complete Business Plan for the next workshop.

During Module D, 1 Business Planning workshops and 1 Business Plan implementation workshops were organised and delivered according to the timing and agenda described in Section 2.2. During the Business Planning workshop, the Expert mainly focused on the first sections of the Business Plan. As an output, beneficiaries were guided in improving their business plans and received further instructions for their finalisation. After the workshops, based on the actual state of the art of the Business Plans, on 05/06/2025 the Expert agreed with beneficiaries to focus on the following aspects during the Business Planning workshops development of a Commercialisation plan. During the Business Plan implementation workshops, the Expert supported beneficiaries in the finalisation of their business plans through

development of a Commercialisation plan. Moreover, a training session on innovation management was delivered, explaining how to effectively and efficiently manage innovation in terms of products/services, processes, organisational culture and structure. At the end of the workshops the expert asked beneficiaries to send back their updated BPs, based on the instructions and suggestions received during the workshops.

Anonymous feedback forms will be gathered from participants at the end of the G2M service.

The tools developed during the G2M service were filled in by the beneficiaries with feedback and suggestions from the Expert. The final version is the result of several iterations, brainstorming and discussions during the webinars and coaching sessions. The level of detail of the content presented in the present report reflects the level of maturity of the project when receiving the service.

As from the recommendations in Chapter 8, from the expert perspective, some quick remarks:

1. Quantify the Unique Value Proposition (UVP). Both KERs describe promising benefits (e.g., recyclability, eco-design guidance), but lack concrete KPIs. Introducing quantifiable impact indicators (e.g., % reduction in CO₂, % materials recovered, % machine downtime avoided) will improve market credibility and investor interest.
2. Clarify IP Ownership and Licensing Strategy. Foreground IP is either undefined or fragmented across partners. A joint IP strategy should be developed, specifying what is protectable (e.g., data models, interfaces, simulation logic) and how it will be exploited (e.g., licensing, SaaS, spin-off).
3. Strengthen Exploitation Planning with Phased Pilots and Cost Models. Both KERs would benefit from a structured roadmap including industrial piloting, refinement, and scale-up. Financial planning should integrate pricing tiers, service models, and long-term support/maintenance schemes.
4. Leverage Regulatory and ESG Trends as Market Enablers. ESPR, digital product passports, and circularity reporting are regulatory drivers. Aligning each KER with these frameworks—and communicating that alignment clearly—will support early adoption and public/private funding opportunities.

2.2 G2M trainings and workshops

2.2.1 G2M - Module A

Exploitation Pillars training held on 07/03/2025

- **Agenda**

Ice breaking (10 min.)

Welcome, Presenting the webinar

Bridging results to the market (20 min.)

The role of D&E, general definitions

Reviewing Key Exploitable Results (30 - 50 min.)

Review of Exploitation intentions and final list of KERs

Break (10 min.)

Planning the next steps (30 - 40 min.)

Introducing the Market Definition Canvas and Value Proposition Canvas

Wrap-up – Q&A (15 min.)

- **Participants**

First name	Last name	Organisation
Bernd	Kopacek	SAT AUSTRIAN SOCIETY FOR SYSTEMS ENGINEERING AND AUTOMATION
Daniele	Perossa	POLIMI
Lorenzo Francesco	Gandini	POLIMI
Paolo	Rosa	POLIMI

- **Post workshop support**

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The exploitation intentions table prepared and discussed during the workshop showed clear improvements in the definition of the final list of KERs to be supported:

- Identification of early adopters
- Identification of solutions currently available;

Some elements related to the selected KERs need particular focus during the implementation of the next G2M Modules:

- Identification of the competitive advantage/ Unique Value Proposition (UVP);

2.2.2 G2M – Module B

UVP workshop for KER 1 held on 28/03/2025

- **Agenda**

Introducing the day (10 min.)

Welcome, Presenting the webinar, insights on draft Market Definition Canvas and Value Proposition Canvas

Working together: The Value Proposition Canvas (45 min.)

Deepening the Value Proposition Canvas, defining the right UVP

Break (10 min.)

Presenting the UVP (15 min.)

Showcasing/updating the KER for the HRP

A quick look at IPR (15 – 30 min.)

Planning next steps (45 min.)

Use Option, the Lean Canvas, the Risk map, the Exploitation Roadmap

Wrap-up – Q&A (10 min.)

▪ Participants

First name	Last name	Organisation
Daniele	Perossa	POLIMI
Paolo	Rosa	POLIMI
Maarten	M.H. Bakker	TNO
Stephan	Harkema	TNO

▪ Post workshop support

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Identification of market drivers
- Definition of the KERs profile for the HRP

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Identification of the right end users
- Identification of the needs of end users
- Identification of solutions currently available;
- Definition of an IP strategy and potential additional support needed

UVP workshop for KER 2 held on 26/03/2025

▪ Agenda

Introducing the day (10 min.)

Welcome, Presenting the webinar, insights on draft Market Definition Canvas and Value Proposition Canvas

Working together: The Value Proposition Canvas (45 min.)

Deepening the Value Proposition Canvas, defining the right UVP

Break (10 min.)

Presenting the UVP (15 min.)

Showcasing/updating the KER for the HRP

A quick look at IPR (15 – 30 min.)

Planning next steps (45 min.)

Use Option, the Lean Canvas, the Risk map, the Exploitation Roadmap

Wrap-up – Q&A (10 min.)

▪ Participants

First name	Last name	Organisation
Bernd	Kopacek	SAT AUSTRIAN SOCIETY FOR SYSTEMS ENGINEERING AND AUTOMATION
Alexandra	Pehlken	OFFIS
Lisa	Dawel	OFFIS

▪ **Post workshop support**

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Identification of the right end users
- Identification of the needs of end users

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Identification of market drivers
- Identification of solutions currently available;
- Definition of an IP strategy and potential additional support needed
- Definition of the KERs profile for the HRP

2.2.3 G2M – Module C

Exploitation Strategy Seminar for KER 1 held on 06/05/2025

▪ **Agenda**

06 May 2025– Exploitation Strategy Seminar

Introducing the day (10 min.)

Welcome, Presenting the webinar, quick feedback on Characterisation Table, Exploitation Roadmap and the Risk matrix

Introducing exploitation routes (30 min.)

Discussing the use models for the exploitation plan

Working together: The Exploitation Roadmap (30 min.)

Defining the right roadmap towards exploitation

Break (10 min.)

Working together: The Risk map (30 – 45 min.)

Deepening the Risk matrix and the risk map, identification of exploitation risks

Summarising use models - the Lean Canvas (15 min.)

Using the Lean Canvas to present the exploitation strategies at a glance

Wrap-up – Q&A (15 min.)

▪ **Participants**

First name	Last name	Organisation
Paolo	Rosa	POLIMI
Maarten	M.H. Bakker	TNO
Stephan	Harkema	TNO

▪ **Post workshop support**

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Identification of early adopters
- Identification of solutions currently available;

- Identification of the Unique Value Proposition (UVP);

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Definition of the revenue generation process (on how value is going to be generated) for the organisation exploiting the KER;
- Milestones and KPIs (Key Performance Indicators) to be defined and agreed upon.

Exploitation Strategy Seminar for KER 2 held on 07/05/2025

▪ Agenda

07 May 2025– Exploitation Strategy Seminar

Introducing the day (10 min.)

Welcome, Presenting the webinar, quick feedback on Characterisation Table, Exploitation Roadmap and the Risk matrix

Introducing exploitation routes (30 min.)

Discussing the use models for the exploitation plan

Working together: The Exploitation Roadmap (30 min.)

Defining the right roadmap towards exploitation

Break (10 min.)

Working together: The Risk map (30 – 45 min.)

Deepening the Risk matrix and the risk map, identification of exploitation risks

Summarising use models - the Lean Canvas (15 min.)

Using the Lean Canvas to present the exploitation strategies at a glance

Planning next steps (15 min.)

Presenting the Business Plan template and the BOSAT

Wrap-up – Q&A (15 min.)

▪ Participants

First name	Last name	Organisation
Bernd	Kopacek	SAT AUSTRIAN SOCIETY FOR SYSTEMS ENGINEERING AND AUTOMATION
Alexandra	Pehlken	OFFIS
Lisa	Dawel	OFFIS
Paolo	Rosa	POLIMI

▪ Post workshop support

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Identification of early adopters
- Identification of solutions currently available;
- Identification of the Unique Value Proposition (UVP);

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Definition of the revenue generation process (on how value is going to be generated) for the organisation exploiting the KER;

- Description of the process to involve decision-makers and other departments within the organisation responsible for taking over the roadmaps;
- Milestones and KPIs (Key Performance Indicators) to be defined and agreed upon.

2.2.4 G2M – Module D

Business Planning workshop for KER 2 held on 28/05/2025

▪ Agenda

Introducing the day (10 min.)

Welcome, Presenting the webinar, Insights on the BOSAT, and draft Business Plan

Introducing Business Planning (45-60 min.)

Presenting how to approach and prepare for business planning

Break (15 min.)

Working together: Assembling the Business Plan (60 - 90 min.)

Reviewing and discussing draft business plans

Wrap-up – Q&A (15 – 30 min.)

▪ Participants

First name	Last name	Organisation
Bernd	Kopacek	SAT AUSTRIAN SOCIETY FOR SYSTEMS ENGINEERING AND AUTOMATION
Alexandra	Pehlken	OFFIS
Felix	Schmedes	OFFIS
Paolo	Rosa	POLIMI

▪ Post workshop support

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Description of the market and segments
- Description of competitors and strengths/weaknesses;
- Identification of the Unique Value Proposition (UVP);

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Definition of the revenue generation process (on how value is going to be generated) for the organisation exploiting the KER;
- Definition of the marketing strategy and marketing plan and related KPIs

Business Plan implementation workshop for KER 2 held on 20/06/2025

▪ Agenda

Introducing the day (15 min.)

Welcome, Presenting the webinar

Working together: Operations and financials (45 min)

Presenting the operation plan, financials and organisational aspects of the Business Plan

Break (15min)

Finalisation of the Business Plan (60-90 min.)

Discussion on the most critical parts of the prepared Business Plan, working on the selected option:
(Option 3) focus on the Commercialisation plan

Break (15 min.)

Training on Innovation management (60 min.)

How to address management of innovations in terms of organisational culture/structure (the Team)

Wrap-up – Q&A (10 min.)

▪ **Participants**

First name	Last name	Organisation
Bernd	Kopacek	SAT AUSTRIAN SOCIETY FOR SYSTEMS ENGINEERING AND AUTOMATION
Alexandra	Pehlken	OFFIS
Paolo	Rosa	POLIMI

▪ **Summary of the training on Innovation Management**

The training focused on the importance of aligning technological development with business viability through structured innovation management. Key topics included defining innovation types, managing the full innovation process, and integrating strategy, governance, and culture. Emphasis was placed on addressing innovation challenges through cross-functional teams, leadership, creativity, learning routines, and continuous internal communication to ensure adaptability, execution, and long-term impact.

▪ **Post workshop support**

Support in fine-tuning available information and provision of final comments, pre and after the workshops

The tools prepared and discussed during the workshop showed clear improvements by beneficiaries:

- Definition and description of marketing/distribution channels
- Definition of the pricing and positioning strategy

However, some elements still need further consideration in the next Modules or as actions envisaged:

- Definition of the operative plan and related IPR
- Definition and calculation of financials
- Identification of resources (financial, human, technical, etc.);

3 MODULE A: Kick off (G2M-A)

3.1 Final list of KERs

KER1: Technology for Disassemblability and Repairability in In-Mould Electronics

Industrial solution enabling separation and reuse of components and plastics in in-mould electronics (IME), improving repairability, recyclability, and sustainability. Allows recovery of 90% of plastics and key electronic parts, aligning with future ESPR compliance. Licensing and research services are foreseen as exploitation channels.

KER2: Digital Twin

Simulation tool supporting sustainability and circularity assessment across product life cycles. Integrates multiple metrics and tools to guide eco-design, quantify strategic supply risks, and enhance regulatory compliance. Targeted at B2B industries with long-lifecycle assets. Exploitation foreseen via licensing or consultancy.

3.2 KER1: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics - Exploitation Intentions Table

KER 1	Input from the Beneficiary
Description	As we do not offer products, our KER provides patented design modifications to electronic devices that increase material recovery at end-of-life and offer repairability. <ul style="list-style-type: none"> ▪ Patents may be licensed. ▪ Approaches are being published (CIRC-uits publication and book chapter). ▪ We are in discussions to provide our experiences to future standards.
Target market/end users	<ul style="list-style-type: none"> • Automotive, house-hold appliances, any other market interested in IME (or generally speaking hybrid & printed electronics) • Customers/end-users are typically tier suppliers, foundries or leading tech suppliers
Competitive advantages	<ul style="list-style-type: none"> ▪ Current state of the art approach to IME does not make use of device separation to improve recyclability or repairability by lack of suitable industrial solution ▪ Sota solution to recycling loses all plastics to favour the metals. With separation, 90% of plastics may be recovered along with the plastics. ▪ Sota solutions cannot recover components from failed devices after manufacturing fail. Components will be lost.
Use model	Licensing of Technology Contract research including services like training, consultancy
Partners	<p>TRAXON Role: main industrial partner for technology implementation Contribution: holds an option to acquire 9 IME-related patents; owns 6 patents on Hybrid Printed Electronics (HPE) Focus: printed electronics manufacturing, automotive sector, strong links with Tier 1 suppliers</p> <p>TactoTek Role: early adopter and collaborator under an existing framework agreement Contribution: interested in commercializing IME technologies Focus: leading tech supplier for in-mould structural electronics</p>

	<p>TNO's Tech Transfer Partner Role: responsible for market analysis, business planning and access to financing Note: the specific entity is not named but referred to as a strategic valorisation partner</p>
Timing	The design-for-recycling principles applied to printed electronics and related topics were patented by TNO at Holst Centre and forms the basis for reparability. With a license to IP rights, commercialization may be possible. Implementation of this technology would require likely at least 3 years.
IP status	TNO has existing IP on this topic. TRACXON has an option agreement of taking over 9 IME patents. TRACXON has 6 patents on HPE.

The exploitation strategy is grounded in strong IP assets (held by TNO and TRACXON), with a licensing model and early partnerships already in place. However, to fully realize the value, the strategy should include clearer FTO assessments and tailored engagement with regulatory-driven adopters. Strategic alignment with OEMs and Tier 1 suppliers will be essential to scale uptake.

3.3 KER2: OFFIS Digital Twin - Exploitation Intentions Table

KER 2	Input from the Beneficiary
Description	The digital twin assists the user to assess the sustainability and circularity of a product throughout its life cycle. The simulation tool is a powerful instrument that can help the user to design and develop more sustainable and circular products, by using digital twin technology. This digital twin helps to assess the best environmental performance and is highly efficient in assessing the circularity and strategic supply risk for various products.
Target market/end users	<p>Target Market and Customer Segments: Target Market: Industries prioritizing sustainability, circular economy, and environmentally responsible practices (e.g., manufacturing, consumer goods, automotive). Specifically, we want to start with B2B companies with specialized machine equipment / pay per use contracts or long maintenance contracts.</p> <p>Customer Segments:</p> <ul style="list-style-type: none"> ▪ Product Designers and Engineers ▪ Sustainability Managers ▪ Innovation Teams ▪ Manufacturers and Producers ▪ Regulatory Compliance Officers ▪ Risk assessment teams ▪ Research Institutions and Universities
Competitive advantages	The digital twin combines different circularity measures which are not combined at the moment. It has links to multiple other tools and is thus modular and can be used according to the needs. The use of the digital twin highlights the impacts of circular behaviour/ design for physical products and sets them in relation to strategic risks.
Use model	The digital twin could be used for licensing or contract research or for consulting.
Partners	Partners from CIRC-UIITS with which the digital twin works: MARAS, SUPSI, TXT
Timing	2-3 years
IP status	IPR Background: GRETA (SUPSI) + circularity tool (MARAS) IPR Foreground: Copyright by Partner (e.g. OFFIS work), most of the work was done within CIRC-UIITS

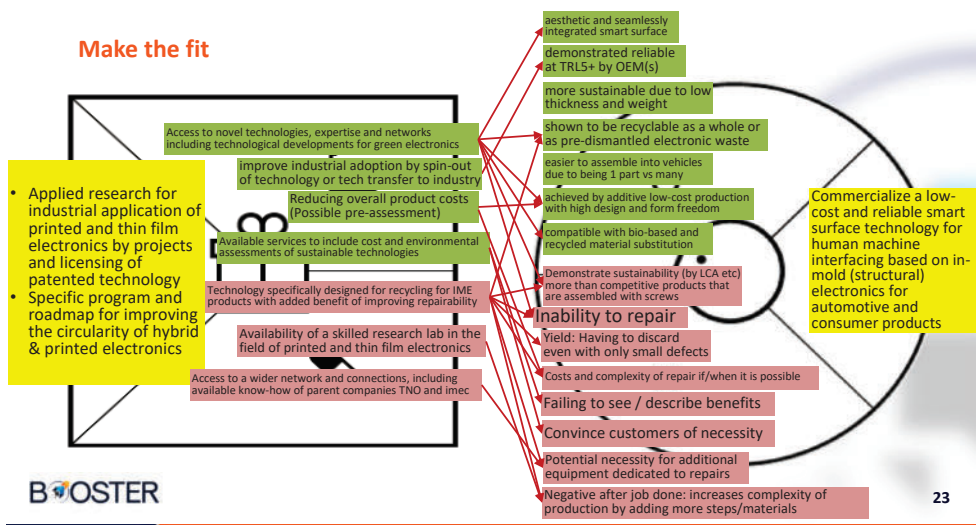
The digital twin addresses an emerging need in sustainable design, with a clear B2B focus and promising partner base. However, current uncertainties on IPR ownership and legal constraints (AI Act, database rights) present a risk. Finalizing

IP clearance and evaluating spin-off feasibility will be critical steps. A modular licensing approach may facilitate early adoption in targeted industrial niches.

4 MODULE B: Unique Value Proposition & Key Exploitable Result(s) (G2M-B)

4.1 KER 1: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

4.1.1 Value Proposition Canvas



EXPERT COMMENTS AND RECOMMENDATIONS

1. Customer Jobs

The canvas effectively identifies dual market goals: applied research in printed electronics and commercialization of smart surfaces for automotive/HMI. Strengthening the link between regulatory compliance (e.g. ESPR) and OEM needs would reinforce market-fit clarity.

2. Customer Pains

Pain points are well detailed and realistic (e.g. inability to repair, discarding after defects). Suggest grouping them under themes such as cost, complexity, and perception to better structure communication with stakeholders.

3. Customer Gains

The listed gains are numerous and credible—especially recyclability, design freedom, and weight reduction. It would be useful to emphasize measurable sustainability impacts (e.g. LCA benchmarks) to improve decision-making by OEMs.

4. Products & Services

A wide and solid offer is visible (technology, services, IP licensing). Clarifying which services are modular/customizable would support early adopter onboarding.

5. Pain Relievers

Multiple features directly address key pains (e.g. simplified vehicle integration, additive manufacturing). Consider quantifying benefits (e.g. cost avoided from repairable defects) to boost persuasive impact.

6. Gain Creators

The gain creators reflect high alignment with OEM drivers, especially TRL validation and aesthetics. A next step could be to map gain creators against customer segments (OEMs vs Tier 1) to tailor value messages.

4.1.2 Related projects

- MULTIMOLD (Horizon 2020, Grant No. 768775)**
 - **Focus:** Develops an innovative injection moulding process for integrated electronics, combining advanced electronic functionalities with high environmental standards.
 - **Relevance:** Shares the goal of embedding electronics into sustainable manufacturing processes, similar to KER 1.
 - **Source:** [CORDIS](#)
- iDEAR (Horizon 2020, Grant No. 101017214)**
 - **Focus:** Designs automated disassembly technologies for electronic waste to boost recycling efficiency and circularity.
 - **Relevance:** Fully supports KER 1's aim to improve disassemblability and material recovery in IME.
 - **Source:** [CORDIS](#)
- TactoTek – IMSE® Strategic Partnership with TNO**
 - **Focus:** Joint development of in-mould structural electronics with circular design approaches and repair-friendly architectures.
 - **Relevance:** Directly connected to KER 1's value proposition, merging structural electronics with sustainability and recyclability targets.
 - **Source:** TactoTek
- TracXon Hybrid Printed Electronics Initiative**
 - **Focus:** Spin-off of TNO focusing on industrial-scale production of hybrid printed electronics using sustainable roll-to-roll techniques.
 - **Relevance:** Supports KER 1 by advancing repairable and recyclable electronics with strong ties to Tier 1 automotive suppliers.
 - **Source:** [TracXon](#)

4.1.3 Related patents

- US11310915B2 - Thermoforming an Electronic Device with Surface Curvature**
 - **Assignee:** TNO
 - **Focus:** Method for manufacturing curved electronic devices by printing non-conductive support patterns on thermoplastic substrates, enabling reliable thermoforming without damaging electrical circuits.
 - **Relevance:** Supports KER 1's objectives by enhancing the structural integrity of in-mould electronics during forming processes, facilitating repairability and recyclability.
 - **Source:** Google Patents
- US11914184B2 - Integrated Optically Functional Multilayer Structure**
 - **Assignee:** TactoTek OY
 - **Focus:** Development of flexible substrate films with printed electrical conductors and embedded light sources, encapsulated within optically transmissive plastic layers for uniform illumination.
 - **Relevance:** Aligns with KER 1 by integrating electronics into thin, 3D structures, enhancing sustainability through reduced material usage and improved recyclability.
 - **Source:** Justia Patents
- Patent-pending - Method for Recycling In-Mould Electronics**

- **Assignee:** TNO
- **Focus:** Innovative method allowing printed electronics to be recycled and repaired, leading to cost savings and efficient material use.
- **Relevance:** Directly addresses KER 1's emphasis on recyclability and repairability, aligning with sustainable production methods and regulatory compliance.
- **Source:** Bits&Chips Article

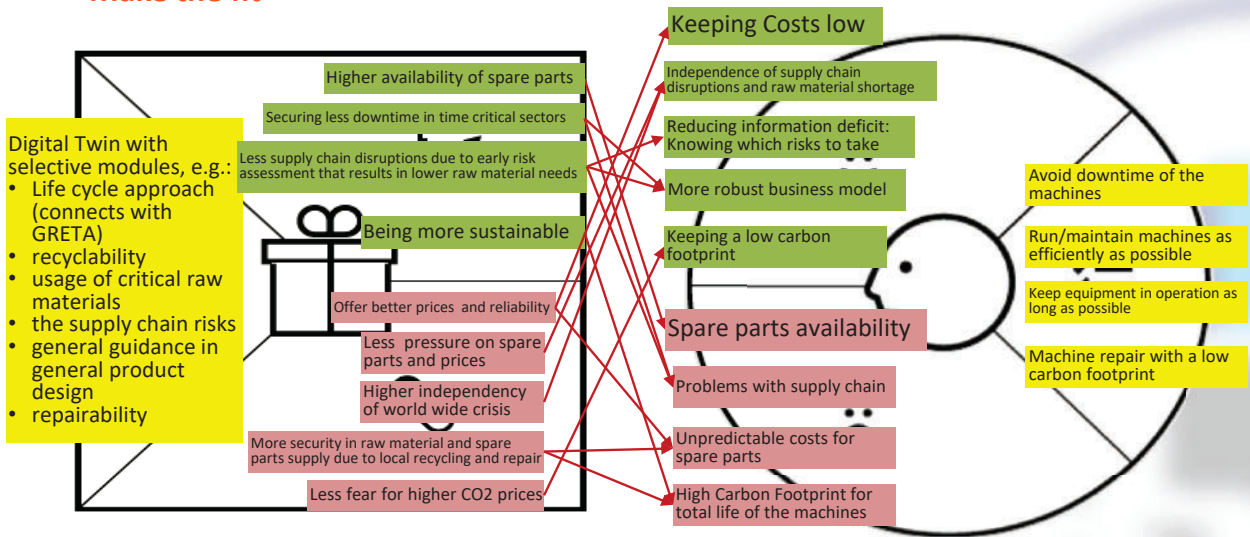
4.1.4 Related standards

1. **EN 45554:2020 – General methods for assessing the ability to repair, reuse, and upgrade energy-related products**
 - **Focus:** Methods to evaluate product repairability and ease of disassembly.
 - **Relevance:** Key to validating KER 1's design-for-repair strategy in IME devices.
 - **Source:** Nordic Council Publication
2. **EN 45555:2019 – General methods for assessing the recyclability and recoverability of energy-related products**
 - **Focus:** Framework to assess how much of a product can be recycled or recovered.
 - **Relevance:** Supports KER 1's objective of plastic and component recovery from IME structures.
 - **Source:** Nordic Council Publication
3. **SEMI Standards for Flexible Hybrid Electronics (FHE)**
 - **Focus:** Quality and sustainability standards for hybrid electronics production.
 - **Relevance:** Relevant for ensuring that KER 1's IME/HPE outputs meet industrial and environmental expectations.
 - **Source:** [SEMI FlexTech](#)

4.2 KER 2: OFFIS Digital Twin

4.2.1 Value Proposition Canvas

Make the fit



EXPERT COMMENTS AND RECOMMENDATIONS

1. Customer Jobs

Jobs such as maintaining machines efficiently, minimizing downtime, and ensuring sustainable operation are clearly stated. Consider adding roles like "Sustainability Officer" and "Risk Manager" to better link with B2B industrial customers.

2. Customer Pains

The canvas identifies key pains (e.g. supply chain unpredictability, high CO₂ costs, spare part pressure). These are well aligned with current industry concerns. Reinforcing how the Digital Twin enables proactive mitigation (vs reactive analysis) could improve differentiation.

3. Customer Gains

Strong emphasis is placed on sustainability, cost control, and resilience. To enhance persuasion, the tool's modularity and ability to simulate specific risk scenarios could be positioned as key gain accelerators.

4. Products & Services

The value proposition highlights a modular digital twin architecture, with lifecycle and circularity features. Clarifying the level of customization or integration with client platforms (e.g. ERP systems) would strengthen B2B appeal.

5. Pain Relievers

The solution addresses multiple pain points through simulation, early risk assessment, and reduced raw material needs. It would be useful to show real case metrics (e.g. % downtime reduction or cost avoidance) to support value claims.

6. Gain Creators

The tool enhances independence from supply chain shocks, enables low-carbon design, and improves robustness of business models. Mapping these gains to specific industry sectors (e.g. automotive, critical equipment) would improve targeting.

4.2.2 Related projects

1. **CIRCULOOS (Horizon Europe, Grant No. 101092295)**
 - **Focus:** Developing digital tools and business practices for small manufacturing companies to transition towards more circular manufacturing processes, integrating supply chain sustainability assessments and life cycle analysis.
 - **Relevance:** Aligns with KER 2's objectives by providing tools for sustainability and circularity assessment across product life cycles, aiding eco-design and regulatory compliance in B2B industries.
 - **Source:** CIRCULOOS Project
2. **EcoProIT (Chalmers University of Technology)**
 - **Focus:** Developing a simulation tool for detailed ecological footprint analyses of production systems, enabling benchmarking and environmental impact assessments across product life cycles.
 - **Relevance:** Supports KER 2's objectives by providing simulation capabilities for sustainability assessment, aiding in eco-design and strategic decision-making in B2B industries.
 - **Source:** [EcoProIT Project](#)

4.2.3 Related patents

1. **WO2014012590A1 – System and method of life-cycle assessment**
 - **Focus:** Provides a system and method for conducting life cycle assessments (LCA) to measure the sustainability performance of technologies.
 - **Relevance:** Aligns with KER 2's objectives by offering a structured approach to evaluate environmental impacts across product life cycles.
 - **Source:** Google Patents [Brevetti Google](#)
2. **US20150019225A1 – System and method for environmental impact assessment**
 - **Focus:** Describes a system for assessing environmental impacts using simulation tools that integrate various sustainability metrics.
 - **Relevance:** Supports KER 2's goal of integrating multiple metrics to guide eco-design and enhance regulatory compliance.
 - **Source:** Google Patents
3. **US20180275845A1 – Method and system for circularity assessment**
 - **Focus:** Introduces a method for assessing the circularity of products by analysing material flows and lifecycle stages.
 - **Relevance:** Directly pertains to KER 2's aim of enhancing circularity assessment across product life cycles.
 - **Source:** Google Patents

4.2.4 Related standards

1. ISO 14040:2006 – Environmental management – Life cycle assessment – Principles and framework
 - **Focus:** Provides the principles and framework for conducting life cycle assessments (LCA), including goal and scope definition, inventory analysis, impact assessment, and interpretation.
 - **Relevance:** Forms the foundational methodology for KER 2's simulation tool to assess environmental impacts across product life cycles.

- Source: ISO 14040:2006
- 2. ISO 14044:2006 – Environmental management – Life cycle assessment – Requirements and guidelines
 - Focus: Specifies requirements and provides guidelines for LCA, detailing the steps and considerations for conducting comprehensive life cycle assessments.
 - Relevance: Complements ISO 14040 by providing detailed requirements that KER 2's tool can integrate to ensure thorough and standardized LCA processes.
 - Source: ISO 14044:2006
- 3. ISO 14006:2020 – Environmental management systems – Guidelines for incorporating ecodesign
 - Focus: Offers guidelines to help organizations integrate ecodesign into their environmental management systems, enhancing environmental performance through product design.
 - Relevance: Supports KER 2's objective to guide eco-design by providing a framework for incorporating environmental considerations into product development.
 - Source: ISO 14006:2020

5 MODULE C: Exploitation Strategy (G2M-C)

5.1 KER 1: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics

5.1.1 Characterisation Table

KER name: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics		
	Input from the Beneficiary	Comments/ suggestions for the discussion at the training
Description	This KER offers patented device design modifications that improve reparability of in-mould electronics devices, as well as recyclability. Our design modifications include a.o. specific coatings for controlled / triggered adhesion between parts of the IME device.	<i>Make sure it is clear and easy to be understood by a third party. Make sure it helps to visualise your KER.</i>
Target market/end users	Target markets in our perception are <ul style="list-style-type: none"> ▪ Automotive industry may be the first industry to adopt IME and printed electronics. Pricewise there is more room for this type of electronics, but legislation is not yet driving the industry towards improving reparability. ▪ Domestic applications appear on e.g. touch panel and lighting applications; there is some support from legislation p.o.v., namely the ESPR. IME has not, however, been adopted yet. ▪ Medical systems 	<i>To finalise the exploitation plan and prepare the use of the KER, is needed a clear identification of the target market, with its segmentation. It should include both a qualitative and quantitative description in terms of size and features.</i>
End-users needs / problems	<ul style="list-style-type: none"> ▪ Lack of reparability and thus lack of meeting future regulations (ESPR) ▪ Inability to recover components upon manufacturing fail (thus losing money). 	<i>Identifying the key problem is crucial to assure the impact of the result.</i> <i>It is advised to describe the problems rather than illustrate the proposed solution.</i> <i>Problems addressed are at the basis of the characterization of the solution and identification of customers.</i> <i>Being able to solve problems the "customers" face is key to ensure the result is used and that the envisaged</i>

Competitive advantages	<ul style="list-style-type: none"> ▪ IME by itself has many advantages over conventional electronics: <ul style="list-style-type: none"> ○ Thinner by a factor 5-10 ○ Light weight in comparison, thus saving fuel ○ Higher design freedom ▪ Current state of the art approach to IME does not make use of device separation to improve recyclability or reparability by lack of suitable industrial solution. This is what this KER offers. ▪ Sota solution to recycling loses all plastics to favour the metals. With separation, 90% of plastics may be recovered along with the plastics with our KER. The functional substrate with exposed silver circuitry may be specifically targeted by metallurgy leading to better yields. ▪ Sota solutions cannot recover components from failed devices after manufacturing fail. Components will be lost. Our KER offers to retrieve these expensive components with CRMs. 	<p><i>impact is achieved. For the future consider the possibility to update and validate the problems.</i></p> <p><i>Competitive advantages are well listed. Highlighting measurable impacts (e.g., time saved, error reduction) and linking them to value propositions per segment would strengthen positioning.</i></p>
Use model	<p>Licensing of Technology Contract research including services like training, consultancy</p>	<p><i>Use model should be consistent with target market and customers' needs.</i></p> <p><i>Use model and target market, customers need to be consistent. In the case of licensing, consider that are several different types of licensing agreements that could be used. Discuss the different options with colleagues from the legal department involved in licensing deals. Delivering a service entails the presence of a "competent" organisation with procedures, insurances and certifications ready to offer the services according to the expectations of the potential customers.</i></p>
Early Adopters	<p>Early adopter is the company we collaborate with (and realized a framework agreement with during the CIRC-uits project): TactoTek. Their goal is to see IME commercialized and selling licenses to their tech platform. Their need is to come across as a (more) sustainable electronics supplier that meets the requirements of OEMs as well as EU.</p> <p>Structural electronic device manufacturers and other (Tier) suppliers may follow.</p> <p>OEMs and automotive brand owners will be last, but may feel the pressure to innovate earlier, thus pushing tier and technology suppliers.</p>	<p><i>Early adopters are the ones who feel the identified problems the most. Make sure the identification is aligned with the problem/customer fit.</i></p> <p><i>Consider integrating information on early adopters with their size, where they are located, etc.</i></p> <p><i>To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to "early majority". Note that innovators</i></p>

		<p>are the ones that “use” the “alfa” version (2,5%, often partners in the R&D project); early adopters are the customers ready to “use” the “beta” version (13,5%). New initiatives fail because they are not able to reach early adopters.</p> <p>You should be as much precise as you can. Being the early adopters the first ones you would like to reach out with your innovative solution it will be important to be able to connect with them. Make sure your early adopters are consistent with the target market (customers).</p>
Adopters’ problems/needs	<p>Upcoming regulations are the biggest problem for the end-users, which is then transferred to the tier suppliers. “a sustainable solution” needs to be provided that meets all requirements. Costs of those solutions is another problem. It may not cost anything unless it offers much more than the less sustainable option.</p>	<p>Identifying the key problem is crucial to assure the impact of the result.</p> <p>It is advised to describe the problems rather than illustrate the proposed solution.</p> <p>Problems addressed are at the basis of the characterization of the solution and identification of customers.</p> <p>Being able to solve problems the “customers” face (regional authority) is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</p>
Alternative solution	<p>Alternative approaches to improve sustainability includes substituting the plastics with recycled plastics and/or bio-based plastics and the mined metals with recycled metals. While this reduces the environmental impact of each product, it does not change the recyclability and repairability. The metals will still be captured in the plastics at end-of-life. Repairability requires solutions like our KER to be improved. Using our KER may not only improve repairability during the use phase but also enable a cost reduction during manufacturing by recovering parts of the device with the expensive components. This may increase the overall yield and reduce costs per part.</p>	<p>Alternative solutions are important to benchmark the novel solution and to get an insight on competition. Collecting information on weaknesses and strengths of the alternative solutions helps to compare and to quantify the added value of the proposed solution and investigate who is providing them and under which conditions.</p>
Unique Value Proposition	<p>We offer multiple potentially suitable solutions to address the problems. Our KER enables repairability during manufacturing and use phase through the use of coatings that can easily be integrated into the device during manufacturing at little extra effort. Alternatively, we have come up with solutions that may not even require new coatings to be added, but these may be more specific to certain</p>	<p>The UVP is crucial to ensure the use and approach the early adopters. Your strength points highlight your uniqueness compared to the alternative solutions. The UVP is the reason why your solution will be</p>

	designs/colours/etc. Despite the chosen approach, our KER offers improved reparability which has not been possible yet for IME.	<i>adopted. Please further validate the UVP by stressing your element of uniqueness and highlight the quality of the solution. Please consider linking the mentioned features to the identified problem.</i>
Competitors	<p>Potentially, IME companies may pick-up the topic, such as Symbiose, WALTERPACK, TACTOTEK, however, this is not very likely as these companies are either tech or product suppliers, rather than repair firms. TRACXON however is a manufacturing company for printed electronics that is focused on IME and automotive and has a strong relation with Tier 1 suppliers. While these firms are capable of inventing and proving solutions to improve circularity, the initial low TRL research is not typical daily work. If it is not enforced by OEMs and legislation, it is not likely that these firms will pursue these options.</p> <p>Universities, however, may provide the necessary low TRL work that competes with our solutions. A great difference is that we pursue options close to the industry as we, as an RTO, are positioned between academia and industry. We should be able to bring the necessary solutions more quickly to higher TRL to make industrial adoption more likely/quicker.</p>	<i>Competitors are connected to the use model. Weaknesses and strengths of the competitors might be presented in order to stress the uniqueness of your solution. Take also in consideration that a collaboration with the competitors might be useful.</i>
Timing	The design-for-recycling principles applied to printed electronics and related topics were patented by TNO at Holst Centre and forms the basis for reparability. With a license to IP rights, commercialization may be possible. Implementation of this technology would require likely at least 3 years, but this depends greatly on the adoption of IME by the sectors, but also the existence of regulations that enforce an improved circularity.	<i>During the development of the project keep a continuous attention to the market timing to be ready to adapt the exploitation and dissemination actions. Please consider that estimated time to market might affect the plan needed to timely assure proper resources for further developments.</i>
IP Strategy	TNO has existing IP on this topic that may be licensed by companies (or bought under specific circumstances). TRACXON has an option agreement of taking over 9 IME patents. We have performed several IP searches and believe we are uniquely position for the time being. Where possible, we will continue to expand our IP portfolio. TRACXON has 6 patents on HPE.	<i>The IP strategy is comprehensive. To support scale-up, include a roadmap for new filings or IP exploitation options (e.g., OEM agreements, data licensing models).</i>

5.1.2 Exploitation Roadmap

KER name: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics		
	Input from the Beneficiary	Comments/ suggestions for the discussion at the training
Actions	<p>While the industrialisation of repairable IME depends on many factors outside of our control, including adoption of IME for mass manufacturing and necessary legislation to enforce rights of consumers for i.e. automotive electronics, we intend to continue our activities.</p> <ul style="list-style-type: none"> ▪ Business development (finding suitable partners) ▪ Technological validation at higher TRL in collaboration with interested parties ▪ (Market analysis) ▪ (IP landscaping: largely performed with IP filing) ▪ Partner search for implementation of technology <p>On short term, we focus on working out a proposal for EU project(s) to use the KER on different use cases in the wearables market (H2020 Materials-47 call). This will allow us to obtain additional proofs supporting our findings so far, evaluate our technology and raise the TRL.</p>	<p><i>The roadmap helps to have a clear vision of what will happen after the end of the project to enable the use and adoption of the KER. Focus should be put on actions to be performed the first 6 months after the project ends and on what it is needed to prepare them during the last 3-6 months of the project.</i></p> <p><i>Possible actions to be taken are:</i></p> <ul style="list-style-type: none"> • <i>Finalise the business model</i> • <i>Define the financial strategy</i> • <i>Finalisation of ownership agreements with other partners</i> <p>....</p>
Roles	<p>TNO – main responsible partner for technology development. Tech Transfer – TNO partner for market analysis/business plan/financing etc. TracXon – main partner for implementation of technology. Also: TactoTek (Finland) – dominant tech supplier for in-mould structural electronics, with whom we have a framework agreement to develop sustainable IMSE</p>	<p><i>Focus on who, within the partnership, will be responsible to implement the planned actions. Describe who will do what. Each role must be consistent with the actions in order to avoid any criticalities in the implementing phase. Reflect if the partners will be keen to support you in carrying out the action for a common scope.</i></p>
Milestones	<p>Milestone: participation in a collaborative project that involves demonstrating reparability on a commercial product by an involved end-user. KPI: TRL 3-6 of reparability in a consumer product, one or more additional patents and/or publications</p> <p>More milestones: Not realistic to provide as adoption by industry cannot be set out in a timeline. Reparability may become mandatory but is not at this point.</p>	<p><i>The milestones focus on what is needed to be checked to monitor advancements in the implementation of the roadmap. This allows you to control if the roadmap is properly implemented. Make sure the timing is consistent and include a set of KPIs for monitoring the milestones achievement. If the timing of the actions is not defined also milestones are undetermined.</i></p>
Costs	<p>Currently our investments focus on maintaining filed patents. Where possible, we intend to participate and invest in further developments on this topic in (EU) projects. One collaborative project is currently being explored that incorporates reparability of IME for a consumer product.</p>	<p><i>It is very important that the estimate present in the plan is consistent and validated.</i></p>

Revenues	At present, due to lack of active regulations on reparability, we foresee no revenues.	<i>An estimation of revenues is important for the finalisation of the exploitation plan. Estimate potential revenues according to your use/business model, early adopters, and expected customers, and include the information in the draft exploitation plan.</i>
Other sources of coverage	Further developments require funding from preferably industrial parties (early adopters), but more likely funding by governments (NL, EU). When funded, TNO needs to co-invest.	<i>Make an estimation of the resources needed to bridge the investment needed to increase TRL and ensure the result is used. Review the action plan to make sure to obtain the funds at the right time in order to cover the costs incurred before collecting the first revenues.</i>

5.1.3 Risk Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
Partnership Risk Factors							
1	No partner for implementing/manufacturing technology	8	5	40	Find early adopters: challenging due to lack of regulations	5	Between Control & No Action
2	Preferred partner going bankrupt	5	2	10	Find more partners: challenging due to lack of regulations	5	Between Control & No Action
Technological Risk Factors							
3	Technology not meeting specs of automotive industry	6	4	24	Invest also in other industry with less stringent specs and improve technology constantly.	8	Control.
4	LCA improvement not enough	6	2	12	Initial LCA looks promising. Still do more research and improve.	8	Control.
5	Other technology better/cheaper	8	4	32	Monitor alternatives and close gaps where needed	7	Control.
Market Risk Factors							

6	Lack of technical suitable approach for high TRL application	8	4	32	More research required to find more suitable approaches	8	Control.
7	Lack of cost-effectiveness for high TRL application	8	6	48	More research required to find more suitable approaches	6	Control.
IPR/Legal Risk Factors							
8	Patent infringement	7	2	14	Our focus is to avoid IP infringement by having a policy on sharing of sensitive information, establishing NDAs or contracts with IP agreements. Any new contact we wish to share sensitive information with will be asked to sign such an agreement. We stimulate recognition of protectable knowledge developments. We also have an IP policy for collaboration with universities: for instance, an NDA is in place with all Dutch technical universities.	3	No Action'
9	Lack of sufficient patented approaches	7	4	28	Continue exploring and filing suitable approaches to claim domain	6	Control.
Financial/Management Risk Factors							
10	Weak exploitation	8	4	32	Find unique selling points for our approach and match with problems of market	7	Control.
11	Few resources for further research due to lack of market adoption / EU regulations	8	6	48	To maintain the option to exploit our KER without immediate involvement of industry, we meanwhile pursue collaborative (EU) projects on the topic.	7	No Action'
Environmental/Regulation/Safety risks:							
12	EU legislation changed or delayed in favour of not needing recycling / repairing	10	5	50	Publish approaches and get involved in discussions with experts, lobbying	4	Between No Action & Warning



EXPERT COMMENTS AND RECOMMENDATIONS

The risk map shows a clear awareness of key challenges such as technology integration, IP transfer, and industrial scalability. However, mitigation strategies are mostly qualitative and need to be backed by timelines and responsible actors. Risks related to supply chain acceptance and recyclability claims validation require structured engagement with OEMs and lifecycle analysts. Integrating KPIs on recyclability performance and developing joint exploitation protocols (especially with TRACXON and TactoTek), would strengthen resilience. The regulatory and market context (e.g., ESPR, right to repair) should be monitored to convert legal risks into strategic levers for early market positioning.

5.1.4 Lean Canvas

The Lean Canvas		IME Repairability		14-05-2025
				Final
<p>Problem In-mould electronics (IME) is an innovative technology for plastic-electronic devices. Currently these devices lack repairability and thus meeting future regulations. Also, this means an inability to recover components upon manufacturing fails.</p> <p>Alternative Solutions Alternative approaches to improve sustainability includes substituting the plastics with recycled plastics and/or bio-based plastics and the mined metals with recycled metals. While this reduces the environmental impact of each product, it does not change the recyclability and repairability.</p>	<p>Solution Our solution offers patented device design modifications that improve repairability of in-mold electronics devices, as well as recyclability. Our design modifications include a.o. specific coatings for controlled / triggered adhesion between parts of the IME device.</p> <p>Key Metrics</p> <ul style="list-style-type: none"> - IME market expanding at CAGR of 31% next decade. - Our UVP: 100% repairable and refurbishable - UVP: Recovery of 100% of components 	<p>Unique Value Proposition We offer multiple potentially suitable solutions to address the problems. Our KER enables repairability during manufacturing and use phase through the use of coatings that can easily be integrated into the device during manufacturing at little extra effort. Alternatively, we have come up with solutions that may not even require new coatings to be added, but these may be more specific to certain designs, colours, etc. Despite the chosen approach, our KER offers improved repairability which has not been possible yet for IME.</p>	<p>Unfair Advantage Since IME has not even reached mainstream our UVP solves a future problem. Unfair advantage is that our technology doesn't require technological superiority because it will be mandatory by regulations. There is no other option than to utilize our technology. Competitors will be to late if have to start R&D when regulations arrive.</p> <p>Channels Partnerships with tier 2 production companies that supply the automotive industry. Patents and conferences.</p>	<p>Customer Segments Target markets in our perception are</p> <ul style="list-style-type: none"> - Automotive industry may be the first industry to adopt IME and printed electronics. Pricewise there is more room for this type of electronics, but legislation is not yet driving the industry towards improving repairability. - Domestic applications appear on e.g. touch panel and lighting applications; there is some support from legislation p.o.v., namely the ESPR. IME has not, however, been adopted yet. - Medical systems <p>Early adopters IME production company (already a partner).</p>
<p>Cost Structure N.A</p>		<p>Revenue Streams Licensing of Technology Contract research including services like training, consultancy</p>		
PRODUCT		MARKET		

Lean Canvas is adapted from The Business Model Canvas (<http://www.businessmodelgeneration.com>) and is licensed under the Creative Commons Attribution-Share Alike 3.0 Un-ported License.

5.2 KER 2: OFFIS Digital Twin

5.2.1 Characterisation Table

KER name: OFFIS Digital Twin		
	Input from the Beneficiary	Comments/ suggestions for the discussion at the training
Description	The digital twin assists the user to assess the sustainability and circularity of a product throughout life cycle. The simulation tool is a powerful instrument that can help the user to design and develop more sustainable and circular products, by using digital twin technology. This digital twin helps to assess the best environmental performance and is highly efficient in assessing the circularity success for various products.	<i>Make sure it is clear and easy to be understood by a third party. Make sure it helps to visualise your KER.</i>
Target market/end users	Our resilient design advisor helps machine suppliers with strong service approach who want their machinery run continuously with low total cost of operation b< reducing spare parts and supply chain risks and increasing circularity.	<i>To finalise the exploitation plan and prepare the use of the KER, is needed a clear identification of the target market, with its segmentation. It should include both a qualitative and quantitative description in terms of size and features.</i>
End-users needs / problems	They want to make their products more sustainable but do not know which component version combination makes the product truly sustainable in the multiple sustainability dimensions. They need More security in raw material supply due to local recycling and repair which result in less fear for higher CO2 prices.	<i>Identifying the key problem is crucial to assure the impact of the result. It is advised to describe the problems rather than illustrate the proposed solution. Problems addressed are at the basis of the characterization of the solution and identification of customers. Being able to solve problems the “customers” face is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</i>
Competitive advantages	<ul style="list-style-type: none"> ▪ Assisting the customer in avoiding less downtime of machines ▪ Maintaining machines as efficiently as possible ▪ Keep Equipment in operation as long as possible Machine repair with low carbon footprint.	<i>Competitive advantages are well listed. Highlighting measurable impacts (e.g., time saved, error reduction) and linking them to value propositions per segment would strengthen positioning.</i>
Use model	Manufacturing of a new product, provision of a service, licensing.	<i>Use model should be consistent with target market and customers’ needs. Use model and target market, customers need to be consistent. In the case of licensing, consider that are several different types of licensing agreements that</i>

		<p>could be used. Discuss the different options with colleagues from the legal department involved in licensing deals. Delivering a service entails the presence of a “competent” organisation with procedures, insurances and certifications ready to offer the services according to the expectations of the potential customers.</p>
Early Adopters	<ul style="list-style-type: none"> ▪ Partners in other research grants that want to design their product as sustainable as possible. ▪ Companies that want to innovate their old products to be more sustainable. ▪ Manufacturers and product designers ▪ Suppliers ▪ Consultants <p>EoL actors.</p>	<p>Early adopters are the ones who feel the identified problems the most. Make sure the identification is aligned with the problem/customer fit.</p> <p>Consider integrating information on early adopters with their size, where they are located, etc.</p> <p>To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to “early majority”. Note that innovators are the ones that “use” the “alfa” version (2,5%, often partners in the R&D project); early adopters are the customers ready to “use” the “beta” version (13,5%). New initiatives fail because they are not able to reach early adopters. You should be as much precise as you can. Being the early adopters the first ones you would like to reach out with your innovative solution it will be important to be able to connect with them. Make sure your early adopters are consistent with the target market (customers).</p>
Adopters’ problems/needs	<p>They want to make their products more sustainable but do not know which component version combination makes the product truly sustainable in the multiple sustainability dimensions.</p>	<p>Identifying the key problem is crucial to assure the impact of the result.</p> <p>It is advised to describe the problems rather than illustrate the proposed solution.</p> <p>Problems addressed are at the basis of the characterization of the solution and identification of customers.</p> <p>Being able to solve problems the “customers” face (regional authority) is key to ensure the result is used and that the envisaged impact is achieved. For the future consider the possibility to update and validate the problems.</p>
Alternative solution	<p>They use the life cycle analysis (LCA) for one product to get the information about life cycle analysis parameters (e.g. GRETA). Information about other sustainability KPIs like reparability, recyclability or criticality of materials have to be calculated for each product version by hand to be combined with the LCA results.</p>	<p>Alternative solutions are important to benchmark the novel solution and to get an insight on competition. Collecting information on weaknesses and strengths of the alternative solutions helps to compare and to quantify the added value of the proposed solution and investigate who is providing them and under which conditions.</p>
Unique Value Proposition	<p>The digital twin combined with the advisory tool function within the CIRC-UIITS project has two purposes: on the one hand, it helps pilots to redefine their product design and, on the other hand, it aims to help manage the future end</p>	<p>The UVP is crucial to ensure the use and approach the early adopters. Your strength points highlight your uniqueness compared to the alternative solutions. The UVP is the reason why your solution will be adopted. Please</p>

	<p>of life of a product's components to optimise circularity either by repair and/or recycling (or the most optimal/circular combination). Both purposes are intertwined and are thus represented as such in the advisory tool.</p> <p>In the first context, the Advisory function guides pilots in the optimisation of their product designs by exploiting different analyses of the existing product. Subsequently, relevant data collected and calculated from these analyses help decision-makers to formulate new designs. Advisory further reinforces this decision-making process by providing an illustrative dashboard summarising the collected and calculated data/results based on the digital twin. This dashboard facilitates the comparison of previous and future design, allowing the decision maker to have an insight into the results of the analyses performed on both iterations on the basis of a range of KPIs addressing various aspects of circularity and sustainability. It will allow the user to use interactive optimization and multi-criteria decision support methodologies. This facilitates the choice of the optimal product design direction.</p> <p>In the second context, the usefulness of the Advisory extends to assisting pilots during the future end-of-life phase of the product. Through an interactive dashboard, the consultancy illustrates feasible end of life scenarios on the basis of quantified comparisons. The dashboard outlines and calculates routes for reparability and the necessary resource use for each step. It also shows recycling possibilities of the product and its components. Similar to the first context, this will be done on the basis of various KPIs. The advisory will be based on the combination and linking of the GRETA, results from the Recycling Simulation Tool and data from the OEM within the platform. The combination of both tools/approaches will be the joint KER in the Advisory.</p>	<p><i>further validate the UVP by stressing your element of uniqueness and highlight the quality of the solution.</i></p> <p><i>Please consider linking the mentioned features to the identified problem.</i></p>
<p>Competitors</p>	<p>Sphera, iPoint, Ansys Granta, Sustainable Minds, Dassault Systems.</p>	<p><i>Competitors are connected to the use model. Weaknesses and strengths of the competitors might be presented in order to stress the uniqueness of your solution. Take also in consideration that a collaboration with the competitors might be useful.</i></p>
<p>Timing</p>	<p>2-3 years</p>	<p><i>During the development of the project keep a continuous attention to the market timing to be ready to adapt the exploitation and dissemination actions. Please consider that estimated time to market might affect the plan needed to timely assure proper resources for further developments.</i></p>

IP Strategy	Background IP: GRETA (SUPSI) + circularity tool (MARAS), Foreground IP: no strategy at this moment	<i>The IP strategy is comprehensive. To support scale-up, include a roadmap for new filings or IP exploitation options (e.g., OEM agreements, data licensing models).</i>
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5.2.2 Exploitation Roadmap

KER name: OFFIS Digital Twin		
	Input from the Beneficiary	Comments/ suggestions for the discussion at the training
Actions	3-6 months after the end of the project, we will have a search with our legal department if there is a conflict of individual property rights and if there is a conflict with any legal constraints in Europe (e.g. AI act). A finalisation of a business plan is strongly dependent of the intellectual property rights of all modules needed for the digital twin. If possible, we collect authorisations of involved data or databases and start with our exploitation plan.	<i>The roadmap helps to have a clear vision of what will happen after the end of the project to enable the use and adoption of the KER. Focus should be put on actions to be performed the first 6 months after the project ends and on what it is needed to prepare them during the last 3-6 months of the project.</i> <i>Possible actions to be taken are:</i> <ul style="list-style-type: none"> • Finalise the business model • Define the financial strategy • Finalisation of ownership agreements with other partners <i>....</i>
Roles	OFFIS will be the main responsible for the exploitation roadmap (exploiting the KER). However, we need to check if a spin-off is possible, as OFFIS is a non-for-profit organisation.	<i>Focus on who, within the partnership, will be responsible to implement the planned actions. Describe who will do what. Each role must be consistent with the actions in order to avoid any criticalities in the implementing phase. Reflect if the partners will be keen to support you in carrying out the action for a common scope.</i>
Milestones	Check involved parties and legal constraints with OFFIS legal department: M 1-3 Check individual property rights with all involved databases: M1-4 Check the possibility of a spin-off: M3-6.	<i>The milestones focus on what is needed to be checked to monitor advancements in the implementation of the roadmap. This allows you to control if the roadmap is properly implemented. Make sure the timing is consistent and include a set of KPIs for monitoring the milestones achievement. If the timing of the actions is not defined also milestones are undetermined.</i>
Costs	Costs estimates will be allocated to mainly person months. Unclear today how much work still needs to be done. Maybe there are licences for databases involved. .	<i>It is very important that the estimate present in the plan is consistent and validated.</i>

Revenues	Revenues you will expect to collect by mainly licensing. At this moment unknown how the licensing would look like. There might be also revenues allocated for the service to implement the service at the customer's site. 1 year after project end, there is nearly no revenue and a test period. 2-3 years after the project first revenues expected.	<i>An estimation of revenues is important for the finalisation of the exploitation plan. Estimate potential revenues according to your use/business model, early adopters, and expected customers, and include the information in the draft exploitation plan.</i>
Other sources of coverage	Resources needed to bridge the investment needed to increase TRL and ensure the result is used: other project grants and national/regional incentives. We are already applying for further funding in 2026 now.	<i>Make an estimation of the resources needed to bridge the investment needed to increase TRL and ensure the result is used. Review the action plan to make sure to obtain the funds at the right time in order to cover the costs incurred before collecting the first revenues.</i>

5.2.3 Risk Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Disagreement over Time spent for company	3	7	21	Agreement that not everyone needs to have the same input at the same time, instantiate time log if necessary	9	Control.
2	Disagreement on further investments: Some partners may leave	7	5	35	long term plan, be open about current situation to other owners, if one partner wants to leave make exit-plan and communicate early,	8,5	Control.
3	Disagreement on ownership rules	4	5	20	Communicate early, Have regular meetings about ownership rules, divide tasks, Talk about rules at the beginning	9	Control.
	Technological Risk Factors						
4	Tool has to be rebuilt from scratch to accommodate new requirements	8	2	16	Create documentation for tool to be used in the case of rebuild, make requirements as broad as possible to ensure future usability	6	Control.

5	Worthless result: Better technology/methodology exists	2	8	16	Change Business model / Include consulting / include customization / add other components to DT / Focus on other markets	9	Control.
Market Risk Factors							
6	Nobody buys: Unsuitable sales force	9	6	54	Use existing contacts, Social media, go to fairs, use research projects for validation / testimony, use exploitation plan by CIRC-UIITS, attend training, use old customers for rapport/ recommendations / testimonials	5	Between Action & Warning
7	Nobody buys: Customers don't see need	6	7	42	Go to events where long-term risk management, sustainability experts are there, see above	7	Control.
8	Nobody buys: Unstable market (Trump) shifts need	6	6	36	Use the circumstances as example for the need of the tool, wait until market has calmed down,	7	Control.
IPR/Legal Risk Factors							
9	Know-how risks: a counterfeit cannot be proved	5	5	25	Focus on consulting than on the tool itself, use old customers for rapport/ recommendations / testimonials, select profitable niche	7	Control.
10	Legal problems: Proceeding against us	9	1	9	Focus on consulting than the tool itself, do a thorough patent and market analysis, legal expenses insurance, ask OFFIS' legal team for advice before launch of company	9	Control.
Financial/Management Risk Factors							
11	Multiple changes to original objectives	3	5	15	Yearly strategy meeting to review customer acquisition	8	Control.
12	Know-how risks: leaks of confidential information	7	2	14	Use secure IT infrastructure when handling sensitive customer information, don't give new employees access to everything, create NDA	9	Control.
13	No resources (human/financial) secured to make next step toward exploitation	9	4	36	Apply for funding, use start-up networks to explore possibility of outside funding, have a blocker to secure human resources, employ students for help in times of lacking human resources	8	Control.
Environmental/Regulation/Safety risks:							
14	Product/service does not comply with standards	8	1	8	Determine gap and make plan to overcome gap, go to conferences to get feedback on state-of-the-art	9	Control.
15	Influence of laws and regulations	5	2	10	Keep up to date with changes in law / regulations, anticipate changes and develop strategy how to deal with them	8	Control.



EXPERT COMMENTS AND RECOMMENDATIONS

The risk map correctly identifies potential barriers such as data availability, user acceptance, and the complexity of integrating multiple assessment metrics. However, mitigation actions appear too general and lack reference to testing cycles, industrial pilots, or interface validations. A stronger link between identified risks and modular deployment strategy is needed. It is advisable to define use-case-based validation phases, particularly for circularity assessment and regulatory compliance. Cross-partner alignment on data ownership and IP boundaries must also be clarified. Proactive risk management could become a differentiator if tied to compliance foresight (e.g., DPP, CSRD) and digital policy evolution in B2B sectors.

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5.2.4 Lean Canvas

The Lean Canvas		OFFIS Digital Twin	12-05-2025	
			Iteration #1	
<p>Problems</p> <ul style="list-style-type: none"> - Problems with Supply Chain → Reliability - Spare Parts Availability + Costs unpredictable - High Carbon Footprint for total life of the machines <p>Alternative /Current Solutions</p> <p>LCA, Manual assessment of reparability, criticality and combination with other results, accepting the risk</p>	<p>Solution</p> <p>Sustainability modules:</p> <ul style="list-style-type: none"> • general guidance in general product design • usage of critical raw Materials → supply chain risks • Integrates LCA, recyclability and reparability assessment <p>Key Metrics</p> <p>1. Customer Retention Metrics: Net Revenue Retention (NRR): Track % of revenue retained annually from existing customers (excluding discounts, refunds, etc.). Active User Engagement Rate: Measure daily active users (DAU) relative to total user base. 2. Financial and Growth Metrics: Time to First Sale (TFS): Track time from initial customer contact to first sale. Customer Acquisition Cost (CAC): Measure cost per new customer. 3. Integration & Partnership Metrics: API Integration Depth: Track number of APIs with CRISYS embedded in partner systems. 4. Operational Efficiency: Track cycle time reduction and defect rate reduction.</p>	<p>Unique Value Proposition</p> <p>The digital twin uniquely integrates multiple sustainability assessments with interactive multi-criteria optimization to empower manufacturers in both product design and end-of-life circularity—addressing two critical gaps in today's sustainability solutions.</p> <p>Why it stands out:</p> <p>1. Design Optimization Uniqueness: Unlike static analysis tools, our dashboard enables live comparison of current vs. redesigned products across 111 circularity KPIs (e.g., recyclability score, repair costs). This directly solves the industry challenge of balancing sustainability with feasibility—pilot reduce material waste by up to 40% while maintaining cost efficiency.</p> <p>2. End-of-Life Precision: By synthesizing data from CRITA, Recycling Simulation Tool, and CEMAs, we provide actionable scenarios (e.g., "Repair Route A saves €12k vs. Recycling Route B"). Competitors lack this granularity, leaving manufacturers guessing—see turn fragmented data into prioritized recovery pathways, increasing component reuse rates by 25%.</p> <p>Validation Point: Early adopters achieved 30% faster design iterations and 25% higher end-of-life revenue through our dashboard optimization—proof that bridging design and disposal unlocks circular profitability.</p>	<p>Unfair Advantage</p> <p>Proprietary Circularity Algorithms & Real-Time Scenario Modeling</p> <p>Why Unfair: Patented models that simulate repair/recycle trade-offs with unmatched speed/accuracy (e.g., predicting end-of-life revenue uplift in seconds). Competitors would need years of R&D to match this, especially if tied to unique datasets like from CIRC-UIITS</p> <p>Channels <small>Details see notes</small></p> <ul style="list-style-type: none"> - Strategic Industry Partnerships - Direct Enterprise Sales Teams - Targeted Thought Leadership & Digital Engagement - Industry-Specific Trade Shows Focus: - API Integrations with OEM Platforms 	<p>Customer Segments</p> <p>B to B machines suppliers with strong service approach and potentially product as a service business model on the European Market</p> <p>Early adopters: Copy Machine Producers with the above characteristics</p>
<p>Cost Structure</p> <p>Hardware: 15% Software: 30% Cloud: 10% Marketing: 5% R&D: 20% Operations: 15% Support: 5%</p>		<p>Revenue Streams</p> <p>License: 40% Subscription: 35% Consulting: 15% Support: 10%</p>		

PRODUCT

MARKET

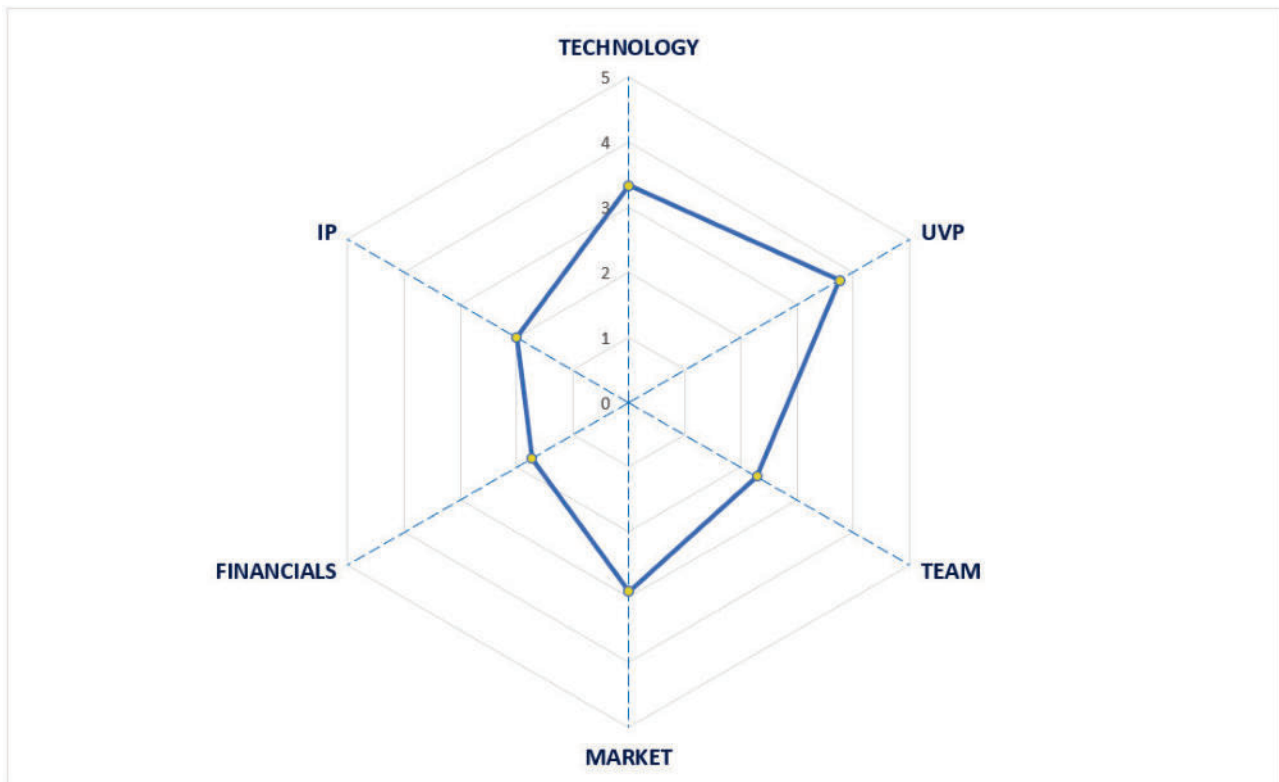
Lean Canvas is adapted from The Business Model Canvas (<http://www.businessmodelgeneration.com>) and is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License.

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6 MODULE D: Business Plan (G2M-D)

6.1 KER 2: OFFIS Digital Twin

6.1.1 BOSAT



The BOSAT self-assessment tool highlighted that the most developed components of the exploitation approach for the concerned KER is the UVP, while the one that needs to be further discussed and needs further work is FINANCIALS.

6.1.2 Business Plan

A. Executive Summary

DT OFFIS is a research-driven spin-off initiative from the OFFIS Institute for Information Technology, dedicated to advancing the digital transformation of manufacturing systems through sustainability and circularity. At the core of the project is CIRCUITS, a modular digital twin platform that enables companies to assess and optimize environmental, circularity, and supply chain risks during early product development.

The platform addresses key industrial pain points: unreliable supply chains, high carbon footprints, and incomplete lifecycle data. Existing solutions like manual LCAs or scattered reparability evaluations fall short of delivering real-time, actionable insights. CIRCUITS bridges this gap by embedding AI-powered sustainability modules into existing development workflows.

Key modules include:

- Design Tool: A real-time module that helps engineers compare product designs using key sustainability KPIs to support eco-conscious decisions.
- Decision Tool
- Critical Raw Material Dashboard: Assesses supply risk and criticality of materials using current EU methodologies.
- Matrix Completion for LCA data: Predicts missing sustainability indicators (e.g., recyclability, material toxicity) using machine learning.
- ECU Fault Detection: Applies AI-based computer vision to detect defects in electronic components, validated in collaboration with BOSCH.

Target markets include industrial equipment manufacturers, automotive OEMs, and B2B service-oriented companies—especially those offering equipment-as-a-service models. Initial pilot clients include copier manufacturers with strong maintenance and sustainability commitments.

The business model is structured around:

- 1) Subscription tiers (Basic to Enterprise)
- 2) Partner-driven revenue (via Siemens, Autodesk integrations)
- 3) Data monetization (e.g., GRETA-powered industry benchmarks)
- 4) Professional services & certification add-ons (e.g., TÜV-compliant ESG reports)
- 5) IP licensing (e.g., for circularity metrics)

The platform is ready for pilot deployment and aims to enter full-scale market rollout within 12 months. Strategic partnerships (e.g., Siemens Teamcenter, TÜV) and a highly specialized team ensure execution capability and market fit.

Over the next 3 years, DT OFFIS will focus on:

- Finalizing and validating sustainability algorithms
- Embedding the platform in leading PLM tools via API
- Scaling through EU-wide regulatory and circular economy initiatives
- Launching a B2B materials marketplace powered by GRETA analytics

Revenue is expected to be primarily driven by recurring SaaS subscriptions and data services. Initial funding will be secured through grants, co-funding from partners, and institutional investors.

Unique Value Proposition: CIRCUITS delivers real-time, multi-criteria optimization for sustainable product design and end-of-life planning—transforming fragmented compliance tasks into profit-driving decisions for manufacturers.

B. The organisation

2.1 Organisation

DT Offis is a research-driven spin-off initiative from the OFFIS Institute of Technology and is part of the group Sustainable Manufacturing Systems (SMS). The group is a specialized research unit within the Manufacturing division at OFFIS. The group focuses on the digital transformation of manufacturing systems under the guiding principles of sustainability, circular economy, and resource efficiency. It collaborates closely with other OFFIS groups, the University of Oldenburg, and industrial stakeholders, providing a robust network for research translation and product co-development.

Governance structure: every opinion is equally weighted. The group has a group leader.

2.2 Strengths

- Interdisciplinary expertise as a core innovation driver: combining data science, environmental impact assessment, and industrial design.
- Strong internal communication and high autonomy within a trust-based team structure.
- High technical and academic proficiency, especially in AI for sustainability and circularity.
- Agility: The team follows an iterative development approach, enabling rapid prototyping and feature rollout.

2.3 Weaknesses

Despite these strengths, the organization faces certain structural challenges:

- The team is currently small and works primarily on a project basis, which requires strict prioritization and resource management.
- Several team members are employed under temporary contracts, which may impact continuity over time.
- The project is heavily dependent on third-party funding, such as EU or national grants.
- Low visibility on social media and professional networks (e.g., LinkedIn, ResearchGate) limits current outreach and brand recognition.

2.4 Long-Term Objectives

The project aims to establish strategic partnerships in both the industrial and academic spheres:

- Industrial collaborations with key players like BOSCH (e.g., in ECU fault detection) and the German Raw Materials Agency (DERA) to integrate critical raw materials analysis into design workflows.
- Scientific partnerships focusing on two core innovation components:
 - The Critical Raw Material Dashboard, enabling risk- and resilience-informed product design.
 - Matrix Completion for LCA data, allowing predictive sustainability insights even with incomplete datasets in early design phases.

These partnerships are intended to advance the platform technically while also strengthening the transfer of knowledge between research and practical application.

2.5 Key Success Factors

Two elements are particularly crucial to the current and future success of the organization:

The team's interdisciplinary composition fosters creativity and innovation, especially at the interface of digitalization, sustainability, and product development.

A positive, collaborative work culture that encourages initiative, high-quality outcomes, and long-term commitment.

To further strengthen the organizational foundation, DT OFFIS is committed to implementing targeted mitigation strategies for the structural challenges identified. In response to the current reliance on temporary contracts, a structured talent retention roadmap will be introduced. This includes transitioning high-performing staff to permanent roles, establishing a long-term talent pool, and leveraging funding programs to secure personnel continuity. Additionally, to address limited external visibility, a comprehensive outreach strategy is planned—combining consistent LinkedIn campaigns, participation in international circular economy events, and the publication of thought leadership content to position DT OFFIS as a leading voice in digital sustainability. Furthermore, the governance structure will be formalized to ensure clarity and accountability in strategic decision-making. This includes appointing a dedicated core leadership team, establishing an advisory board with academic and industry experts, and implementing a transparent roles-and-responsibilities framework supported by quarterly review cycles. To retain top talent, DT OFFIS will introduce structured career development paths, incentives linked to product milestones (e.g., performance-based bonuses or IP-sharing mechanisms), and flexible hybrid work models that reflect the organization's collaborative and innovation-driven culture. These measures will ensure long-term stability, resilience, and sustained growth as the platform scales across markets.

C. The product/service

3.1 Product Outline

Modern manufacturing companies are increasingly confronted with unreliable supply chains, unpredictable spare parts availability and costs, and a high carbon footprint over the entire product lifecycle. These challenges not only affect operational stability but also threaten long-term sustainability and compliance with emerging regulations.

While current approaches such as Life Cycle Assessments (LCA) offer partial insights, they are often limited in scope and rely on manual, time-consuming evaluations of repairability, material criticality, and recyclability. As a result, companies are forced to make design and procurement decisions based on incomplete data, often accepting substantial risk regarding environmental performance and supply chain resilience.

The solution developed by our team is a modular digital twin platform that integrates comprehensive sustainability assessment tools into early product development phases.

These sustainability modules provide:

- General guidance for eco-oriented product design, supporting decision-makers with real-time KPIs.
- Analysis of critical raw materials, enabling proactive identification of supply chain risks based on current EU criticality assessments.
- Integrated evaluation of LCA, recyclability, and repairability, allowing for multidimensional trade-off analysis and optimized design choices.

This enables manufacturers to reduce risk, increase resilience, and design more sustainable products—all supported by transparent data and interactive dashboards tailored for industrial application.

The digital twin uniquely integrates multiple sustainability assessments with interactive multi-criteria optimization to empower manufacturers in both product design and end-of-life circularity—addressing two critical gaps in today's sustainability solutions.

3.2 Main functions

The core product is a Digital Twin Platform that integrates multiple dashboards for comparing alternative product designs based on key sustainability and circularity KPIs, all seamlessly connected to various underlying databases. It brings together specialized modules with different focus areas into a unified, modular Digital Twin Platform that supports sustainable product design and decision-making.

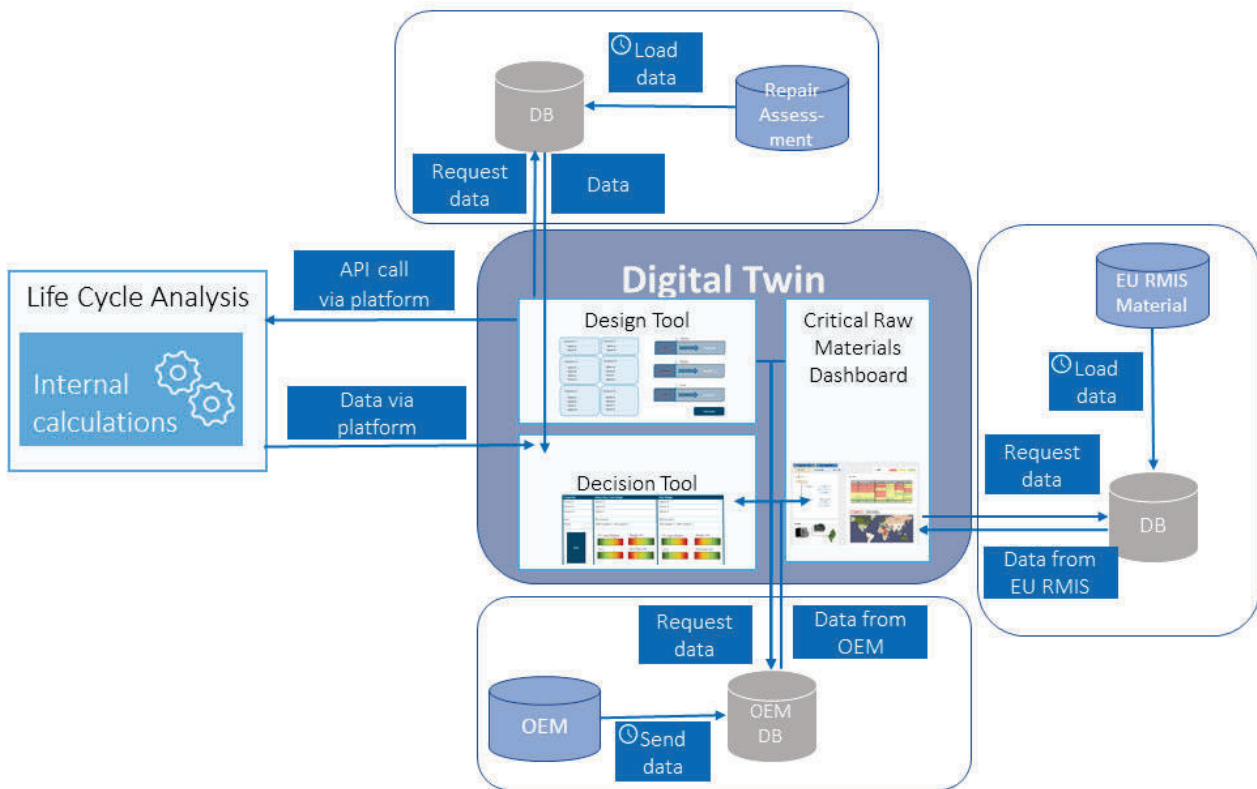


Figure 1: Design Digital Twin

The Design Tool enables engineers and product developers to compare alternative product designs in real time using over 15 key sustainability and circularity KPIs, such as recyclability scores, repair costs, and material criticality. By integrating directly into existing development workflows, the tool offers immediate feedback on the environmental implications of design choices. Interactive dashboards provide data-driven guidance for eco-oriented decision-making, helping teams to identify and prioritize more sustainable and resilient product configurations early in the design process.

Decision Tool module

The Critical Raw Material Dashboard (CRM) module provides product designers with a comprehensive overview of the criticality of materials used in their products, based on up-to-date EU assessment methodologies. It enables users to analyse supply risks, economic importance, and import dependencies for selected materials, helping prioritize design decisions that reduce reliance on high-risk resources and support economy strategies.

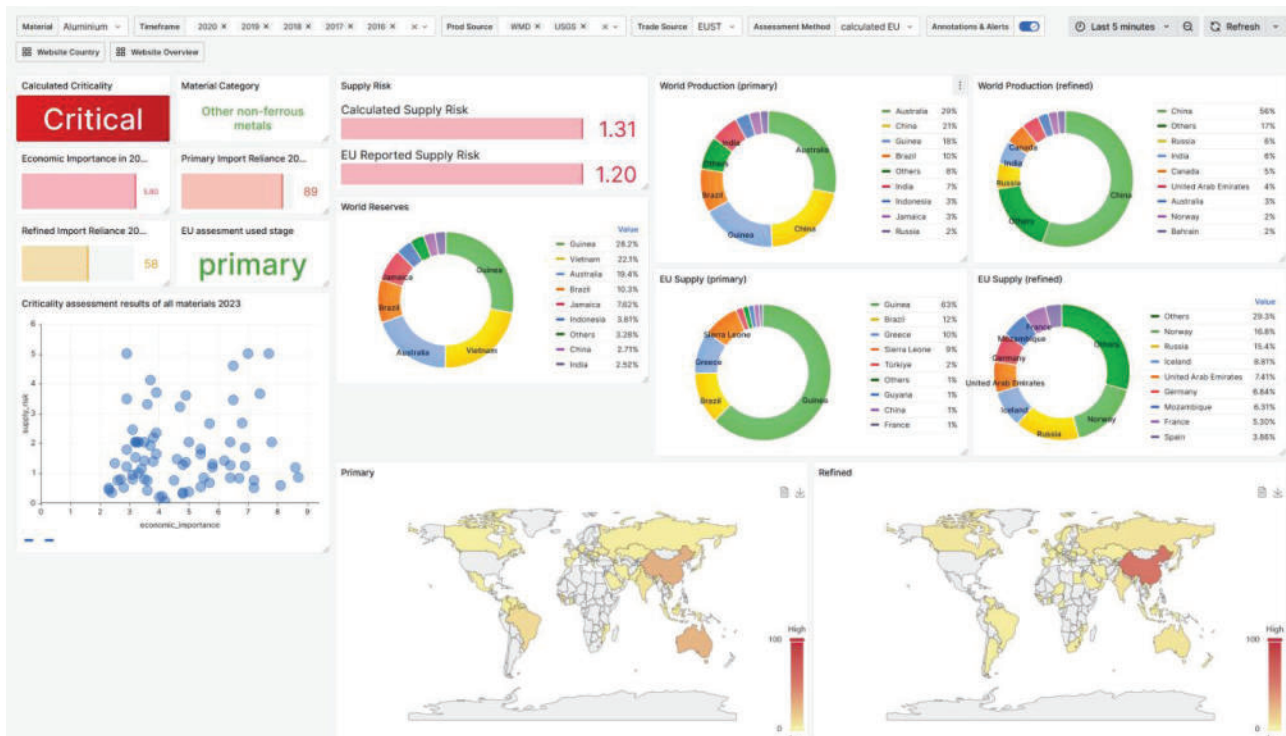


Figure 2: Critical Raw Material Dashboard

The ECU Fault Detection module leverages AI-powered computer vision to automatically identify defective electronic control units (ECUs), particularly in high-volume automotive components such as ESP units from BOSCH. By applying energy-efficient preprocessing techniques (e.g., HDR, CLAHE, and cropping) during image data collection, the system improves model accuracy while minimizing environmental impact. Further model improvements were made using advanced Generative Adversarial Network Image Augmentations (GAN Image Augmentation). The model enables early fault classification, which avoids unnecessary resource use (e.g., transport, cleaning), and supports sustainable repair processes in line with circular economy goals.

The Matrix Completion module enables the Digital Twin Platform to estimate missing sustainability-related (e.g. Life Cycle Analysis) data points in product datasets, such as recyclability, reparability, or material composition, based on known values and learned patterns. Using advanced low-rank matrix approximation algorithms, the system can accurately infer incomplete or noisy product data, making circularity assessments possible even when product information is sparse or inconsistent. This allows for broader applicability of the platform in early design phases or with legacy data, reducing dependency on complete LCA or expert input.

3.3 State of development

The product is currently in development. The next step is the completion of the different modules.

The CRM Dashboard module is finished and needs to be integrated in the Digital Twin Platform.

The ECU Fault Detection module is at 75%. The expected completion date is October 25.

The Matrix Completion module is at 80%. The expected completion date is October 25.

The Design/Decision Tool Module is at 60%. The expected completion date is December 26.

Problems

- Problems with Supply Chain → Reliability
- Spare Parts Availability + Costs unpredictable
- High Carbon Footprint for total life of the machines

Alternative /Current Solutions

LCA,

Manual assessment of reparability, criticality and combination with other results, accepting the risk

Solution

Sustainability modules:

- general guidance in general product design

- usage of critical raw

Materials → supply chain risks

- Integrates LCA, recyclability and reparability assessment

Key Metrics

1. Customer Retention Metrics:

Net Revenue Retention (NRR): *Track:* % of revenue retained annually from existing customers (including upsells/cross-sells). *Why:* If NRR >120%, the tool is sticky and clients see escalating value (e.g., buying new modules for compliance or carbon accounting).

Active User Engagement Rate: *Track:* Weekly logins, time spent in scenario modelling tools, API calls to GRETA. *Why it matters:* Embedded workflows (like Siemens integrations) should show daily use by engineers; low engagement signals risk of churn.

2. Product-Led Growth Drivers

Time-to-First-ROI: *Track:* Days until clients achieve measurable waste reduction (e.g., 15% cost savings from material reuse). *Why:* Faster ROI = higher retention; pilot contracts should convert to long-term deals if results are delivered in <90 days.

Feature Adoption Rate: *Track:* % of clients using modules *Why:* Advanced features increase switching costs; 80% adoption of core tools signals stickiness.

3. Ecosystem & Partnership Metrics

API Integration Depth: *Track:* Number of clients with OFFIS DT embedded in their PLM (Product Lifecycle Management) systems e.g. via Siemens/Autodesk APIs. *Why:* Deep integrations = harder to replace; target 70% of enterprise clients using custom API connections.

Partner-Driven Referrals: *Track:* % of new deals sourced through Siemens/EMA co-selling campaigns. *Why:* Ecosystem partners amplify retention by aligning CIRCUITS with their own renewal cycles (e.g., Siemens license renewals).

Unique Value Proposition

The digital twin uniquely integrates multiple sustainability assessments with interactive multi-criteria optimization to empower manufacturers in both product design and end-of-life circularity—addressing two critical gaps in today's sustainability solutions.

Why it stands out:

1 Design Optimization Uniqueness: Unlike static analysis tools, our dashboard enables live comparison of current vs.

redesigned products across 15+ circularity KPIs (e.g., recyclability score, repair cost). This directly solves the industry challenge of balancing sustainability with feasibility—pilots reduce material waste by up to 40% while maintaining cost efficiency.

2 End-of-Life Precision: By synthesizing data from GRETA, Recycling Simulation Tool, and OEMs, we provide actionable scenarios (e.g., “Repair Route A saves €12k vs. Recycling Route B”). Competitors lack this granularity, leaving manufacturers guessing—we turn fragmented data into prioritized recovery pathways, increasing component reuse rates by 55%.

Validation Point:

Early adopters achieved 30% faster design iterations and 25% higher end-of-life revenue through our dual-phase optimization—proof that bridging design and disposal unlocks circular profitability.

State of development: When are the products ready for the market?

The product is in development and is ready for deployment in (x).

D. The market

Target Market: Industries prioritizing sustainability, circular economy, and environmentally responsible practices (e.g., manufacturing, consumer goods, automotive).

Specifically, we want to start with B2B companies with specialized machine equipment / pay per use contracts or long maintenance contracts.

Customer Segments:

Product Designers and Engineers

Sustainability Managers

Innovation Teams

Manufacturers and Producers

Regulatory Compliance Officers

Risk assessment teams

Research Institutions and Universities

Unfair Advantage

Proprietary Circularity Algorithms & Real-Time Scenario Modelling

Why Unfair: Patented models that simulate repair/recycle trade-offs with unmatched speed/accuracy (e.g., predicting end-of-life revenue uplift in seconds). Competitors would need years of R&D to match this, especially if tied to unique datasets like from CIRC-UITs

Customer Segments

B to B machines suppliers with strong service approach and potentially product as a service business model on the European Market

Early adopters:

Copy Machine Producers with the above characteristics

E. The business model and marketing strategy

The business model is centred around a tiered subscription-based software-as-a-service (SaaS) offering, complemented by high-margin professional services, strategic partnerships, and data monetization streams. The core product—a modular Digital Twin Platform designed to support sustainable product development—is offered through various licensing tiers. The Basic tier includes access to recyclability simulations and compliance dashboards, priced between \$15,000 and \$25,000 per year. The Pro tier, which adds advanced scenario planning, access to GRETA benchmarks, and API integrations, ranges from \$50,000 to \$75,000 annually. The Enterprise tier, starting at \$100,000 per year, provides custom workflows (e.g., Siemens PLM integration), pre-compliance reporting, and dedicated customer success managers.

To complement this subscription model, usage-based add-ons allow clients to pay per simulation or for high-volume API calls—ideal for SMEs or clients with fluctuating needs. Additional revenue is generated through co-selling agreements with platform partners such as Siemens and Autodesk, who receive a share of subscription revenues when CIRCUITS is adopted via their ecosystems.

Data monetization forms another pillar of the model. Anonymized sustainability insights, presented as "Industry Circularity Scorecards," are sold to OEMs, recyclers, or investors for between \$10,000 and \$50,000 annually. Furthermore, the predictive analytics models behind GRETA—such as those offering material substitution recommendations—are licensed via APIs for integration into third-party tools.

High-margin professional services include custom platform integrations tailored to specific client environments, which are priced between \$20,000 and \$100,000 depending on complexity. Training and certification programs in circular design best practices are also offered, creating recurring engagement while building user expertise.

The marketing strategy is multi-layered and designed to establish CIRCUITS as a trusted and indispensable tool within industrial sustainability workflows. The go-to-market approach begins with strategic partnerships—particularly with sustainability certifiers (e.g., Cradle to Cradle), ERP/PLM software providers (e.g., Siemens Teamcenter, Autodesk), and circular economy networks. These partnerships not only enhance credibility but also ensure that CIRCUITS is embedded into existing industrial processes from the outset.

To measure and optimize the effectiveness of these marketing initiatives, a set of concrete KPIs will be introduced. These include lead-to-customer conversion rate per channel, cost per qualified lead (CPQL) for industry events and digital campaigns, and return on marketing investment (ROMI) to assess campaign profitability. In addition, customer acquisition cost (CAC) will be tracked across all acquisition channels to ensure efficient budget allocation. A multi-touch attribution model—supported by CRM analytics—will further help evaluate the specific impact of webinars, whitepapers, LinkedIn outreach, and co-selling campaigns on lead generation and conversion. These KPIs will ensure that marketing resources are focused on the most impactful activities and that CIRCUITS gains visibility in a targeted and data-driven manner.

Enterprise sales efforts target large manufacturing clients through pilot projects, focusing on roles such as sustainability officers and R&D leaders. Sales teams emphasize clear ROI, citing early adopters who achieved significant cost savings and faster design iterations.

To support long-term brand positioning, the team will invest in thought leadership and digital engagement strategies. This includes hosting webinars, publishing case studies (e.g., on waste reduction and end-of-life optimization), and running targeted campaigns on platforms like LinkedIn. Participation in trade shows and industry-specific events, such as Hannover Messe or Circular Economy 2030, is also planned, offering hands-on demos and limited-time pilot access to attract decision-makers.

Finally, CIRCUITS plans deep technical integration with OEM platforms via plug-and-play APIs. These integrations are critical for reducing customer onboarding friction and increasing product stickiness, as clients embed CIRCUITS' functionality directly into their existing digital engineering environments.

By combining recurring software revenue with strategic services, ecosystem integration, and data licensing, the business model is designed for scalability, differentiation, and long-term customer retention.

F. The Team and management structure

Management and Ownership

Leadership Experience and Qualifications: the leadership has qualifications in sustainability management, circular economy and product lifecycle management with a specialization on the semiconductor industry. It brings years of hands-on experience of B2B technology environments and complex stakeholder ecosystems.

The organizations appear structures around several key functional domains

R&D and Engineering: Responsible for circularity algorithm development, simulations, and digital twin optimization. This team has a high priority in the organization.

Data & Integration: Magages API Integrations (e.g. Siemens, Autodesk) and GRETA Dataset partnerships.

Sales & Business Development: Responsible for enterprise Sales, strategic partnerships, and industry co-selling campaigns.

Customer Success: ...

Compliance & Regulatory Affairs: Monitors EU sustainability regulations (e.g. CRSD, Ecodesign Directive).

Compliance & Thought Leadership: Builds brand credibility through events, webinars, and industry publications.

Management and decision-making policy

Wie soll das Unternehmen geführt werden und wie werden Entscheidungen getroffen?

Relevant Partnerships

Siemens or Autodesk via Digital Twin API Integrations

Compliance & Certification: TÜV, DEKRA for third-party validation and trust.

G. The operative plan

The operational plan is strategically structured around the finalization of core R&D components—particularly algorithms for recyclability assessments, circularity scorecards, and life cycle analysis (LCA)—and the scalable deployment of cloud infrastructure. The plan places equal emphasis on integration into existing industrial ecosystems, especially through API connections with platforms such as Siemens Teamcenter and Autodesk. These integrations are not only technical milestones but essential enablers for seamless adoption within clients' digital product development environments.

The CIRCUITS platform is being developed in iterative cycles, with each module (e.g., the CRM dashboard, ECU Fault Detection, Matrix Completion, and Design Tool) undergoing separate validation phases in collaboration with early pilot partners. To strengthen implementation transparency, critical path dependencies such as API integration timelines, regulatory certification (e.g., TÜV validation), and LCA data harmonization will be explicitly tracked through quarterly project reviews. This ensures accountability for delivery timelines and de-risks the onboarding of enterprise clients.

The organization operates from Oldenburg with a hybrid and remote-first team model. Scalable computing capacity is provided via GDPR-compliant cloud services (AWS, Azure), enabling simulation-driven optimization and real-time analytics. Personnel growth is aligned with product maturity, scaling from five to ten employees over three years. Initial hires cover core engineering, data science, ESG compliance, and sales roles. Certain non-core activities—such as legal documentation, specialized certification, and parts of the API backend—are outsourced to maintain flexibility and reduce overhead.

Resource needs are carefully mapped to development and deployment phases. These include licenses for simulation tools, curated datasets (e.g., Ecoinvent), and cloud environments. Strategic partnerships with OEMs, software vendors, and certification bodies are a cornerstone of the plan, contributing both to co-development and market entry.

The operative roadmap is divided into three distinct phases:

- Year 1 – Development & Pilot Validation: Completion of modules, integration of CRM dashboard, initial pilot testing, and TÜV readiness.
- Year 2 – Market Entry & Partner Integration: Finalize Siemens/Autodesk API rollouts, scale B2B sales, and launch certification support services.
- Year 3 – Internationalization & Platform Expansion: Deploy AI-enhanced analytics, launch B2B material marketplace, and expand across the EU with regulatory alignment.

To address potential implementation risks, a dedicated risk register tracks technical, regulatory, and partner-related dependencies. In addition, the team employs agile project methodologies to ensure iterative delivery, enabling quick responses to unforeseen delays in integration or compliance processes.

H. Financials

Cost Structure

The cost structure of DT OFFIS reflects a strategic allocation of resources designed to support product development, market entry, and long-term scalability. The majority of costs are personnel-related, accounting for approximately 30% of the overall expenses. This is due to the highly specialized nature of the development team, which includes machine learning engineers, circularity experts, compliance specialists, and customer success managers. These roles are essential for building proprietary sustainability algorithms, maintaining regulatory alignment, and supporting enterprise clients through complex onboarding and integration processes.

Another major cost block is research and development (R&D), which includes not only the core development of the CIRCUITS platform but also costs related to acquiring high-quality sustainability datasets, staying aligned with evolving EU regulations (e.g., Ecodesign Directive, CSRD), and pursuing intellectual property protection through patent filings. These costs are expected to remain significant during the first two years of operation due to ongoing feature innovation and model training.

Distribution-related costs (10–15%) mainly include cloud infrastructure for hosting simulations, fees for accessing and maintaining API integrations with third-party platforms (e.g., Siemens, Autodesk), and commissions for co-selling agreements with strategic partners. As these integrations are central to user adoption and retention, such expenses are critical to the platform's stickiness and scalability.

Marketing and customer acquisition costs (CAC) are also non-negligible, especially during the market validation and scaling phase. Enterprise sales cycles are long and require personalized demos, proof-of-concept pilots, and ROI-driven

case studies. These activities drive high CAC—estimated between \$25,000 and \$50,000 per client—but are considered a worthwhile investment to secure high-value, long-term contracts.

Cost Category	Examples	Estimated Share of Total Costs
Distribution	Cloud infrastructure, API fees, co-selling commissions	10–15%
Personnel	R&D team, data partnerships, CSMs, compliance experts	~30%
Marketing / CAC	Enterprise sales teams, events, content marketing	High CAC (\$25k–\$50k/client)
R&D	Algorithm development, data licensing, patent filings	Significant
Engineering & Production	Platform scalability, API maintenance, ISO certifications	5–8%
Legal & Certifications	Sustainability certifications, GDPR, legal contracts	Not specified

Table X: Cost Structure

Lastly, costs associated with legal compliance and third-party certifications (e.g., TÜV validation, GDPR alignment) are necessary to build trust and enable client adoption in regulated industries. While these costs may seem relatively low, they are vital for securing contracts with compliance-sensitive clients, particularly in the EU market.

Overall, DT OFFIS maintains a lean and strategic cost structure that prioritizes high-impact areas such as technical differentiation, platform integration, and regulatory readiness—factors that are crucial for success in the sustainability and circular economy space.

Area	Share (%)
R&D	40%
Partner Integration	25%
Compliance/Certifications	15%
Marketing/Sales	12%
Contingency	8%

Table X: Budget Allocation Year 1

Revenue Streams

Revenue Stream	Description	Example Prices
Subscription Models	License tiers (Basic to Enterprise), add-ons	\$15k–100k+/year depending on model
Partner-Driven Revenue	Revenue share with Siemens/Autodesk	15–25% revenue share
Data Monetization	Selling anonymized benchmarks & ML APIs	\$10k–50k/year per dataset
Professional Services	Integrations, trainings, certifications	\$20k–\$100k+ per integration
Compliance & Certification	Reports, pre-compliance subscriptions	\$10k/month, +20–30% markups
IP Licensing	White-labelling, patents	7–12% royalty fee
Consulting	Additional consulting revenues	Project-based

Table X: Revenue Streams

The revenue model of DT OFFIS is designed to balance recurring software income with high-margin services and scalable data monetization. At its core, the company offers tiered subscription models that provide access to its modular digital twin platform. These tiers range from a Basic license—including criticality simulations and compliance dashboards—to more advanced Pro and Enterprise packages that offer full access to GRETA-powered analytics, scenario planning tools, and API integrations. These subscriptions represent the most stable and predictable revenue stream, particularly attractive for enterprise clients seeking long-term digital sustainability solutions.

In parallel, partner-driven revenue plays a crucial role. Through co-selling agreements and integrations with established software ecosystems (e.g., Siemens Teamcenter, Autodesk), DT OFFIS benefits from revenue-sharing mechanisms while expanding its market reach. This strategy not only reduces customer acquisition costs but also embeds CIRCUITS into the daily workflows of engineers, increasing platform stickiness and renewals.

A highly strategic component of the revenue model is data monetization. By leveraging anonymized datasets generated through GRETA analytics and platform usage, DT OFFIS can offer industry-specific benchmarks, predictive material substitution APIs, and circularity scorecards. These insights are monetized through annual licenses or one-time sales to OEMs, recyclers, and institutional investors—creating new value from existing data without additional service costs.

In addition, professional services such as custom integrations into client PLM/ERP systems, training sessions, and certification programs offer high-margin opportunities. These services not only generate income but also deepen client relationships and platform dependency.

DT OFFIS also addresses regulatory demand by offering compliance and certification premiums, including TÜV-validated reports and pre-compliance subscription bundles aligned with upcoming EU directives such as CSRD and ESPR. These value-added services are packaged into existing plans or sold at a premium, ensuring customers can meet legal obligations efficiently.

To further leverage its proprietary innovations, DT OFFIS licenses its algorithms and circularity metrics through IP licensing agreements with consultancies and third-party software vendors, generating royalties while expanding the reach of its technology.

Together, this diversified revenue approach allows DT OFFIS to scale sustainably, reduce dependency on any single income stream, and align its financial model closely with its mission: enabling industry-wide transformation toward circular and sustainable product design.

Risk Mitigation

Avoid over-reliance on high-touch sales by automating onboarding (e.g., AI-guided simulations).

Partner with TÜV/DEKRA for trust in certifications, reducing compliance risk.

EXPERT COMMENTS AND RECOMMENDATIONS

1. Executive Summary

The revised version presents a clearer and more structured overview of the platform, CIRCUITS. Key use cases, modules, and market entry are effectively prioritized. Compared to the previous draft, unnecessary background and placeholder texts have been removed. However, the summary could still better highlight differentiation from direct competitors and clarify immediate value for early adopters.

2. Organisation and Team

The new version expands on organizational strengths and long-term mitigation plans (e.g., retention roadmap, governance structure). Compared to the older draft, these additions are well-aligned with suggestions for clearer management strategy. Nonetheless, a visual org chart or explicit decision-making workflows would strengthen the structure section.

3. Product / Service

Product description now includes specific modules with functional and technical insights (e.g., CRM dashboard, ECU fault detection). Updates reflect earlier feedback by integrating more detailed KPI impacts. The use of AI and data

augmentation techniques is well articulated. Still, the integration roadmap into client ecosystems (PLM/ERP) could be more detailed.

4. Market and Customers

The revised draft narrows down the B2B target to machinery-as-a-service providers and product designers, which is an improvement. Customer roles are clarified. However, personas and quantified market potential (e.g., TAM/SAM/SOM) are still lacking, which would be essential for investor-readiness.

5. Business Model and Go-to-Market Strategy

The updated version clearly articulates subscription tiers, usage-based pricing, and ecosystem-based revenue sharing. The integration of marketing KPIs (CAC, ROMI) is a strong improvement. Prior recommendations about partner co-selling and pilot incentives are now incorporated. The narrative could still benefit from comparative benchmarks (e.g., how pricing compares with similar tools).

6. Team & Management

Leadership expertise is now framed more convincingly, and organizational domains are introduced. Names are tentatively mentioned but not confirmed. Improvements from the earlier version are evident, but inclusion of a full management chart and HR plan would further enhance credibility.

7. Operational Plan

The updated plan offers a three-phase roadmap (dev, scale, internationalize) with detailed dependencies (TÜV, API rollouts). It reflects previous advice to increase realism and timeline coherence. The revised version uses agile milestones and external dependencies well, though implementation KPIs (e.g., module adoption, user onboarding time) are still missing.

8. Financial Plan

Cost structure and budget allocation are better structured, with focus on personnel, R&D, and certifications. Revenue model diversification (SaaS + data + IP) is retained and clarified. Enhancements since the previous draft include higher precision in cost breakdowns and better use of examples. It would benefit from a clearer break-even projection and funding timeline.

9. Risk Management

The new version briefly outlines mitigation measures and references a risk register. These are good additions but still not fully developed. A table with main risks, impact/probability scores, and mitigations would improve clarity and fulfil standard investor expectations.

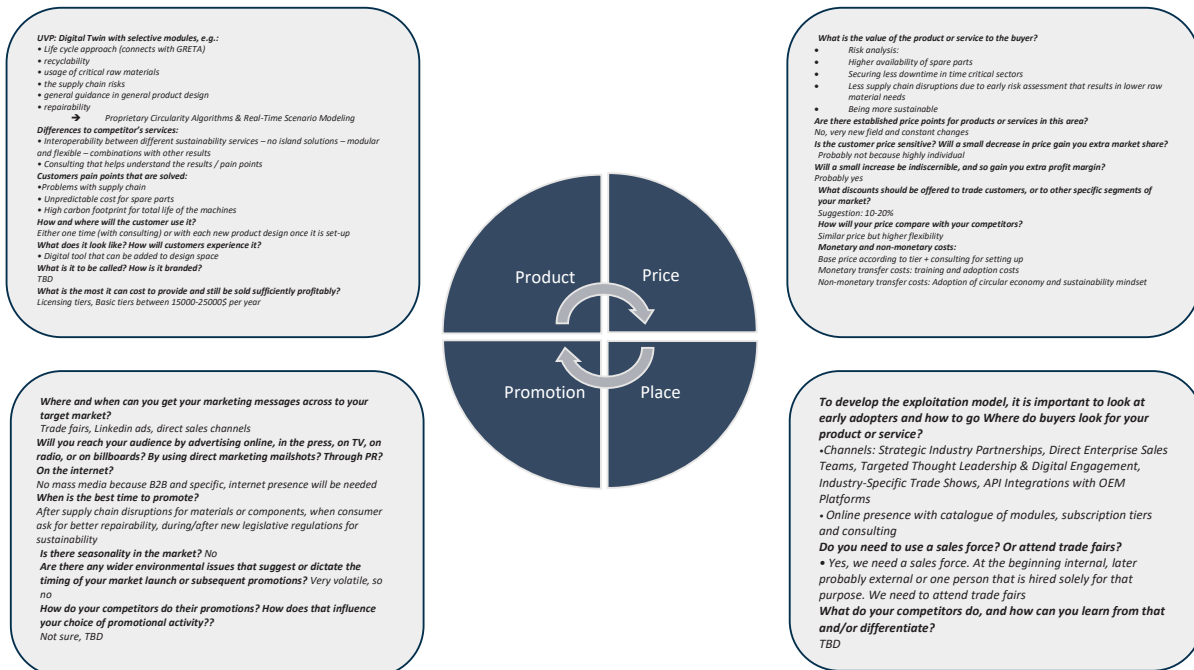
10. Resources & Investment Plan

Still remains one of the weakest sections. The new version lacks concrete figures on financial needs, expected investor share, or funding stage (e.g., seed, Series A). This section needs urgent attention to make the plan fundable.

Overall Assessment

The updated version integrates many prior recommendations and demonstrates clearer strategic planning, modular product design, and credible partnerships. The tone is more professional and market-oriented. However, the BP still requires more emphasis on quantified market opportunity, funding trajectory, and risk transparency. Adding visuals (roadmaps, org charts, value chain) could greatly enhance presentation quality.

6.1.1 Commercialisation Plan



EXPERT COMMENTS AND RECOMMENDATIONS

1. Promotion (How and when to promote the product)

Clear indication of B2B-specific promotional tools (LinkedIn Ads, trade fairs, direct channels). Timing aligned with contextual triggers (e.g., regulatory changes, supply chain disruption).

Lacks competitor benchmarking and concrete PR strategy. Consider adding visibility efforts through targeted content (e.g., webinars, industrial journals).

2. Product (What is offered and how it's used)

Strong UVP focused on circularity modules, risk modelling, and eco-design support. Clear description of customer usage models (consulting + per-design use).

Branding and naming strategy still TBD. Early identity definition would help strengthen positioning and communication.

3. Place (Sales channels and distribution model)

Multi-channel strategy well described: strategic partnerships, salesforce, API integration. Realistic evolution from internal to dedicated sales support.

No detailed go-to-market phasing by region or segment; suggest adding first-entry sector roadmap (e.g., machinery → transport → energy).

4. Price (Pricing model and customer perception)

Licensing tiers clearly defined; customer willingness to pay and price sensitivity addressed. Non-monetary transfer costs (mindset, adoption) acknowledged — a rare but relevant inclusion.

Consider supporting the price tier with comparative data (benchmarks or willingness-to-pay surveys) and aligning discount policy with use case or early-adopter incentives.

7 Final recommendations by the Expert

KER1: Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics	
Issues	Assessment and Recommendations
Maturity of the KER	<i>The technology is at a medium-high TRL (5–6), with demonstrators and early adopters identified (e.g., TactoTek). To strengthen its readiness, the team should validate it in operational environments with OEM/Tier 1s and quantify recovery efficiency through pilot data.</i>
Market definition	<i>The KER targets automotive HMI and printed electronics. Market segmentation by component type and exploration of adjacent domains such as appliances or wearables could expand its reach.</i>
Unique Value Proposition definition	<i>The value proposition is focused on recyclability (90% plastics), component reuse, and repairability. To improve stakeholder engagement, UVP should be expressed in measurable benefits such as CO₂ or cost savings and benchmarked against conventional IME.</i>
IPR/Intellectual assets management	<i>TNO holds background IP and TRACXON controls 15+ patents. The team should conduct FTO analysis, align IP protection with KER functionalities, and define a clear licensing and valorisation strategy.</i>
Use/business model	<i>The current strategy involves licensing and tech transfer to industrial players. To enhance exploitation, introducing service-based models like pilot-as-a-service or expert consulting could diversify revenues.</i>
Exploitation Risks	<i>Low market awareness and integration complexity with existing design flows pose risks. These can be reduced through early validation with OEMs and quantifiable LCA-based evidence.</i>
Planning of next steps	<i>Although IP transfer and interest from partners exist, the roadmap lacks granularity. Defining milestones that align TRL, IP, and market engagement goals is needed.</i>
Financial plan (revenues/costs)	<i>Revenue generation is currently undefined, with value expected from IP licensing. Building a financial model with revenue projections and associated costs is key for investor readiness.</i>
Team	<i>The team includes strong technical (TNO), industrial (TRACXON), and early adoption (TactoTek) partners. To complete the skillset, commercial and business development roles should be integrated.</i>
Funding opportunities	<i>No post-project funding has been identified yet. Opportunities such as EIC Transition, Eurostars, or IPCEI could fund technology maturation and commercial scaling.</i>
Creation of startup/spinoff	<i>Currently not foreseen, with tech transfer preferred. However, a spin-off could be reconsidered if OEM traction increases and IP consolidation is secured.</i>
Further support	<i>No specific support pathways are mentioned. The team should leverage available services such as the Horizon Results Booster, IPR guidance, and matchmaking platforms.</i>
Other elements	<i>The KER aligns with ESG and ESPR trends, which are increasingly valued by industry. These aspects should be embedded in business and investor-facing communications.</i>

KER2: OFFIS Digital Twin	
Issues	Assessment and Recommendations
Maturity of the KER	<i>The tool appears at TRL 5–6, with initial modular components tested. To reach readiness, a pilot with real industrial data is needed to validate usability, interoperability, and predictive reliability.</i>
Market definition	<i>The target includes B2B industries with long-lifecycle assets, but it remains broad. The market scope should be refined to prioritize sectors with highest pressure on circularity and regulatory compliance (e.g., machinery, transport, infrastructure).</i>
Unique Value Proposition definition	<i>The UVP highlights lifecycle analytics, supply risk assessment, and eco-design guidance. To increase traction, it should quantify value for decision-makers (e.g., cost reduction, avoided downtime, regulatory alignment).</i>
IPR/Intellectual assets management	<i>Background IP is acknowledged, but foreground IP is unaddressed. An IP audit is needed to identify which parts of the tool are protectable (algorithms, visualisations, interfaces) and to define a licensing roadmap.</i>
Use/business model	<i>Licensing and consultancy are foreseen, but the path to scalability is unclear. Offering simulation-as-a-service or domain-specific modules could help address diverse industrial contexts while generating recurring revenue.</i>
Exploitation Risks	<i>Risks include low data availability, limited standardisation, and validation needs. These can be mitigated by integrating open standards (e.g., ISO 14044), modular validation protocols, and early feedback loops with adopters.</i>
Planning of next steps	<i>While partners are committed, no detailed exploitation milestones are provided. A roadmap with phases (integration, piloting, refinement, scaling) is needed to track progress and attract adopters.</i>
Financial plan (revenues/costs)	<i>The revenue logic is service-oriented but remains qualitative. Defining pricing tiers, estimation of deployment costs, and long-term maintenance models would support investment readiness.</i>
Team	<i>The technical team is strong, with partners such as OFFIS and SUPSI. However, exploitation would benefit from involving market-facing profiles (business development, customer support, regulatory specialists).</i>
Funding opportunities	<i>No specific funding path is planned. The KER fits EIC Pathfinder/Transition or Innovation Fund (for digital circularity tools) and should be positioned accordingly.</i>
Creation of startup/spinoff	<i>Not currently planned. A spinoff could be reconsidered if industrial partners show traction and if IP consolidation and modular product architecture progress.</i>
Further support	<i>No support is listed. Horizon Results Booster (strategy or go-to-market service) and national innovation accelerators should be engaged to strengthen visibility and market fit.</i>
Other elements	<i>The KER aligns well with EU Green Deal priorities, ESPR and digital product passport regulations. This alignment should be leveraged more explicitly in dissemination and pitch materials.</i>

8 Annex 1: Memorandum of Understanding (MoU)

1. Valorisation and exploitation of ... (please refer to the specific KER)

1.1 Agreement between partner, partner, partner

1.2 The following Memorandum of Understanding is made on the dd/mm/yyyy by and between

- **Partner a**, VAT ..., registered in ..., hereinafter referred to as ...
- **Partner b**, VAT ..., registered in ..., hereinafter referred to as ...
- **Partner c**, VAT ..., registered in ..., hereinafter referred to as ...
-

Individually referred to as a “Party” or collectively as the “Parties”.

1.3 Background of the Agreement

During the **[name of the project]** project’s life the KER was developed... *(clearly describe the KER)*

As per consortium agreement of the Project signed by the Parties, **[number of Section]**: Results, ... Results are owned by the Party that generates them.

Partner a, b, c, x, y and z contributed to the generation of the KER. Each one contributed in the following way:

- **Partner a**, ...
- **Partner b**, ...
- **Partner c**, ...
- **Partners x**, ...
- **Partner y**, ...
- **Partner z**, ...

Upon successful conclusion of the project activities, Parties agreed to jointly define the best way to exploit and valorise the KER.

Partners **a, b, c, ...** expressed the willingness to further valorise and exploit the above-mentioned KER, securing the needed resources, while partners **x, y, and z** agreed to give to partners **a, b, c, ...** the full right to exploit declaring to have nothing to claim.

Given the uniqueness and further impact potential of KER/s above mentioned, all Parties through this agreement aim to define clear roles and modalities to exploit the programme beyond the grant received from the European Commission.

1.4 Purpose of the Agreement

The agreement is therefore aimed at clarifying and regulating

- A. Scope and objectives of KER
- B. Use of the brand *(example)*
- C. Use of the data collected via the platform *(example)*
- D. Use of the DB (software) *(example)*
- E. Procedures and Roles of the Parties *(example)*

2. Scope and objectives of KER

The Parties agree that KER is ... *(KER description)*

The KER is built around... and it is implemented through:

- A. A network(s)-based outreach approach; *(example)*
- B. ...;
- C. ...;
- D.

3. Use of the brand

....

...

4. Use of the data collected

...The registered data are the property of each of the Parties, who can use them for other activities in respect of GDPR and only for non-competing purposes with the current agreement **(to be finetuned by partners legal offices)**.

5. Use of the

5.1 Procedures and Roles of the Parties

All Parties shall appoint 1 person within their respective organisation as the first and foremost contact point for ensuring swift and clear communication between the Parties and for implementation of the exploitation plan for this KER as approved by **[name of the project]** and annexed to this MoU.

The initial persons responsible for being the contact point are:

- Partner a: Name, email address, telephone number
- Partner b: Name, email address, telephone number
- Partner c: Name, email address, telephone number
- Partner

All partners will be informed of changes in the contact points in a timely fashion, not exceeding 5 working days from the moment the appointment from the organisation.

Partners **a, b, c, ...** who expressed the willingness to further valorise and exploit the KER will proactively look for potential business development opportunities. Each time one of the Parties is clearly informed by a potential customer, the Party must inform the other Parties' relevant contact points and receive organisational approval **(X out of X)** to proceed.

It is the responsibility of each Party to ensure the contact points of the other Parties are informed using, if necessary, more than one communication channel (*e.g., email, WhatsApp, phone, etc*). It is the responsibility of the other Parties to ensure the approval to proceed (or denial thereof) is communicated back to the Party in a timely fashion, not exceeding 1 working week (5 working days) from the moment the latter's communication has reached them.

5.2 Dedicated KER management (in the case of a horizontal governance set-up – to be finetuned according to the governance set up chosen by the concerned partners, before the end of the project)

The Party in charge of any new contract will inform all partners about the client, the scope of the contract and foreseen role for each partner (if possible and to different degrees). In order to progress with a new programme, partners must agree on its relevance and viability. Parties have 5 working days to register non-agreement, otherwise the proposal will be considered suitable.

When the contract is finalised, agreed by all Parties and service sold to the client, the Party in charge will act as main contract manager and coordinator, responsible and liable for the smooth implementation of the envisaged activities throughout all phases.

The partner who secures the contract should also perform a "client financial check" and all Parties will be paid promptly upon payment from the client according to the payment schedules agreed upon.

The Party will be the interface between the client and the Parties and will also be responsible for proposing the allocation of resources among partners.

5.3 Promotion and marketing

Parties **a, b, c, ...** who expressed the willingness to further valorise and exploit the KER will ensure the proper outreach, using their networks and contacts (social media, newsletters, websites) to promote the KER toward the target markets and early adopters initially identified in the exploitation plan annexed to this MoU.

The most suitable party to deliver the communication activities will be decided on the basis of the scope of the contract and the main target audience.

Cost of marketing and sales activities will be split among partners according to the provisions of the exploitation plan for the current KER.

5.4 To summarise:

<i>Activity</i>	<i>Party responsible</i>	<i>Cost split between parties (%)</i>
<i>Programme management and coordination</i>	<i>Party who secured a contract</i>	
<i>KER and methodology management</i>	...	
<i>Innovation and IPR management</i>		
<i>KER update</i>		
<i>Outreach and communication</i>	...	
...	...	

6. Intellectual Property Rights and NDA

The Parties acknowledge that nothing in this Agreement shall affect any pre-existing (background) and future (foreground) ownership of any intellectual property rights.

Dedicated NDA will be developed and signed between Parties and customers every time needed.

7. Miscellaneous

In the event of further participation in call for proposals covering actions that fall in the scope of this Agreement, the parties mutually recognize a first right of information and best effort to bid together

This Agreement is at-will and may be modified by mutual consent of all the Parties. This Agreement shall become effective upon signature by the authorised officials and will remain in effect until modified or terminated by any one of the Party by mutual consent. In the absence of mutual agreement by the Parties this Agreement shall remain in force for twenty-four months.

Any dispute that might arise concerning this Agreement shall be settled amicably.

8. Date & Signatures

FOR [please insert name of participant or potential or current partner]

Partner a: Name, Position

Partner b: Name, Position

Partner c: Name, Position

Partner x: Name, Position

Partner y: Name, Position

Partner z: Name, Position

9 Annex 2- The Lean Startup methodology

To contribute to the sustainability plan and to dissemination activities, it is important to further focus on the problems the novel solution is addressing, who are the ones who feel this problem the most (the users of the solution, the target group of dissemination activities, your “customers”), the unique value proposition (what makes the novel solution much better than current ones, the pivot for messages to be used for the messages to be delivered during dissemination) and to identify how to reach customers/users out (use mode and distribution channels). It is also important to identify the costs of providing our target groups with the novel solution how to monitor progresses and how to cover costs incurred (sustainability).

The Lean Canvas is a tool that can help in these crucial activities. The Lean Canvas is an adaptation of Business Model Canvas by Alexander Osterwalder which Ash Maurya¹ created in the Lean Startup spirit (Fast, Concise and Effective startup). It focuses on problems, solutions, key metrics and competitive advantages.

Among the different type of canvas, the lean business model canvas, by Ash Maurya, is the most suited for R&D projects. It is a powerful tool to be used by consortia to further develop the characterization of their KERs, prepare the materials to be discussed at meetings and draft the exploitation/business plan for a KER.

9.1 How to approach the use model

The use model or “business model” is the plan for the creation of impact (successful delivery of a solution), identifying, the intended “customer” base, the result (product/service), sources of revenue and details of financing. It describes the way in which “value” can be extracted from an exploitable R&D result and impact generated.

When working on the “use” model it is important to focus on the following elements:

Your objective <ul style="list-style-type: none"> • Why am I doing this thing? • Which are my goals? (Best and worst scenario) • Am I really better/different? 	
Global market <ul style="list-style-type: none"> • Competitors • Incumbents • Investors (geography matters) • Level of investment 	Local market <ul style="list-style-type: none"> • Competitors • Incumbents • Investors • Peculiarities
6-12-18 months plan <ul style="list-style-type: none"> • Product roadmap • Cashflow • Valuation target • KPIs • Next step 	

¹ For more information about this canvas, please refer to the blogpost explaining Lean Canvas and the ideas behind it on his website: <http://www.ashmaurya.com/2012/02/why-lean-canvas/>

Every “customer” has a problem, every problem has a solution

When working on the use model, it is crucial to start from the problem not from the solution. New initiatives (including spin-offs) fail because their offer (a product, a service, a license) is not designed for the intended users, “customers”. Every “customer” has a problem; every problem has a solution. Vice versa, not every solution has a problem, not every problem has a customer. Brainstorm and identify the problem (forget the solution) focus on the problem, identify a common definition.

Early Adopters

To develop the exploitation model, it is important to look at early adopters and how to go from early adopters to “early majority”. Innovators are the ones that “use” the “alfa” version (2,5%, often the industrial partner in an R&D project); early adopters are the customers ready to “use” the “beta” version (13,5%). Next step is to reach the “early majority” (34%). New initiatives fail before reaching out the early majority and this is connected with the capability to reach early adopters.

Identify the “customers”, who will pay, focus on the riskier ones and describe them in the most specific way. Why that customer has that problem is the way to select the assumptions (how they deal with the problem, what are they looking for). Focus on the most important one, the one that, if not validated, will make everything fall down.

UVP

The Unique Value Proposition, or Unique Selling Proposition (USP), is a clear statement describing the benefits of the novel offer, how you solve your customer's needs and what distinguishes you from the competition. It is clearly related to the customers' needs and how their problems are solved so far.

In defining the UVP you do not want a “point of parity” when your features are similar to the ones of the competitors”. What counts are the points of difference, what you do, that the others do not and that matters to the customers. You do not want to be better than your competitors, you want to be better for your customers. Do not imitate/mirror competitors. Keep in mind customers, not competitors.

9.2 The Lean Canvas

For preparing the Exploitation Plan (your business plan) of a R&D result and define the use mode, it is useful to work with the Lean Canvas. The Lean Canvas is an adaptation of Business Model Canvas by Alexander Osterwalder which Ash Maurya² created in the Lean Startup spirit (Fast, Concise and Effective startup). Lean focuses on problems, solutions, key metrics and competitive advantages.

The canvas is a good tool to focus on the exploitation model and start collecting information for the exploitation plan. Among the different type of canvas, the lean business model canvas, by Ash Maurya, is the most suited for R&D projects. It is a powerful tool to be used by the partners to further develop the characterization of their KERs, prepare the materials to be discussed at consortium meetings and draft the exploitation/business plan for a KER.

The lean canvas helps to fine-tune and develop the exploitation strategy for a KER having in mind four questions:

- 1) Who is my “customer”?
- 2) What is “her/his” problem?
- 3) How does “She/he” solve the problem now?
- 4) Is our solution more efficient than the current one?

² For more information about this canvas, please refer to the blogpost explaining Lean Canvas and the ideas behind it on his website: <http://www.ashmaurya.com/2012/02/why-lean-canvas/>

9.3 How to fill out a Lean Canvas

The end goal of the lean canvas is that an unknowing third-party will be able to review the information provided and understand what the KER and its use is about. They will understand the problem in focus, the customer groups that you target, the solution you provide, how it differentiates from competitors, how you intend to create value, etc. The lean canvas is very important for an effective implementation of dissemination actions. Due to this, it is very important to avoid the use of highly technical language, abbreviations etc. They can result in third parties not understanding the nature of your KER.

Below a description of the main steps to draft the canvas.

1) **PROBLEM** - find 3 main problems you are addressing.

Explain: **What** is the problem and **why** is it a problem.

Additionally, attempt to add numbers or quantifiable measures that will clearly highlight the scale of the problem.

Describe EXISTING ALTERNATIVES - Find out how they are solving the problem now (today's alternatives)

2) **CUSTOMER SEGMENT** - identify who has the problem, define target customers (do not confuse with users).

Be clear on explaining the geographic location of your customers, the industry in which they are operating in, as well as connecting them to the problem in question.

EARLY ADOPTERS - find a small niche that is having the biggest problem, the ones that suffer the most (early adopters).

These will be the first customers of your solution; Be sure to find as much information about these as possible. Explain the geographic location, connect them to the problem, explain exactly why these will be the first adopters, clarify your current connection to them etc.

3) **UNIQUE VALUE PROPOSITION**

Define your UVP based on the today's alternative, what makes your product/service more efficient for your customers, a single and compelling sentence that makes everybody understand why you are far better (your features need to be compelling to the customers' needs, otherwise are irrelevant to clients).

Ensure that you clearly define how you differentiate from alternative solutions, and why the customer will come to you; Explain the **uniqueness** of your solution.

Provide facts and data, explaining the performance of your product compared to alternative solutions (efficiency increase of 20%, decreased energy consumption of 10%, 30% fewer development costs etc.).

4) **SOLUTION** – outline the main features of your solution.

When your features are similar of the ones of the competitors, this is an equality. What matters are the points of difference! What you do, that the others do not do and are what matters to the clients.

Be sure to explain the format of your solution (is it a machine, an equipment, a software, a service, a process, etc.), what it does, and how it does it.

5) **CHANNELS** – How will you reach your customers?

Be sure to investigate whether the chosen channels are suitable for your choice of customers and consider whether they will be enough to establish the needed reputation on the market.

6) **KEY METRICS**

key activities you will measure to track the success (e.g. units sold, users registered, retaining users, paying customers, number of complaints ...)

7) **UNFAIR ADVANTAGE** – what is it that gives you an advantage in front of the competition? Something that can't be easily copied or bought.

This could be IPR, being first movers on new technology that takes years to develop etc. Be sure to explain, *why* the listed points provide you with an advantage. It can be difficult for third-parties to understand if they do not have a wide array of knowledge regarding your industry.

8) COST STRUCTURE

which will be the main costs when the solution is ready for the market (e.g. customer acquisition costs, distribution costs, hosting, people etc). As with revenues, estimate the total costs issued after 6 months and 3 years along with the estimated cost of each "cost-entity". This will connect your revenues to your costs.

9) REVENUE STREAMS

Which will be the main revenue streams when the solution is ready for the market. Explain how each of them will generate revenue and how much you expect to generate from each stream.

Estimate revenues for seed stage after 6 months and after 3 years. Quantify amounts and prices by detailing, for example, the expected amount of services provided and paid, amount of licenses sold at which prices etc.

After you finish the exercise, test your hypothesis "out the lab", with at least 2 to 3 real potential customers. Validate the following assumptions:

- Are the problems you assume really the ones? Is your solution to solving their problem?
- Are the features your solution is offering the ones the market needs and looks for?
- Are the explanations provided in the canvas sufficient to provide the customer with an understanding of your project?

Write down the feedbacks and update, revise, iterate the Canvas accordingly.

An example of Lean Canvas by Ash Maurya

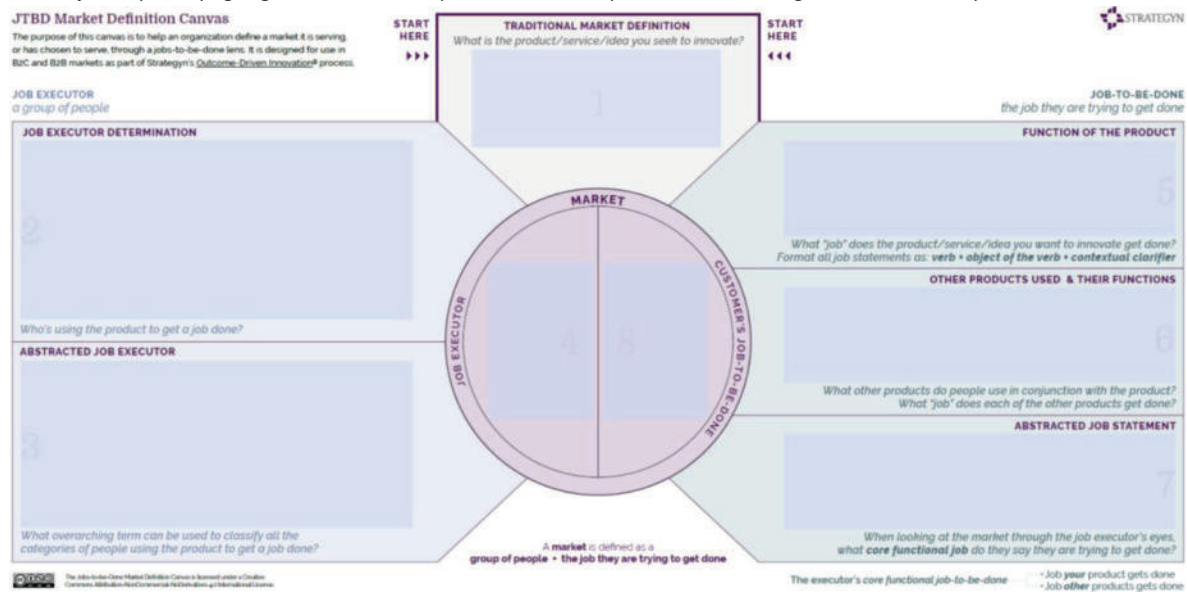
Problem 1)	Solutions	Unique Value proposition	Unfair Advantage	Customer segment
1) For 95% of solar cell manufacturers there is the need to: <ol style="list-style-type: none"> 1. Reduce Silver cost of 90% 2. Reduce carbon footprint of 95% 3. Increase efficiency of solar cell of 1%÷3% 	4) <p>Top 3 features</p> <ol style="list-style-type: none"> 1.No resist or mask necessary to plate copper 2. Only one plating equipment is necessary and no other support equipment or added process 3.Low footprint 	3) <p>The advanced micro turbines »plug and play« micro generator allows providers of electronic systems to offer off grid real time monitoring and control solutions with the highest reliability over time and across operating conditions, with no need</p>	7) <ul style="list-style-type: none"> • Patent pending • Breakthrough in electroplating concept 	2) <p>Target customers</p> <p>HJT cells manufactures; currently the only European Community company that produce Heterojunction are EGP and one Hungarian company plus one Russian customer</p>

<p>2) For 5% of solar cell manufacturers there is the need to:</p> <p>1. Reduce CapEx and OpEx impact for copper deposition</p> <p>Alternative Solutions Copper deposition using protective mask (no cost reduction respect Silver metallization)</p>	<p>Key Metrics</p> <p>6) Key activities you measure</p> <ul style="list-style-type: none"> • 100MW Unit sold yearly • Copper consumed per 100MW: monthly • Yield of equipment: monthly 	<p>of permission for installing generators unlike solar panels</p>	<p>Channels</p> <p>5) Path to customers</p> <ul style="list-style-type: none"> • Exhibition and Fair • Commercial agreement with big companies • Technical Workshop with selected customers 	<p>Early Adopters</p> <p>R&D Centers, University, Corporate laboratories to test the new technology and develop new cell structures due to the unique future offered by Rise technology (Europe and Worldwide) Currently the R&D Institute in Europe is around 12 and main countries that will be prioritized are France, Germany and Switzerland.</p>
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<p>Cost structure (when solution is ready for the market)</p> <p>8)</p> <table border="1"> <thead> <tr> <th>Cost</th> <th>6 month</th> <th>3 years</th> </tr> </thead> <tbody> <tr> <td>Direct Labor</td> <td>300k€</td> <td>4M€</td> </tr> <tr> <td>Material</td> <td>300k€</td> <td>5M€</td> </tr> <tr> <td>Manufacturing overhead (indirect material)</td> <td>30k€</td> <td>500k€</td> </tr> <tr> <td>Manufacturing overhead (indirect labor)</td> <td>30k€</td> <td>100k€</td> </tr> <tr> <td>Manufacturing overhead (other)</td> <td>150k€</td> <td>200k€</td> </tr> </tbody> </table>	Cost	6 month	3 years	Direct Labor	300k€	4M€	Material	300k€	5M€	Manufacturing overhead (indirect material)	30k€	500k€	Manufacturing overhead (indirect labor)	30k€	100k€	Manufacturing overhead (other)	150k€	200k€	<p>Revenue Streams (after 6 months and 3 years)</p> <p>9)</p> <p>Two possible revenue models:</p> <ol style="list-style-type: none"> 1) Ink-Jet Printer Multi-year service contracts (5 years) 6 months after seed stage → 1.5M\$ 3 years after → 10M\$/year (5-year contracts) 2) Selling Equipment 6 months after seed stage → 1.5M\$ 3 years after → 20M\$ (10 equipment)
Cost	6 month	3 years																	
Direct Labor	300k€	4M€																	
Material	300k€	5M€																	
Manufacturing overhead (indirect material)	30k€	500k€																	
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9.4 The Market Definition Canvas

According to Ulwick and Ted Thayer all markets can be described by what job the user wants to get done. The Jobs-to-be-Done Market Definition Canvas make the Lean Startup methodology more effective in better finding and defining a market up front. Generally, people buy products and services to get a “job” done, where a job is defined as a task people are trying to accomplish, a goal or objective they are trying to achieve, a problem they are trying to resolve, something they are trying to avoid. According to this assumption, a market is best defined as a group of people and the job they are trying to get done. Such concept assumes more importance when dealing with New and Disruptive Markets.



9.5 How to fill out the Market Definition Canvas

The Market Definition Canvas works for both B2C and B2B applications. While it is optimized to define single-sided markets, it can be used twice to define both sides of a double-sided market. For component manufacturers who sell to OEMs or who are at the top of a long distribution chain, a canvas can be completed for each constituent in the distribution chain, including the end-user, as each constituent has its own unique job to get done.

The definition of a market as a Job to Be Done, is structured in 8 steps:

- **1. Traditional market definition**

During this phase, research teams have to define what is the product/service/idea they seek to innovate. This is used as the grounding point, as the subsequent steps will help transition from a product view to a jobs-to-be-done view of the market.

- **2. Job executor determination**

The focus on “jobs to be done” begins with this step by asking who's using the product (or who would use the product once released) to get a job done. The goal is to reveal the diverse set of potential product users by producing a list of all the categories of people who use or would use the product to extract its value. The focus here is on the job executors, not on influencers, economic buyers, people who support the product throughout its lifecycle, or other customer types. For example, if we address circular saw market, we can conclude that finish carpenters, framers, roofers, general contractors, electricians, and plumbers use circular saws (all categories of people who use circular saws).

- **3. Abstracted job executor**

Next research teams have to define the one overarching term that can be used to classify or describe all people using, or potentially using, the product as a single group. Since the definition of a market needs a group of people + the job-to-be-done, when defining the group of people, it is not suggested to use an actual job title. Instead, an all-inclusive term that encapsulates all job executors, usually a higher-level, generic term has to be found. Following the previous example, abstracted roofers, framers, plumbers, finish carpenters, etc., can be grouped into a higher-level category using the term “tradespeople”. For consumer product goods, the job executors are often referred to simply as “consumers.”

- **4. Job executor**

Since more than one way to describe the “group of people” could be identified, at this stage research teams have to choose a label that fits all types of people using the product, service, or idea. Some examples include the use of the term surgeons over cardiac surgeons, tradespeople over tradesmen, educators over teachers, accountants over tax preparers, or consumers over adults, to be more inclusive. It is important to define the “group of people” before defining the job-to-be-done, as representatives of the group will be interviewed to determine, from them alone, the way they define the job they are trying to get done.

- **5. Function of the product**

Products don't have jobs-to-be-done; people do. But to uncover the targeted group's job-to-be-done, it is often helpful to start by understanding what function/job the innovative product performs.

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The typical question is: what does/will the new product or service help the group of people accomplish from a functional perspective? This can be investigated internally or, better, by going directly to the “group” of people (defined in step 4). Responses have to be collected into a single statement according to this formula: “The product will help the group of people [verb] + [object of the verb] + [contextual clarifier (optional)]”. For example, a boiler may be used to “heat + water + to the desired temperature,” or a dental drill may be used to “contour + the shape + of a tooth.”

This is not the customer’s job-to-be-done yet. It is the function or the job that the product gets done, which is often only part of the job the customer is trying to get done. For example, while people may use a kettle to “heat water to the desired temperature,” the overall job they are trying to get done may be to “prepare a hot beverage for consumption.”

The goal of the market definition canvas is to help innovators uncover the job-to-be-done as perceived by the customer, not the product developer.

• 6. Other products used and their functions

To get a feel for the entire job customers are trying to get done, research teams have to analyse what other products they use immediately before, while, and immediately after using the innovative product/service. For example, when tradespeople use a circular saw to “cut wood,” what other products are they using in conjunction with a circular saw? Perhaps they are also using a T-square, a measuring tape, sandpaper, and (or) a pencil. Once this list of products is ready, the functions / jobs that each of these other products gets done for the group of people has to be documented, using the same format used previously: [verb] + [object of the verb] + [contextual clarifier (optional)].

For example, it can be found through customer interviews that while the function of the circular saw is to “cut wood” (a job statement), that tradespeople use a T-square to ensure they “make a cut in a straight line” (a job statement), and that they use a pencil to “mark the cut path” (a job statement).

• 7. Abstracted job statement

Putting all the pieces together helps reveal the customer’s ultimate job-to-be-done at the right level of abstraction. It is assumed that the new product is getting part of a job done and people are using other products to complete the entire job-to-be-done. The customer’s job-to-be-done has to be defined in a way that includes the new product’s function (job) and rationalizes why customers are using all these other products as they cobble together a complete solution. For example, tradespeople are using a circular saw along with other products so they can “cut wood in a straight line” (the abstracted job statement); accountants use tax preparation software in conjunction with other products so they can “formulate and execute a tax strategy for a client” (the abstracted job statement). Defining the market at this level of abstraction allows an evolution of the new product over time to help customers get more, and eventually all, of their job done. It offers the innovator a built-in path and vision for growth, tied directly to what customers are trying to accomplish.

• 8. Customer’s Job-to-be-Done

Now the customer’s job can be documented. If there are multiple versions of the job statement, research teams will have to work with job executors to gain consensus on the best version.

Steps 5-8 need the use of customer interviews. If the job of the product is not represented, might be the job statement was abstracted to too high a level.

The market defined as a Group of people (Step 4) + Job-to-be-Done (Step 8) will facilitate the application of the Lean Startup approach and better use further tools.

9.6 The Value Proposition canvas

The Value Proposition Canvas (VPC) is used to facilitate R&I projects clarifying the customer needs & how to create value for them. Osterwalder introduced this concept at depth in his book Value Proposition Design. The Value Proposition Canvas helps teams deepen their understanding of target customers. This allows to avoid one of the most common mistakes when developing an innovation: building something that nobody wants.

The Value Proposition Canvas is a plug-in tool to describe the Value Propositions and the target Customer Segments in more detail and evaluate the “fit” between the value the solution intends to create and the expectations the selected customers’ segment. The Value Proposition Canvas can be used before, during and after developing an in-depth knowledge of the customers. If used before, it will highlight what is needed to learn about customers and test about value propositions. If used after, it will help analyse and evaluate the “fit”. The Value Proposition Canvas can be applied to new and existing value propositions and customer segments alike.

An example of the Value Proposition Canvas

Customer job

- Providing monitoring/control system with self-electric power production capabilities (operating off grid)

Customers pains

- Reliability (over time and across weather conditions)
- Certification (Certified solutions)

Gains

- Plug and play (easy to install)
- Low maintenance /operation costs
- Capability to operate over a wide range of conditions (including limitations on pressure/flow of the fluid to be monitored/controlled)
- Self-monitoring
- Low dismantling costs

Product/service

- Micro-generator (activated by pressure drop in gas/water pipes)

Pain relievers

- Operating from inside the valve housing (protected from thieves/vandals)
- Produces energy 24/7 under any condition - Start working at low pressures (0,5 bar)
- CE / ATEX Zone 1 certification

Gain creators

- Pre-assembled (easy and fast to install)

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- Embedded self-diagnosis capabilities
- Data exchange with third party devices
- No need for authorisation for installation
- No consumption of monitored fluid
-



Resulting UVP

The advanced micro turbines »plug and play« micro generator allows providers of electronic systems to offer off grid real time monitoring and control solutions with the highest reliability over time and across operating conditions, with no need of permission for installing generators unlike solar panels

9.7 How to fill out the Value Proposition Canvas

The VPC is based on 2 main concepts:

- the Value Map: the set of value proposition benefits that are designed by R&I projects to attract customers.
- the Customer Profile: the set of customer characteristics that R&I projects assume, observe and verify in the market.

The Customer profile section has to be filled in by making assumptions on:

- jobs: it specifies what target customers are trying to get done. As an example, in case of taxi passengers as customers, they generally try to call a taxi, find a taxi, pay the taxi driver, etc.
- customers pains: it makes assumptions on what annoys the customer before, during & after getting job done. This is the space to uncover and document what frustrates target early adopters. There is the need to detail what creates friction and to learn about the things early adopters are desperate to solve. Following the previous example, taxi passengers may not want to wait for long time, be with an unsafe driver, etc.
- customers gain: it makes assumptions on what outcomes & benefits customers want. In the previous examples, taxi passengers may want to arrive on time, a fair price, an easy payment.

By doing this, an effective Customer Profile Summary will be created, which allows to have an immediate visualization of the customer profile.

Then it is the turn of the Value Map which describes explicitly how a product/service creates value, by specifying:

- products/services: This is how the value proposition manifests itself. In this space it's possible to be more specific about the proposed innovation.
- pain relievers: they specify exactly which customers pains the proposed products/services alleviate specifically. This space is useful to document how the innovative product or service could relieve the existing customer pains.
- gain creators: it describes how the innovative product or service could fulfil the desired customer gains.

The "Pain relievers" and "Gain creators" spaces are not designed to describe features. Rather, they are designed to describe ways in which the desired outcome (relieved pain, desired gain or jobs to be done) could be fulfilled.



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Finally, the Customer Profile and the Value Map have to be used to establish fit. Strategyzer defines fit as: “when your value map meets your customer profile- when your products and services produce pain relievers and gain creators that match one or more of the jobs, pains and gains that are important to your customer.”

10 Annex 3 - Follow-up funding opportunities

10.1 EIC Transition

The EIC Transition funding scheme builds on promising research results to demonstrate and mature the technology and develop business plans.

EIC Transition funds innovation activities that go beyond the experimental proof of principle in laboratory to supports both:

- the maturation and validation of your novel technology in the lab and in relevant application environments
- the development of a business case and (business) model towards the innovation's future commercialisation.

Grants of up to €2.5million and more are available to validate and demonstrate technology in application-relevant environment and develop market readiness.

EIC Transition has open funding for projects in any field of science or technology as well as challenge driven funding on specific strategic fields.

Single applicants (SMEs, spin-offs, start-ups, research organisations, universities) or small consortia (max 5 partners) may apply.

https://eic.ec.europa.eu/eic-funding-opportunities/eic-transition_en

10.2 EIC Accelerator

The EIC Accelerator supports individual Small and Medium Enterprises (SMEs), in particular Startups and spinout companies to develop and scaleup game-changing innovations. In some cases, small mid-caps (up to 500 employees) are supported.

The EIC Accelerator provides substantial financial support with:

- grant funding (non-dilutive) of up to €2.5 million for innovation development costs,
- investments (direct equity investments) of up to €15 million managed by the EIC Fund for scale up and other relevant costs.

In addition, EIC selected companies receive coaching, mentoring, access to investors and corporates, and many other opportunities as part of the EIC community.

Applications can be submitted at any time through the EIC platform. Applicants have to submit a video pitch, a slide deck and respond to a short set of questions about their innovation and their team.

Applications that meet all the criteria at the remote evaluation stage and are assessed positively by the EIC jury but not recommended for funding, will be awarded a Seal of Excellence to help them secure funding from other sources. Companies with a Seal of Excellence can also get support from EIC Business Acceleration Services.

https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator_en

10.3 EIC Prizes

The EIC Prizes are awarded to whoever can most effectively meet a pre-defined challenge, without prescribing how that challenge should be solved. These will boost breakthrough innovation across sectors by fostering cutting-edge solutions which bring major benefits to citizens and society.

In 2021 the following challenges are defined:

- EU Prize for Women Innovators (3 prizes of €100k, 1 prize for 'Women Innovators' main category, 1 prize of €50k for 'Rising Innovator' category)
- The European Capital of Innovation Awards (iCapital) (total budget €1,8 million, European Capital of Innovation winner €1 million)
- The European Innovation Procurement Awards (total budget €300k)
- The European Social Innovation Competition (total budget €200k)

10.4 Fast Track scheme to apply for the EIC Accelerator

The 'Fast Track' scheme is a novelty under Horizon Europe and a specific process applicable to the EIC Accelerator. It provides for a specific treatment of applications that result from existing Horizon Europe or Horizon 2020 projects.

Under the Fast Track scheme, applicants do not apply directly to the EIC Accelerator call. Instead, a project review is carried out by the responsible funding body to assess the innovation or market deployment potential of an existing project, to decide whether the project is suitable for support under the EIC Accelerator.

The responsible funding body can submit the outcome of the projects review to the EIC Accelerator, if the project review concludes that the following conditions are met:

- the proposal meets the two first criteria of the EIC Accelerator (excellence and impact),
- there is no duplication of funding of activities to be supported under the EIC Accelerator with the existing grant, and
- the applicant meets the eligibility criteria for the EIC Accelerator.

The applicant will then be invited to prepare a full application for the EIC Accelerator to one of the cut-off dates within the next 12 months following initial review. They will receive support through the EIC artificial intelligence-based IT platform and coaching.

10.5 Ad hoc grants for EIC Pathfinder and EIC Transition grant holders

The grant holders of EIC Pathfinder projects (including grants resulting from certain EIC pilot Pathfinder, FET-Open and FET-Proactive calls) and of EIC Transition projects are eligible to receive ad hoc grants with fixed amounts of up to EUR 50 000, as specified in the relevant call sections of the EIC work programme.

In line with Article 47(3)(b) of the Horizon Europe Regulation, the ad hoc grants are not subject to any call. They reflect the necessity and hence the possibility for the EIC to proactively support, at any stage of a project implementation, the assessment of any potentially innovative lead stemming from a EIC Pathfinder project, or reinforce the coordination and management of a Portfolio where needed.

These ad hoc grants fund either complementary activities to explore potential pathways to commercialisation (for EIC Pathfinder grant holders) or portfolio activities (for EIC Pathfinder and EIC Transition grant holders).

These ad hoc grants do not fund research or activities that were already foreseen in the original project. A maximum of three ad hoc grants can be awarded for each EIC Pathfinder project and more than three may be awarded in exceptional

and duly justified cases. A maximum of one ad hoc grant can be awarded for each EIC Transition project. Any such ad hoc grant can be awarded to an individual grant holder or a group of grant holders.

EIC grant holders, after discussion with a EIC Programme Manager or following a project review, can apply for such an ad hoc grant.

10.6 The InvestEU Programme

The InvestEU Programme builds on the successful model of the Investment Plan for Europe, the Juncker Plan. It will bring together, under one roof, the European Fund for Strategic Investments and 13 other EU financial instruments. Triggering more than €372 billion in additional investment over the period 2021-27, the InvestEU Programme aims to give an additional boost to sustainable investment, innovation and job creation in Europe.

The Programme consists of:

- The InvestEU Fund which aims to mobilise more than €372 billion of public and private investment through an EU budget guarantee of €26.2 billion that backs the investment of implementing partners such as the European Investment Bank (EIB) Group and other financial institutions.
- The InvestEU Advisory Hub which provides technical support and assistance to help with the preparation, development, structuring and implementation of investment projects, including capacity building.
- The InvestEU Portal which brings together investors and project promoters on a single EU-wide platform, by providing an easily accessible and user-friendly database of investment opportunities available within the EU.

10.7 INTERREG EUROPE

Interreg Europe can help in the following ways:

- **Financial support** – funding is available for interregional cooperation projects, which have the potential to lead to longer-term collaborations and partnerships
- **Expand your network** – meet new like-minded partners, stakeholders, and business colleagues across Europe.

The DG also gives the opportunity to organisations to get some grants through calls for proposals. These are invitations for suppliers to submit a proposal on a specific commodity or service. A grant or a subvention is a direct financial contribution from the European Commission to support a specific action or project of a non-commercial nature, to cover eligible costs directly incurred by the beneficiaries.

For more information check here: <http://www.interregeurope.eu/>

10.8 EUREKA and Eurostars funding

Eurostars supports international innovative projects led by research and development- performing small- and medium-sized enterprises (R&D-performing SMEs). With its bottom-up approach, Eurostars supports the development of rapidly marketable innovative products, processes and services that help improve the daily lives of people around the world. Eurostars has been carefully developed to meet the specific needs of SMEs. It is an ideal first step in international cooperation, enabling small businesses to combine and share expertise and benefit from working beyond national borders.

Eurostars applies a decentralized funding procedure; participants do not receive funding directly from the EUREKA Secretariat or the EU. All funding to participants in approved projects is managed by their respective funding body and

according to their national funding rules and procedures. These rules and procedures are dependent on the member countries involved in the project. Project partners are strongly advised to contact their National Project Coordinators (NPCs) and browse on the Eurostars in each country. <https://www.eurostars-eureka.eu/>

10.9 CASCADING GRANTS

Cascade Funding, also known as Financial Support for Third Parties (FSTP), is a European Commission mechanism to distribute public funding in order to assist beneficiaries, such as start-ups, scale-ups, SME and/or mid-caps, in the uptake or development of digital innovation.

This funding method aims at simplifying the administrative procedures, creating a light, SME-friendly application scheme, by allowing that some EU-funded projects may issue, in turn, open calls for further funding.

This scheme is based on the model of Erasmus students and was first introduced by the European Commission in Horizon 2020, the Framework Programme for Research and Innovation (2014-2020). It will be used also in the new Horizon Europe Framework Programme for Research and Innovation (2021-2027).

More information and open calls available here: <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/competitive-calls>

10.10 Seal of Excellence – EuroQuity Initiative

This initiative is dedicated to those companies who have received the Seal of Excellence from the EU Horizon 2020 SME Instrument Programme. Matchmaking activities and support services will be provided in order to facilitate their access to risk finance and enhance their visibility, through a specific on-line community based on the EuroQuity platform.

Each “Seal of Excellence” SME will gain in this way instant visibility among different actors: the main EU business angels’ networks, VCs, corporate investors and new business partners, at the same time investors will be guarantee on the quality of SMEs’ projects and their innovation potential. Free services will also be offered to these companies allowing them to grow on a European level:

- Visibility and access to European investors
- Possibility to pitch online in front of investors during e-pitch sessions
- Connections with National Contact Points of your Country

More information available here <https://www.euroquity.com/fr/communitAccess4SMEs--Seal-of-Excellence-5bb56459-4f88-4d3c-a2eb-8e4b6e865ea5/>

10.11 European Green Deal

Background

On 11 December 2019, the Commission presented the European Green Deal, with the ambition of becoming the first climate-neutral bloc in the world by 2050. Europe's transition to a sustainable economy means significant investment efforts across all sectors: reaching the current 2030 climate and energy targets will require additional investments of €260 billion a year by 2030.

The success of the European Green Deal Investment Plan will depend on the engagement of all actors involved. It is vital that Member States and the European Parliament maintain the high ambition of the Commission proposal during the negotiations on the upcoming financial framework.

A swift adoption of the proposal for a Just Transition Fund Regulation will be crucial.

The Commission will closely monitor and evaluate the progress on this transition path. As part of these efforts, every year the Commission will hold a Sustainable Investment Summit, involving all relevant stakeholders, and it will continue to work for promoting and financing the transition. The Commission invites the investment community to make full use of the enabling regulatory conditions and ever-growing needs for sustainable investments, and authorities to take an active role in identifying and promoting such investments.

The Just Transition Mechanism

The Just Transition Mechanism (JTM) is a key tool to ensure that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind. While all regions will require funding and the European Green Deal Investment Plan caters for that, the Mechanism provides targeted support to help mobilise at least €100 billion over the period 2021-2027 in the most affected regions, to alleviate the socio-economic impact of the transition. The Mechanism will create the necessary investment to help workers and communities which rely on the fossil fuel value chain. It will come in addition to the substantial contribution of the EU's budget through all instruments directly relevant to the transition.

The Just Transition Mechanism will consist of three main sources of financing:

- 1) **A Just Transition Fund**, which will receive €7.5 billion of fresh EU funds, coming on top of the Commission's proposal for the next long-term EU budget. In order to tap into their share of the Fund, Member States will, in dialogue with the Commission, have to identify the eligible territories through dedicated territorial just transition plans. They will also have to commit to match each euro from the Just Transition Fund with money from the European Regional Development Fund and the European Social Fund Plus and provide additional national resources. Taken together, this will provide between €30 and €50 billion of funding, which will mobilise even more investments. **The Fund will primarily provide grants to regions. It will, for example, support workers to develop skills and competences for the job market of the future and help SMEs, start-ups and incubators to create new economic opportunities in these regions. It will also support investments in the clean energy transition, for example in energy efficiency.**
- 2) A dedicated **just transition scheme under InvestEU** to mobilise up to €45 billion of investments. It will seek to attract private investments, including in sustainable energy and transport that benefit those regions and help their economies find new sources of growth.
- 3) **A public sector loan facility with the European Investment Bank** backed by the EU budget to mobilise between €25 and €30 billion of investments. It will be used for loans to the public sector, for instance for investments in district heating networks and renovation of buildings.

The Commission will come with a legislative proposal to set this up in March 2020. **The Just Transition Mechanism is about more than funding: relying on a Just Transition Platform, the Commission will be providing technical assistance to Member States and investors** and make sure the affected communities, local authorities, social partners and non-governmental organisations are involved. **The Just Transition Mechanism will include a strong governance framework centred on territorial just transition plans.**

More information available here https://ec.europa.eu/info/research-and-innovation/strategieuropean-green-deal/call_en

10.12 European Institute of Technology and Innovation

Under EIT's Knowledge and Innovation Communities (KICs) are partnerships that bring together businesses, research centers and universities. Through the KICs, EIT strengthen cooperation among businesses (including SMEs), higher education institutions and research organisations, form dynamic pan-European partnerships, and create favorable environments for creative thought processes and innovations to flourish. These partnerships are called Innovation Communities and each is dedicated to finding solutions to a specific global challenge, from climate change and sustainable energy to healthy living and food.

There are 8 Innovation Communities and each focuses on a different societal challenge:

- EIT Climate-KIC
- EIT Food
- EIT Health
- EIT Digital
- EIT Manufacturing
- EIT Innoenergy
- EIT Urban Mobility
- EIT Raw Materials

10.13 LIFE Programme

LIFE programme is the EU's funding instrument for the environment and climate action. The programme is divided into two sub-programmes, one for environment (representing 75% of the overall financial envelope) and one for climate action (representing 25% of the envelope).

- The programme includes large scale demos/pilots with focus on Environment and Climate Action; with clear impact aims during the project; and clear environmental/climate problem baseline (de-risk).
- Projects start at TRL 6-7 aiming up to 9 to bridge valley of death (income allowed – end-user important).
- The funding programme uses bottom-up approach (call-topics are broad) allowing proposers to define their solutions needed for their environmental context/problem.
- Focus is on making Environmental impacts in the EU.
- Even proposals from single EU beneficiaries are allowed.
- Proposers can apply in their own language.
- There is no set proposal budget limit.

10.14 Contracts and grants - access to business opportunities

Several different contracts and grants are regularly made available for companies or organisations who want to work with Directorate General (DG) for Internal Market, Industry, Entrepreneurship, and SMEs or apply for funding.

In the framework of public procurement contracts, DG Internal Market, Industry, Entrepreneurship, and SMEs regularly organizes calls for tenders. Calls for tenders are special procedures to generate competing offers from different businesses looking to obtain works, supply, or service contracts.

Those tenders/calls also give an insight in competitors' activities as well as ideas for partnerships and stakeholders. Furthermore, there are possibilities for winning contracts.

11 Annex 4 – Non-financial support

11.1 European Investment Project Portal (EIPP)

The European Investment Project Portal (EIPP) is the EU matchmaking portal, enabling EU-based project promoters – public or private – to reach potential investors worldwide. The Portal is a free service offered by the European Commission and is part of the Investment Plan for Europe, which aims to mobilise investment, boost economic growth and create jobs across the EU.

For more information check here: <https://ec.europa.eu/investeuportal/desktop/en/index.html>

11.2 Entrepreneurship and Small and medium-sized enterprises (SMEs)

The dedicated section on EU portal offers a wide focus dedicated to information on possible EU funding opportunities for SMEs and in general on what EU does for SMEs: <https://ec.europa.eu/growth/smes>

Furthermore, to know if a programme is relevant to your particular case, we strongly suggest that you contact your local Enterprise Europe Network partner, who can give you one-to-one advice and support in applying for EU funding.

Contact details of the Enterprise Europe Network members: <http://een.ec.europa.eu/about/branches/>

11.3 Access to finance in Europe

University technology transfer offices (UTTOs) often perform the function of transferring technology and commercialising innovations emerging from the University sector to the market place.

For more information check here:

http://europa.eu/youreurope/business/funding-grants/access-to-finance/index_en.htm

This site can help to apply for loans and venture capital supported by the European Union

Click on your country to locate banks or venture capital funds that provide finance supported by the EU.

11.4 Tenders Electronic Daily

TED provides free access to business opportunities from the European Union, the European Economic Area and beyond.

Every day, from Tuesday to Saturday, a further 2,000 public procurement notices are published on TED.

You can browse, search and sort procurement notices by country, region, business sector and more.

Information about every procurement document is published in the 24 official EU languages. All notices from the EU's institutions are published in full in these languages. For more information check here:

<http://ted.europa.eu/TED/search/search.do>

11.5 Innovaccess - Intellectual Property Portal

Innovaccess aims to enhance Intellectual Property (IP) support services to Small and Medium-sized Enterprises (SMEs) to turn their Intellectual capital into commercial values and competitiveness.

The portal helps to protect IP rights and to understand IP security rules. For more information check here: <http://www.innovaccess.eu/>.

11.6 Dealflow

Dealflow is sponsored by the European Commission to support EU-funded innovations with fundraising, venture building and networking. It supports EU-funded projects from H2020.

Three typologies of support are foreseen:

- Venture-building: giving tailored support on challenging business topics (e.g. sales strategy, market sizing & research, organizational structure, and pitching);
- Fundraising (preparation): preparing investor materials and providing access to investor networks;
- Networking: introductions to industry experts, potential clients and new partners through their matchmaking platform, community & events.

<https://dealflow.eu/>

11.7 Innovfin

InnovFin – EU Finance for Innovators is a joint initiative launched by the European Investment Bank Group (EIB and EIF) in cooperation with the European Commission under Horizon 2020. InnovFin aims to facilitate and accelerate access to finance for innovative businesses and other innovative entities in Europe.

Innovfin makes available specific instruments for different typologies of financing.

Start-up and SME financing

- InnovFin Equity provides equity investments and co-investments to or alongside funds focusing on early stage financing of enterprises operating in innovative sectors covered by Horizon 2020, located or active in the EU or Horizon 2020 Associated Countries. InnovFin Equity is available via four products: InnovFin Technology Transfer, InnovFin Business Angels, InnovFin Venture Capital, InnovFin Fund-of-Funds
- InnovFin Guarantee SME guarantee provides guarantees and counter-guarantees on debt financing between EUR 25 000 and EUR 7.5 million, in order to improve access to loan finance for innovative small and medium-sized enterprises (SMEs) and small mid-caps (up to 499 employees).

Corporate finance

- InnovFin Emerging Innovators offers a range of tailored products which provide financing in support of R&I by small, medium-sized and large companies and the promoters of research infrastructure. It provides loans or guarantees directly or indirectly via financial intermediaries.
- InnovFin MidCap Guarantee provides guarantees and counter-guarantees on debt financing of up to EUR 50 million, in order to improve access to finance for innovative midcaps (up to 3 000 employees) which are not eligible under the InnovFin SME Guarantee.
- InnovFin Corporate Research Equity (in collaboration with EFSI) increases the supply of equity-type financing under the European Fund for Strategic Investments (EFSI) to large research and innovation (R&I) programmes and to innovative large mid-caps and small or medium-sized enterprises (SME). It addresses the market gap for

large equity-type investment in the form of contingent loans, in particular with mid- to long-term repayments profile that are directly linked to product development cycles.

Science

- InnovFin Science (for research institutions and universities) aims at supporting research and innovation (R&I) investments by public or private research institutes/organisations and universities, including the financing of buildings and other infrastructure directly related to R&I activity. It provide different forms of debt or equity-type financing

Thematic financing

- InnovFin Energy Demo Projects provides loans, loan guarantees or equity-type financing to innovative demonstration projects in the fields of energy system transformation, including but not limited to renewable energy technologies, smart energy systems, energy storage, carbon capture and storage or carbon capture and use, helping them to bridge the gap from demonstration to commercialisation. The product is deployed directly by the EIB.
- InnovFin Infectious Diseases provides financial products ranging from standard debt to equity-type financing for amounts typically between EUR 7.5 million and EUR 75 million, to innovative players active in developing innovative vaccines, drugs, medical and diagnostic devices or novel research infrastructures for combatting infectious diseases. The product is being made available directly through the European Investment Bank.

11.8 Startup Europe

STARTUP Europe is an initiative of the European Commission to connect high tech startups, scale-ups, investors, accelerators, corporate networks, universities and the media. The 4 main objectives of Startup Europe are to:

- Connect people
- Connect local start up ecosystems
- Help start-ups soft land in other market
- Celebrate entrepreneurs' success

In order to help build a strong European ecosystem where startups can thrive, Startup Europe is empowering 7 projects, funded under Horizon 2020, that are connecting local ecosystems across Europe. These projects will connect deep tech startup ecosystems and support cross-border activities for startups and scale-ups. The cross-border activities include the following: connecting tech entrepreneurs with potential investors, business partners, accessing skills, and services helping startups soft land in new international markets.

- Scaleup4Europe: The Scaleup Labs will provide deep tech start-ups with a structured open innovation approach in which they can achieve cross-border market success, through first successful collaborations with corporate customers, investors and/or public institutions.
- B-HUB FOR EUROPE: Will target deep tech vertical startups in the blockchain domain. The initiative is aimed at: discovering high-potential innovations, shaping suited proof of concepts and business models, providing specialised acceleration services to overcome current market barriers and assist the go-to-market process, unlocking new market channels with potential private/public customers, scaling up innovative businesses across five startups ecosystems in Europe: IT (Rome), FR (Paris), DE (Berlin), LT (Vilnius) and RO (Cluj-Napoca).
- The Scale-up Champions: Project builds on the premise of equalising opportunities of scaling up for startups across five countries represented through the partners of the consortium: Estonia, Lithuania, Poland, Denmark and Spain. Main activities targeting: corporate-startup collaboration, investment readiness and internationalization
- STARTUP 3: Will scout for top founding teams to identify (uptake) breakthrough innovations from deep tech verticals (i.e. built on tangible scientific discoveries or engineering/ technical advances). Then STARTUP3 will

help them fine tune (upgrade) their technologies/ business models and align their value proposition to the actual market demand (the so-called Key Performance Areas – KPAs). Finally, STARTUP3 will bring together top deep tech startups/ SMEs and the most prominent corporate innovators – CVC arms, incubators and accelerators, and innovation labs (facilitated by clusters and digital innovations hubs – DIHs) with the aim of catalysing productive interaction (upscale).

- X-Europe: Brings together leading training, acceleration, events, and media companies from across Europe. Through the delivery of training, matchmaking & promotional services X-Europe will support 150 deeptech startups and help them to internationalize, grow across borders, and into developing frontiers.
- INNODEC - (Innovation Radar Data-based Identification & Commercialisation): Aims to close the gap between investors and research projects from both sides. On the one hand, this is achieved through placing investors/partners in contact with the research projects with the highest potential, and then on the other, to coach the projects on raising capital, identifying a business model and developing a sound go-to-market strategy. This approach will ensure scalability while simultaneously catering to the large diversity between projects and their needs.
- MediaMotorEurope: Will boost solutions that can address challenges. Its goal is to nurture high-potential European deep tech innovators, solving today's most prominent media industry challenges and support them in building the media solutions of tomorrow such as misinformation, accessibility, user interfaces and use of data. A large focus will be on deep tech solutions, such as AI and machine learning, and their potential application in the domain of media and creative industries.

11.9 Accelerators and Incubators

If you have the intention to create a startup/spinoff, you are suggested to check Accelerators/Incubators in your area. Here below there is a non-exhaustive list of international and pan-European Accelerators/Incubators networks:

- Startup Bootcamp: founded in 2010, Startup Bootcamp is a well-known global network of startup accelerators that offer an intense 3-month program. After Selection Days, 10 startups join diverse accelerator programs (Amsterdam, Istanbul, London, Barcelona, Copenhagen, Berlin, Eindhoven and Haifa) where they receive mentoring, free workspace, great networking opportunities, and pitching opportunities to over 400 investors on Investor Demo Day.
- Startup Weekend: Startup Weekend brings together developers, designers, product managers, aspiring entrepreneurs, marketers and tech enthusiasts to launch a startup in 54 hours. These weekend-long events are focused on learning through creating, building professional relations and networking.
- StartupBus Europe: is a unique project founded in 2010. It is a hackathon for European tech entrepreneurs ("buspreneurs") where they compete over the course of a 3-day bus ride on the way to Vienna.
- IMPACT Accelerator: (Internet Mobile Projects Accelerator) offers premium acceleration services for European mobile start-ups and small and medium-sized business for a period of six months. It operates in several locations in Spain and Italy and given it is one of the 16 consortia selected by the European Commission within the framework of the Seventh Framework Programme, the selected start-ups in the extended phase can count on the Buongiorno Headquarters in 14 countries.
- Wayra: launched in 2011, Wayra is a startup accelerator financially backed by Telefonica, one of the biggest telecommunication companies in the world.

Here below a non-exhaustive list of Accelerators/Incubators in Member States:

- Austria: i5invest, INiTS, Up to Eleven, Kubator
- Belgium: Telenet Idealabs, NEST'Up
- Bulgaria: 3Challenge, Eleven, LAUNCHub
- Croatia: Zip

- Czech Republic: StarCube, Startup Yard
- Denmark: Accelerace
- Estonia: GameFounders, Garage48, Startup Wise Guys
- Finland: Startup Sauna
- France: TheFamily, Numa (Le Camping)
- Greece: OpenFund
- Germany: Axel Springer Plug & Play, hub:raum
- Hungary: iCatapult
- Italy: H-Farm, LuissEnLabs
- The Netherlands: Rockstart
- Norway: betaFACTORY
- Lithuania: StartupHighway
- Portugal: The Lisbon Challenge
- Poland: Gamma Rebels
- Romania: SeedForTech, Innovations,
- Spain: SeedRocket, Tetuan Valley

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BOOSTER



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Not provided yet by BOOSTER consultants!

3.3 – IAM – Intellectual Asset Management – CIRC-UITs Project

Reporting Document IAM Services

By Michele Dubbini and Cemresu Yucebalkan

October 2025



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1. Executive summary and timeline of the service delivery plan

1.1. Executive Summary

This first part of the service report encloses the main characteristics of the expert, the project and the beneficiaries supported, including the main documentation upon which the service provision is based.

1.1.1. Details of the project supported

Project Name: "Circular Integration of Re-manUFACTuring strategies to Improve the Lifecycle of Technological Systems"

Project Acronym: CIRC-UIITS

Grant Agreement Number: **101091490**

Project Start: January 2023

Project End: December 2025

Beneficiary Requesting the Service: [Kopacek, Bernd](#), bernd.kopacek@sat-research.at

Project Coordinator: Paolo Rosa, paolo1.rosa@polimi.it

1.1.2. Personnel involved in the service

From the Beneficiaries' side the following personnel to part to the Capacity Building Workshop:

Name	Surname	Email Account	Institution
Bernd	Kopacek	bernd.kopacek@sat-research.at	SAT
Chris	Klok		
Maarten	Bakker		
Alexandra	Pehlken		
Francesca	Lazzari		
Jozefa B	Kovacs		
Paolo	Rosa	paolo1.rosa@polimi.it	POLIMI
Simonetta	Cota	simonetta.cota@erion.it	ERION

From the Beneficiaries' side the following personnel to part to the Coaching Workshop:

Name	Surname	Email Account	Institution
Bernd	Kopacek	bernd.kopacek@sat-research.at	SAT
Daniele	Perossa	daniele.perossa@polimi.it	POLIMI

1.1.3. Documentation provided

Documentation provided by the Management Team:

In preparation to the service provision the Management Team shared the following documentation about CIRC-UIITS:

- Booster Application
- CIRC-UIITS DoA
- ELC Final Report

Documentation provided by the Beneficiary:

In preparation to the service provision the Beneficiary, after the first contact meeting shared the following documentation:

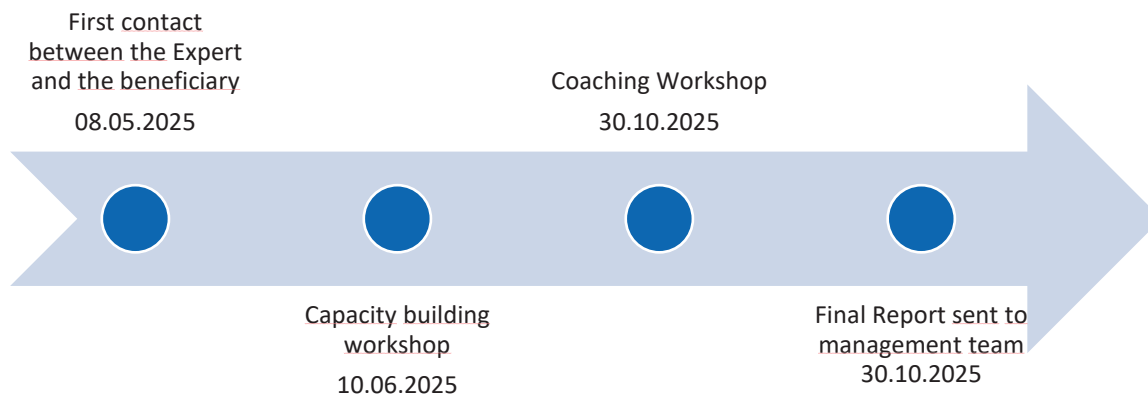
- CIRC-UIITS Consortium Agreement
- D6.4 - Dissemination & Communication plans (2nd version)
- D5.1 - Exploitation IPR business model roadmaps final

All information shared is covered by confidentiality as per NDA signed by the HRB and the Experts and will be deleted after the confirmation by the management team of this final report.

1.2. Service Delivery Plan

1.2.1. Timeline

The following is the timeline of the service provision:



1.2.2. Administrative/Organisation problems to highlight

The project took quite along time to complete because somehow the project partners lost interest in the service as they were not that interested in the content of the Capacity building workshop and decided not to participate in the Coaching Workshop, which made the organisation activities far more complicated.

Finally, only POLIMI (the Coordinator) decided to be part of the Coaching workshop and in that workshop only strategic topic regarding KER7 (Sole ownership of POLIMI were discussed).

This was somehow disappointing as many more topics could have been object of the Coaching workshop (the Project had 15 results in total) if only the Beneficiaries had the patience to take part to the planned appointments.

2. Service Provision

2.1. First contact with the service user

A first email to the Beneficiary was sent by the expert with to potential dates for the First Contact Meeting:

- 11.04.2025 at 16.00 CET
- 14.04.2025 at 14.00 CET

The Beneficiary chose to meet on the 08.05.2025 at 14.00 CET as he had no availability in the proposed dates.

2.1.1. Topic discussed

In this initial meeting the Experts explained the characteristics of the Intellectual Asset Management Booster service, including the Seminar on Capacity Building and the Coaching Workshop, the timeline of the provision and its objectives.

2.2. Capacity building workshop

Topics discussed

The Capacity building session was designed as a preparatory step to the IAM Coaching Workshop and revolved around the specific context of CIRC-UIITS (Circular Integration of Re-manUFACTuring strategies to Improve the Lifecycle of Technological Systems). The project, funded under Grant Agreement 101091490, involves 20 partners working across diverse technological domains including EV inverters, tyre sensors, in-mold electronics, and obsolete PCBs. These pilot activities generate a wide array of knowledge outputs—from hardware prototypes and embedded systems to serious games and digital twins—all requiring careful handling of background, ownership, and IP protection to ensure successful exploitation.

The first part of the workshop series introduced the legal and policy framework of IP management under Horizon Europe. Participants explored the distinction between invention and innovation, with emphasis on the EU's definition of impact: the extent to which research outputs generate tangible societal, technological, or commercial benefits. The workshop also highlighted that innovation is not restricted to commercial exploitation, but includes further research, open science, policy uptake, and public engagement.

A foundational topic was the management of background knowledge, defined as any data, know-how, or IP held prior to the Grant Agreement and necessary for the implementation or exploitation of project results. It was noted that CIRC-UIITS currently lacks a proper Attachment 1 (Background List) in the Consortium Agreement, which poses a risk for future exploitation, especially where ownership or access rights are contested. Through practical examples, the facilitators explained how missing background declarations can lead to confusion about joint vs. individual ownership, hinder licensing, and create FTO issues.

Next, the workshop addressed the ownership regime for results (foreground) under Horizon Europe. According to the default rules, results belong to the beneficiary who generates them. In case of indivisible contributions from multiple parties, joint ownership applies, triggering the need for a Joint Ownership Agreement (JOA) to regulate rights, responsibilities, licensing, and decision-making. Examples were provided on how to structure JOAs and distinguish them from general CA clauses, which are often too broad or generic.

To ground these concepts, the training sessions applied IP management principles to selected Key Exploitable Results (KERs) from CIRC-UIITS:

- KER1 – Circularity in Printed and Structural Electronics (TNO): proposed for patent protection, including device, method, and use claims covering disassemblable in-mold electronics with recyclable features.
- KER7 – Optimized Disassembly and Rework Operations (POLIMI): discussed in terms of exploitation models ranging from trade secrets to licensing in joint ventures or start-ups.
- KER14 – Digital Twin with Advisory Functions (OFFIS): considered for copyright protection and integration in circularity simulations.
- KER15 – Serious Games for Circular Economy Education (BESU): explicitly analysed under Creative Commons licensing models, balancing open access with attribution and reuse.

The workshop also revisited the principle of territoriality of IP rights, underlining that patents, copyrights, and design rights are geographically bounded. This highlighted the importance of selecting jurisdictions strategically and aligning protection efforts with target markets and exploitation regions.

A dedicated section was devoted to open science and open access, reminding partners that “open” does not mean “unprotected.” Rather, results can be openly shared while still benefiting from IP safeguards, such as publishing under appropriate CC licenses, releasing software under open-source models (e.g., MIT, AGPL), or using data-sharing protocols that preserve attribution and integrity. The EC's dissemination checklist was explained in detail, with steps to follow before and after publication, including 45-day partner notifications, EC reporting obligations, and embargo handling.

Finally, the workshop introduced tools and processes to be used in the upcoming coaching phase, such as the Results Ownership List (ROL) to be completed at the end of the project, detailing definitive owners for each result. The facilitators emphasized that ownership, protection, and exploitation must be clarified well before project closure, and that the coaching workshop will offer dedicated time to map contributions, align protection strategies, and formalize ownership arrangements through templates and legal models.

In conclusion, the CIRC-UIITS Capacity Building Workshop laid the essential groundwork for effective IP and results management. It enabled the consortium to identify legal gaps (such as the missing background list), introduced strategic thinking around protection and licensing, and built a shared vocabulary around ownership, open access, and exploitation planning. The follow-up coaching workshop will now focus on operationalizing these principles through result-specific actions.

2.3. Coaching Workshop

2.3.1. Topic discussed

Workshop Context and Objectives

This one-to-one coaching session formed part of the Horizon Results Booster Intellectual Asset Management (IAM) service for CIRC-UIITS. While the broader coaching workshop was intended to address multiple KERs, only POLIMI, lead beneficiary of KER7, was present on the day. Therefore, the session was dedicated to a focused exploration of the ownership, protection, and exploitation strategy surrounding this key result.

KER7 is a semi-automated system for non-destructive disassembly of electronic components from printed circuit boards (PCBs). By enabling precise removal and quality-controlled reuse of components, it directly supports the circular economy goals of the CIRC-UIITS project. The system integrates machine vision, robotics, and data analytics to automate and optimize rework operations in electronics.

Result Ownership and Contribution Structure

During the session, it was confirmed that POLIMI holds sole ownership over the IP linked to KER7. While other partners such as BOSCH, CONTINENTAL, WHIRLPOOL, and TNO contributed input in the form of industrial specifications, test cases, and validation scenarios, they are not considered technical co-authors of the underlying tool. No shared authorship or joint development of the software core was identified. Therefore, no Joint Ownership Agreement (JOA) is currently required for KER7.

This clarification allowed for a more straightforward discussion of protection and licensing options, as POLIMI retains full discretion over exploitation decisions, including the possibility to adopt open-source or public licensing frameworks.

Protection Strategy: From Copyright to Licensing

The current plan, reflected in D5.1 – Exploitation and IPR Roadmap, was to protect the software via copyright and potentially release it under a Creative Commons license for non-commercial educational and scientific purposes. The slides presented several licensing alternatives, including:

- Creative Commons (e.g., CC-BY, CC-BY-NC) – suitable for educational content, documentation, and datasets;
- EUPL – a copyleft license developed by the European Commission, strong in ensuring reciprocal openness;
- Apache 2.0 – a permissive open-source license that includes a patent clause and allows for commercial use, proprietary integration, and strong reuse protections.

The discussion emphasized the importance of aligning the license type with the intended downstream uses of KER7 and ensuring clarity by including:

- A LICENSE.txt file in any code releases;
- License headers in source files (when applicable);
- Attribution instructions and proper public access via GitHub, Zenodo, or the CIRC-UIITS repository.

Protection Strategy: From Copyright to Licensing

A key moment in the workshop occurred when Daniele Perossa (POLIMI) introduced the idea that, contrary to the original non-commercial intention, a Software-as-a-Service (SaaS) pathway might be under consideration for KER7. This would allow POLIMI to deploy the system as a hosted online service, potentially targeting:

- Industrial users wishing to optimize disassembly lines;
- Academic institutions for training and research purposes;
- Public sector actors or recyclers engaging in electronic waste processing.

This shift opens the door to a hybrid exploitation model: while the core software could remain open under a permissive license (e.g., Apache 2.0), the SaaS deployment could be monetized via subscriptions, service fees, or consulting support. The facilitators highlighted that this approach:

- Avoids direct software licensing, reducing friction in user uptake;
- Maintains control over updates and usage;
- Ensures traceability of how the tool is deployed and for what purpose;
- Keeps open the possibility of future spinoff creation or technology transfer.

The strategy is especially well-suited to results like KER7, which combines automation logic, AI/vision algorithms, and data handling — all of which benefit from cloud deployment and iterative refinement.

Key Outcomes and Next Steps

POLIMI confirmed sole ownership of KER7, avoiding joint ownership complexities.

The result will be protected via **copyright**, with licensing still under discussion.

Creative Commons licenses may apply to documentation and visuals, while **Apache 2.0** or **EUPL** are potential options for the software components.

A **SaaS-based exploitation model is now being actively explored**, enabling future revenue generation without restricting access to the source code.

- Facilitators advised POLIMI to:
 - Finalize their licensing decision before any dissemination;
 - Prepare appropriate license documentation;
 - Consider setting up a **dedicated exploitation roadmap**, potentially leading to a service-based offering post-project.

3. Main findings and recommendations of the service provision

3.1. Resume of the Findings and recommendations

The expert tried to provide recommendations taking into consideration as much information specific to the CIRC-UIITS project as possible. The discussion in the different meetings of the service can be resumed as follows:

- Finding:** The Consortium Agreement currently lacks a completed Attachment 1 listing the partners' background IP.

Recommendation: Partners should urgently populate Attachment 1 to clarify pre-existing IP, especially for software, datasets, tools, and methods that will underpin the ownership of results and access rights.
- Finding:** The project includes diverse result types (hardware, software, educational content, data), each requiring different protection strategies.

Recommendation: Encourage each KER leads to assess the most suitable protection method—e.g., patent, copyright, trade secret—based on the nature of the result and adopt a complementary protection approach where needed.
- Finding:** Joint ownership provisions in the CA are generic and not tailored to specific results or partners.

Recommendation: Prepare specific JOAs for jointly developed KERs with clear terms on licensing, exploitation
- Finding:** Although KER7 was initially described as non-commercial and intended for scientific dissemination, the idea of a SaaS deployment model was introduced during the workshop.

Recommendation: POLIMI should conduct a feasibility assessment of a SaaS-based business model, considering cloud infrastructure, cost recovery, user segmentation, and compatibility with Horizon Europe dissemination obligations.
- Finding:** The existing plan to release software under Creative Commons may not be suitable for executable code or commercial reusability.

Recommendation: Consider applying Apache 2.0 or EUPL licenses for the software source code, as these are better aligned with code reuse, modular integration, and potential SaaS monetization, while still complying with EU open access expectations.
- Finding:** KER7 includes both software logic and training/educational components (e.g., datasets, visuals, tutorials).

Recommendation: Apply dual-licensing:
Use Apache 2.0 or EUPL for the codebase;
Use CC-BY for other data and educational content.
This ensures flexibility across user groups and reuse scenarios without licensing conflicts.
- Finding:** The SaaS option introduces new dimensions for post-project exploitation that weren't included in the original D&E plan.

Recommendation: Update the KER7 exploitation pathway in the project's exploitation deliverables (e.g., D5.1 or the Exploitation Logbook), explicitly stating the dual-use potential (non-commercial research + potential commercial SaaS) and noting required actions (hosting infrastructure, GDPR compliance, user terms, etc.).

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Not provided yet by BOOSTER consultants!

Service 3.5

Audio Visual Support

CIRC-UIITS

Circular Integration of independent Reverse supply Chains for the smart reUse of IndusTrially relevant Semiconductors
(101091490)

Date: 04/09/2025

Authors: Lóránt Dékány, Eylul Aksekili



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List of abbreviations

Abbrevia tion	Definition
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PDEC	Plan for Dissemination Exploitation and Communication
D&C	Dissemination & Communication
TRL	Technology Readiness Level
KPI	Key Performance Indicator
KER	Key Exploitable Result
ECU	Electronic Control Unit
EOL	End-of-Life
EPR	Extended Producer Responsibility
ESP	Electronic Stability Program
HMI	Human Machine Interface
IP	Intellectual Property
IPR	Intellectual Property Rights
KER	Key Exploitable Result
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
SLCA	Social Life Cycle Assessment
TPMS	Tire Pressure Monitoring Sensor

1. Introduction

The CIRC-UIITS is following **Service 3.5 – Audio-Visual Support (AVS)**, which is an add-on service provided under the Horizon Results Booster framework. It aims to equip projects with tailored, professional video content to enhance the dissemination and exploitation of their Key Exploitable Results (KERs). Through a structured five-step process, the service helps projects produce a short, engaging video aligned with the communication standards of the Horizon Results Platform (HRP) and suitable for wider dissemination, including on the project's own website and social media channels.

The AVS service works closely with the project team, beginning with a requirements-gathering phase, moving through co-creation of the script and video production, and culminating in expert advice on dissemination strategies and final reporting. The goal is to maximise the visibility, engagement, and potential uptake of project results. The service will provide the applicant project with a short video that the project can publish on the Horizon Results Booster Platform (HRP), their own project website and other platforms.

The EU-funded **CIRC-UIITS project** aims to enhance circularity in the automotive and mass electronics sectors by promoting the reuse of semiconductors from multiple sources. In addition to extending the life of these components, the project will support their remanufacturing into new, high-value products and applications within these industries. Funded under the HORIZON-RIA programme, CIRC-UIITS is a middle-stage project with a current TRL of KERs at 3.

2. Executive Summary

This report summarises the Audio-Visual Support (AVS) service delivered to the CIRC-UIITS project under the Horizon Results Booster framework. The objective was to support the project in creating a short, high-quality video showcasing one or more Key Exploitable Results (KERs) for dissemination across the Horizon Results Platform (HRP), the project website, and other outreach channels.

Following an initial consultation and planning phase, a tailored video was developed through a collaborative process involving scriptwriting, visual design, and expert coaching. The final video highlights the project's core results, their potential applications, and key messages aimed at attracting partners, investors, and stakeholders.

Beyond the video production, the service provided strategic advice on how to best disseminate the video to maximise visibility and engagement. Guidance was also given on publishing the video on the HRP.

The AVS service strengthened the project's dissemination assets and equipped the team with practical tools and recommendations to support future communication and exploitation activities.

The AVS is an add-on designed to enhance research and innovation projects by driving stakeholder engagement and maximising dissemination and exploitation (D&E) outcomes.

3. Methodology

The AVS provides the project with a video that can be published on the Horizon Results Platform as well as the project’s own website and other platforms.

As the figure below shows, the service is broken down into five steps with the service running for up to 60 days. Based on the previous Booster services, the Booster team identify the projects needs before setting up the first call. The call will establish the objectives of the video and the target audience which will form the basis for the video script and identification of video content. In step 2, the Booster team create the video script which is shared with the project for their feedback and then the first version of the video is created and shared. In step 3, the project and Booster team converge to fine-tune the final version of the video.

In step 4 the Booster team provides recommendations and guidance on how to promote the video, including the provision of a description and social media posts, and how to publish on the Horizon Results platform. In this step, the project is advised to publish the video on the HRP. In step 5, the Booster team provides the final service report.

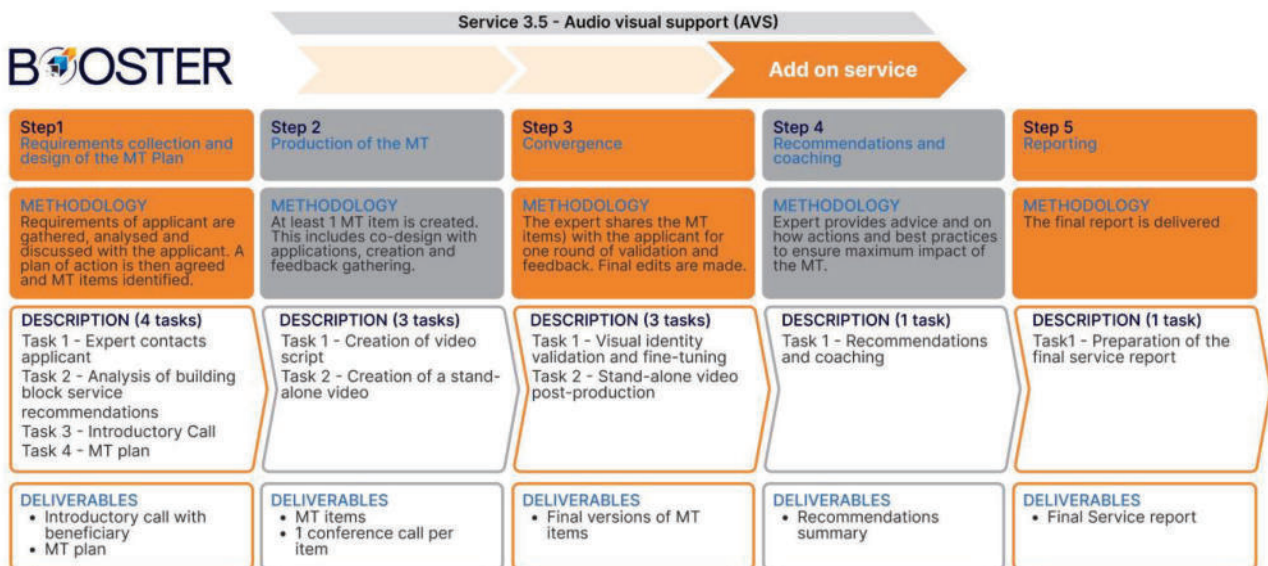


Figure 1: Service 3.5 Audio visual support

4. Video design and delivery

4.1. Overview of the CIRC-UIITS project

Brief overview of the project, its overall objectives and Key Exploitable Results.

The CIRC-UIITS project will deliver the KERs listed below. These can serve as a starting point to define the focus of the video.

	Portfolio of KERs for Networking
--	----------------------------------

KER Number	KER Name/Description	Result type ¹	Target audience ²	TRL	Delivery date
KER#1	Knowledge on circularity in printed electronics and integration of circularity concepts in structural electronics	Technology	Structural electronic device manufacturers and other (tier) suppliers OEMs and automotive brand owners	3	2-3 years after the project ends
KER#2	Digital Twin with advisory functions	Technology	Manufacturers and product designers, Suppliers	3	3-5 years after the project ends
KER#3	Serious games aimed at both students and professionals to raise awareness of the transition to a circular economy and to upskill employees for future CE jobs	Service	Civil society, students, entrepreneurs in the educational sector	4	1-2 years after the project ends

Table 1: Project's KERs

4.2. Video objectives

The video that will be provided can be used for different purposes and uploaded onto different platforms. Primarily, the Booster service encourages the project to publish the video on the Horizon Results Platform as well as on the project website.

The Horizon Results Platform encourages projects to publish KERs and to include a link to a short video (ideally not more than 90 seconds). The video should state the following information:

Information	Details
What is the project result	

¹ 1) **Policy Related Result** - Result primarily useful and influential for policy makers or legislators (Ex. regulatory analysis, policy related study, foresight analysis, pre-standard, standard, publications of other forms, etc.); 2) **Scientific or Technological R&D Result including ICT Hardware** – Any scientific or technological R&D related result at any stage of development. The results can be a scientific finding or approach, model or method, a proof of concept, a technological solution or component, a chemical, a new material, a new manufacturing process, a medicine, a therapy, an agri-food, an electric component, sensor, processor, computer hardware, etc. The result can be at any stage of development: from the basic, applied research to the prototype and commercial readiness; 3) **ICT Software Digital solution** – Any software, algorithm, database, model, online platform, cloud, etc. at any stage of development; 4) **Other Intangible Results** (Ex. citizens engagement platform, know-how, best practices, methodologies etc.); 5) **Services** (Ex. research infrastructures, educational sources, citizen helplines, etc.); 6) **Other** - please specify in the Result Description.

² Public or private funding institutions; Eu and Member State Policy-makers; International Organisations (ex. OECD, FAO, UN, etc); Other Actors who can help us fulfil our market potential; Research and Technology Organisations; Academia/Universities; Private Investors.

What is it for (uses or applications)	The video explains the project's four pilots, providing an overview of general objectives. Can be shown on the project website, during events or for other communication and dissemination activities.
What makes it special in terms of adding value	The project had already worked on the production of videos, e.g. partners presentation videos, but the project did not have a presentation video yet. Specifically, it was requested that the video highlights the 4 pilots objectives at the core of the project. The Audio-Visual Support provided CIRC-UITs with a video focused on the expected results.
Knowledge and potential impact	The video is created to generate awareness of the project and to increase outreach and engagement.
The purpose of making it public (are you looking to share knowledge, raise awareness, look for partners, look for customers, look for investors?).	<ul style="list-style-type: none"> • Share the project's objectives • Raise awareness • Reach a broader audience

Table 2: HRP video summary

Further information has been identified to support the video production.

Information	Details
Main topic / message	The CIRC-UITs project recovers and reuses components from electronic waste circuits by turning electronic waste into components for the automotive and electronic sectors. CIRC-UITs is based on four pilots' objectives that aim at developing strategies to increase recyclability, reparability and circularity of the components.
Target stakeholders & why the video should be interesting for them	<p>Electronic devices manufacturers</p> <p>The video shows electronic devices that directly address the recyclability properties of these technologies, and how such practices create an advantage for the generation of collaboration while reducing dependency on imported resources.</p> <p>Suppliers</p> <p>The creation of different eco designs based on circularity allows for the improvement of obsolete electronic devices to allow full reparability.</p> <p>Civil society</p> <p>The narrative of the video supports key EU objectives of diminishing reliance on foreign markets for the usage of electronic components, and to reshape the electronic industry towards sustainability.</p>
Target use	The video ought to be used to reach a wider audience, serving as a general presentation to be showcased at various occasions and events. It can be used during the project duration until its end, and even after the project ends.
Length	The video is 1 minute and 42 seconds long.

Credits	<p>Disclaimer for BOOSTER:</p> <p>Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or DG RTD. Neither the European Union nor the granting authority can be held responsible for them.</p> <p>Credit for the images and the videos:</p> <p>iStock, Pixabay</p> <p>CIRC-UIITS Project</p> <p>Credit for voiceover:</p> <p>The voiceover was generated with the assistance of Elevenlabs.</p>
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Table 3: Further video information

4.3. Script, visuals and video production

The script was created in collaboration with CIRC-UIITS and is provided below. This was done in an iterative process based on input from the CIRC-UIITS project.

Version & date	Description
06/05/2025	First call
20/05/2025	Script production
20/07/2025	Storyboard production
01/08/2025	Finalisation of the video

Table 4: Script iterations

Script

As Europe’s reliance on non-EU semiconductor suppliers weakens its economy, the CIRC-UIITS project leads efforts to recover and reuse strategic components from electronic waste.

CIRC-UIITS drives circular innovation by turning e-waste into high-value components for the automotive and electronics sectors. It enables data tracking of critical materials, supports reuse and recycling, and promotes collaboration across value chains to enhance sustainability and circularity, while reducing dependency on imported resources by the development and application of digital sustainability & circularity tools.

CIRC-UIITS will turn digital innovations into real-world results through four pilot objectives by:

ECUs —developing next-generation units using old cars braking systems and more sustainable design approaches.

Recyclable and modular TPMS components to improve both performance and environmental impact for tyre sensors

Advancing In-Mold Electronics, integrating circuits directly into plastic parts as a more efficient and eco-conscious alternative to traditional PCBs. Improving how obsolete PCBs are sorted and stored to boost recycling and resource recovery.

CIRC-UIITS is more than a project; it’s a commitment to reshaping the electronics industry towards sustainability.

Visit <https://circuitsproject.eu/resources/circular-business-models/>

Version & date	Description
20/05/2025	First version of the script

06/06/2025	First version of the storyboard
14/07/2025	Second version of the storyboard
21/07/2025	Delivery of final video

Table 5: Video iterations

5. Video publication

The full video can be found at <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/87844?keywords=CIRC-UIITS&isExactMatch=false&order=DESC&pageNumber=1&pageSize=50&sortBy=publicationDate> .



Figure 2: Video screenshot – CIRC-UIITS

5.1. Video overview

As Europe faces growing risks from dependence on non-EU semiconductor suppliers, the CIRC-UIITS project is rethinking how we use and recover critical electronic components. This initiative aims not only to reduce reliance on imports, but also to create high-value solutions for the automotive and electronics sectors by reusing and recycling semiconductors from electronic waste.

Through four pilot projects, CIRC-UIITS transforms digital innovation into tangible results: developing next-generation ECUs from reused components, designing recyclable and modular TPMS sensors, advancing In-Mold Electronics as an eco-friendly alternative to traditional PCBs, and improving sorting and storage of obsolete boards to boost recycling.

By enabling data tracking of materials, fostering collaboration across value chains, and applying digital circularity tools, CIRC-UIITS is driving a more sustainable and resilient electronics industry.

Learn more at: circuitsproject.eu

5.2. Social media posts

The following LinkedIn social media posts are provided:

- 1) As Europe works to strengthen its resilience, **CIRC-UIITS** is transforming electronic waste into opportunity. From reusing semiconductors to developing recyclable and modular components, we're reducing dependency on imports while building a more circular electronics industry. Smarter design. Stronger sustainability. Greater resilience. Watch our video: (link)
- 2) What if yesterday's e-waste could power tomorrow's innovation? That's the mission of **CIRC-UIITS**: We're recovering semiconductors, redesigning components for circularity, and applying digital tools to track and reuse critical resources. From next-gen ECUs to recyclable sensors and advanced In-Mold Electronics, CIRC-UIITS is reshaping how Europe thinks about technology. Circular electronics. Resilient supply chains. A sustainable future. Watch the video: (link)

5.3. Uploading on the Horizon Results Platform

The Horizon Results Platform is a tool for beneficiaries in disseminating their Key Exploitable Results, for stakeholders to engage with beneficiaries, directly or through NCP, and for the EC to learn from project results.

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/87844?keywords=CIRC-UIITS&isExactMatch=false&order=DESC&pageNumber=1&pageSize=50&sortBy=publicationDate>

5.3.1. What is a KER?

The EC explain what should be uploaded on the HRP:

*Before you upload a result in the Horizon Results Platform, please make sure that it is a **Key Exploitable Result!***

According to the Horizon 2020 text, a result is defined 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".

*A **Key Exploitable Result (KER)** is an identified main interesting result (as defined above) which has been selected and prioritised due to its high potential to be "exploited" – meaning to make use and derive benefits - downstream the value chain of a product, process or solution, or act as an important input to policy, further research or education.*

In order for you to select and prioritise your results we would recommend that you use the following criteria:

- a) degree of innovation
- b) exploitability
- c) impact

Results such as "outcomes or announcements of consortia meetings, conferences or other events" are not considered as KERs and therefore are not in the scope of the Horizon Results Platform. "Project deliverables" are not necessarily Key Exploitable Results either and it is not the purpose of the Horizon Results Platform to be the reporting tool to the Project Officer.

5.3.2. How to upload your KER on the HRP

The project participants should upload the video on the HRP platform. First it should be uploaded onto a platform such as YouTube so the link can be added directly on the HRP.

Uploading your results can be done via the My Projects section of the Funding and Tenders Portal using your EU Login credentials.

Under the relevant project, click on Actions-> "Project Results" and then click the "Add" button on the top right. Detailed instructions can be found [here](#)³.

You will see in the instructions above, that there is a field called "Tags/Keywords" to be filled. For HRP to make sure to identify your result profiles, you should include the precise keyword in this.

Once uploaded, you may update your result profiles whenever necessary, according to changes in the progress of your organisations and products. For any questions uploading your result you should contact EC-HORIZON-RESULTS-PLATFORM@ec.europa.eu.

Details on all the sections and fields to be completed when uploading the video or KER can be found [here](#)⁴.

6. Conclusions and next steps

The **CIRC-UIITS project** is in its early implementation phase. While technical work is advancing, it is crucial to establish strong communication actions to raise awareness, engage stakeholders, and ensure long-term impact.

To boost visibility and reach target audiences, the project should:

- Share the presentation video widely across platforms such as LinkedIn, YouTube, Zenodo, ResearchGate, and the EU Science & Innovation YouTube Channel, reaching both experts and the public.
- Disseminate through sector-specific channels in electronics, circular economy, and automotive industries to connect with key stakeholders.
- Use LinkedIn groups and professional networks to foster discussion on circular electronics and semiconductor reuse.
- Align video promotion with relevant international events (e.g., World Circular Economy Forum, EU Industry Days, E-Waste Day) through targeted campaigns.
- Showcase the video during conferences, workshops, and stakeholder meetings as a clear and engaging introduction to the project.
- Upload the video to each partner's YouTube channel and share via partners' social media.
- Integrate the video prominently on the project website as a key communication asset.

³ <https://webgate.ec.europa.eu/funding-tenders-opportunities/pages/viewpage.action?pageId=8913466>

⁴ <https://webgate.ec.europa.eu/funding-tenders-opportunities/pages/viewpage.action?pageId=8913468>

7. ANNEX I – Service delivery practical info

The following calls have been carried out in this service.

Introductory Call

The following table includes the list of participants to the Introductory call organised.

Date	Name & Surname	Organisation	e-mail
06/05/2025	Eylul Aksekili	ICONS	Eylul.aksekili@icons.it
	Bernd Kopacek	Sat research	bernd.kopacek@sat-research.at
	Paolo Rosa	Politecnico di Milano	Paolo1.rosa@polimi.it

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ANNEX 4.1: Business Model for BOSCH’s Pilot

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - Growing concerns and legislation (e.g., CRMs Act) related to the criticality of materials (moreover, in Europe and North America), often encouraging a circular approach for products that embed them. - Growing awareness, concerns, and legislation related to sustainability issues. - Growing attention and legislation related to circularity practices. - Likely future regulations related to mandatory dismantling and recovery of cars’ electronics. 	<ul style="list-style-type: none"> - Governments and institutions (making legislation about the repair of components).

Table 1 - BOSCH Sustainable Circular Business Model Innovation: Business Ecosystem Level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Relationship costs with car dismantlers, consortia, car repair shops, and plastics recyclers. - Labor costs (for repairing). - Facility and equipment costs (including maintenance) for ECUs and PCBs repairing. 	<ul style="list-style-type: none"> - Car dismantlers (e.g., Pollini) for the recovery of ECUs from EoL vehicles. Consortia (e.g., Erion) may support interaction with dismantlers. - Recyclers, e.g., plastic recycler for ECU’s housing - Materials refining companies (e.g., Alpha) for eco-design collaboration. - Universities and research centres (e.g., POLIMI, OFFIS) are developing new digital solutions to support eco-design and disassembly of ECUs and PCBs. 	<ul style="list-style-type: none"> - Specialised operators and equipment to perform first ECUs and PCBs conditions and repairability assessment, and then ECUs and PCBs repair. - Knowledge and expertise in the eco-design of the braking system and its ECU. - Digital dashboard of the ECU based on its digital twin to support its eco-design and the disassembly operations. 	<ul style="list-style-type: none"> - Design4Environment of the ECUs, moreover design4disassembly and design4repair. - Establishment of reverse logistics process, through a dedicated Bosch business unit or after-sales service. - ECUs conditions and repairability assessment and repair. - Eco-design R&D activities, to keep improving ECUs and PCBs disassemblability and repairability. - From ECUs that cannot be repaired, collection of single components (e.g., ECUs houses, ECUs’ PCBs, components mounted on the PCBs, etc.) to store them and use them in case of future shortages or to be recycled. 	<p>More environmentally friendly, cheaper braking-system ECUs. Furthermore, repaired ECUs allow for offsetting supply risks related to new ECUs. Finally, OEMs’ customers will enjoy cheaper repair services for their ECUs. For car repair shops, the provided repaired ECUs will be cheaper than new ones.</p>

Table 2 - BOSCH Sustainable Circular Business Model Innovation: Business Level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Car repair shops as a channel to retrieve broken ECUs from customers and provide them back repaired ones (dismounting and remounting of ECUs in charge of shops). - Collaboration with OEMs for eco-design of vehicles and components, to ease the recovery of broken ECUs. 	<ul style="list-style-type: none"> - OEMs mounting ECUs and PCBs on their cars. - Car repair shops receiving repaired ECUs by BOSCH. 	<ul style="list-style-type: none"> - Traditional selling channels to OEMs. - Dedicated service for recovery of broken ECUs from EoL vehicles, using dedicated after-sales services for recovery of broken ECUs gathered by car dismantlers, with eventual support from consortia. In this case, repaired ECUs will be sold to OEMs. - Partnership with car repair shops for the return of broken ECUs from users' cars. In this case, repaired ECUs will be given back to the shops as spare parts. 	<ul style="list-style-type: none"> - Payment by the OEMs for more sustainable Bosch ECUs. - Payment by car repair shops for the repair of ECUs by Bosch.

Table 3 - BOSCH Sustainable Circular Business Model Innovation: Business Level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Materials and energy efficiency of the reverse logistics and repairing processes. 	<ul style="list-style-type: none"> - Decrease in the generation of waste. - Decrease in the raw materials consumption. - Savings of environmental impacts thanks to the avoided production of new ECUs. - Offsetting supply risk and component shortages risks.

Table 4 - BOSCH Sustainable Circular Business Model Innovation: Sustainability Impact

ANNEX 4.2: Business Model for BEKO’s Pilot (with ERION and TXT)

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - Growing concerns and legislation (e.g., CRMs Act) related to the criticality of materials (moreover, in Europe and North America), often encouraging a circular approach for products that embed them. - Growing awareness, concerns, and legislation related to sustainability issues. - Growing attention and legislation related to circularity practices. - Increasingly stringent right-to-repair regulations, which require manufacturers to provide spare parts and technical information, are pushing both producers and treatment facilities to develop solutions that enhance reparability, extend product lifetime, and enable component recovery. 	<ul style="list-style-type: none"> - Manufacturers - Treatment plants - Technical assistance centres - re-use service providers - Governments and institutions (making legislation about the repair of components). - Consumers are gradually demanding more sustainable products

Table 5 - BEKO Sustainable Circular Business Model Innovation: Business Ecosystem Level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Labor costs. - Equipment for PCBs and components testing: investment and operational costs. - Transfer cost between key partners - Design costs for implementing disassemblability and modularity to enable component reuse. Purchase of reusable PCBs or components. - Logistics cost for components shipment - Access to the Marketplace 	<ul style="list-style-type: none"> - Tech provider (e.g., TXT) as a provider of the marketplace, enabling the exchange of reusable PCBs between OEMs and WEEE treatment plants. - PROs (e.g., ERION) can facilitate the relationship between treatment operators and OEMs and the adoption of the new business model. 	<ul style="list-style-type: none"> - Treatment plant operators and manufacturers have the know-how to identify valuable material streams and components - Database of PCB-containing products suitable for refurbishing and reuse. - Warehouse of components ready to be implemented in refurbished products - Equipment and know-how to perform PCBs testing. - Digital marketplace (provided by TXT) to simplify the exchange of components and coordinate the agreements between actors - Expertise and know-how provided by the PRO (i.e., ERION) to support WEEE treatment plants in implementing reverse logistics. 	<ul style="list-style-type: none"> - Communication from the OEMs of target products and components - Identification and removal of target components - Evaluation of PCBs reusability, through the assessment of basic parameters like integrity, and <i>ICT (In-Circuit Test) verifying the electrical functionality and FVT (Functional Verification Test) inspections</i> and ATE test of PCBs(performed by WEEE treaters or by the manufacturer). - Certification of components (EoW end of waste and specific certifications for product safety) - Remanufacturing of new washing machines embedding reused PCBs or reuse of PCBs' 	<p>Selling of washing machines embedding reused PCBs or reuse of repaired PCBs as a spare parts in order to offer a customers maintenance service aiming to extend components and machine lifecycle .</p>

		- AI algorithms provided by digital partners (i.e., TXT) for the identification of reusable PCBs components.	components as spare parts.	
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Table 6 - BEKO Sustainable Circular Business Model Innovation: Business Level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<p>Marketing and advertising to consumers about the enhanced sustainability of the washing machines and the related maintenance services.</p> <p>Advertisement raising awareness about the importance of proper treatment of WEEs and the possibility of reuse.</p> <p>Collaboration between the manufacturer and the treatment plant</p>	<p>Final consumers are enjoying more sustainable washing machines.</p> <p>Main customer segments will be consumers sensitive to sustainability issues (green consumerism).</p> <p>OEMs adopt new design practices to facilitate component reuse and leverage dedicated marketplaces.</p> <p>Treatment plants need to invest in testing equipment and use dedicated marketplaces</p>	<p>Traditional sales channels to consumers.</p> <p>Reverse logistics managed by partners consortia (e.g., Erion) that interface with WEEE treatment plants. The reverse channel is also enabled by the marketplace provided by TXT.</p>	<p>Selling of refurbished washing machines to consumers. Selling of spare parts as a maintenance programme for customer loyalty.</p> <p>Avoided costs from producing new components and products from scratch.</p>

Table 7 - BEKO Sustainable Circular Business Model Innovation: Business Level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Materials and energy efficiency of the reverse logistics. - Identify the components suitable for the process stage that ensure minimal operational impact on the treatment plant - Compliance with regulations 	<ul style="list-style-type: none"> - Decrease in the generation of waste. - Decrease in the raw materials consumption. - Savings of environmental impacts thanks to the avoided production of new PCBs and PCBs' components.

Table 8 - BEKO Sustainable Circular Business Model Innovation: Sustainability Impact

ANNEX 4.3: Business Model for AUMOVIO’s Pilot

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - Growing concerns and legislation (e.g., Critical Raw Materials Act) related to the criticality of materials (moreover, in Europe and North America), often encouraging a circular approach for products, embedding them. - Growing awareness, concerns, and legislation related to sustainability issues. - Growing attention and legislation related to circularity practices. - Consumers' demand for a more sustainable mobility 	<ul style="list-style-type: none"> - Governments and institutions making legislation about the implementation of circular economy practices (e.g., Critical Raw Materials Act, Circular Economy Act).

Table 9 - AUMOVIO Sustainable Circular Business Model Innovation: business ecosystem level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Fees paid to dismantlers based on the amount of recovered and returned functioning components and other costs to manage the reverse supply chain. - Labor, facility, and equipment costs (for returned sensors conditions assessment). - Costs for implementing and managing circular operations (disassembly, rebuilding, and testing). 	<ul style="list-style-type: none"> - Car dismantlers (e.g., Pollini) for recovery of sensors from EoL vehicles. - Rubber valve suppliers for the reuse of the valve and the steam. - Other plastic parts suppliers for the reuse of housing and cover. - PCB suppliers for the reuse of PCBs. - Electronics suppliers for the reuse of EE components. - Battery suppliers for the reuse of batteries. - Materials refining companies (e.g., Alpha) for the development of new materials solutions (e.g., Solder material able to recover components). - Universities and research centres (e.g., POLIMI, OFFIS) are developing new 	<ul style="list-style-type: none"> - Specialised operators and equipment able to perform sensors conditions (in terms of “state of health”) assessment and disassembly. - Knowledge and expertise in the eco-design of tire pressure sensors. This is currently under development through the strategy to achieve full recovery of production scraps. - Digital Twin of the tire sensor to support its eco-design and the disassembly operations. - Expertise for building new types of contractualization related to the quality of the components, warranty return, and use. - Already existing AUMOVIO’s business unit is currently managing the eco-design implementation strategy and circularity of the scraps in the plant, for the recovery of still functioning 	<ul style="list-style-type: none"> - Design4Environm ent of the sensors, moreover design4disassem bly and design4reuse. - Establishment of reverse logistics process. Relations with the tire dealers will be managed by the dedicated business unit, which is currently managing eco-design and gradual circular transition. - Sensor conditions and reusability assessment. - Eco-design R&D activities to keep improving sensors' reusability. - Dismantling of tire sensors from EoL cars (activity performed by car dismantlers). A fee, based on the amount of recovered components, will 	<p>Provision of a Product-as-a-Service (PaaS), according to the Product-Service Systems logic, related to the tire sensors of cars. AUMOVIO keeps the ownership of the tire’s sensor, offering a more environmentally sustainable approach, where the sensor is reused by AUMOVIO itself. In case this is not possible, the sensors’ components that can be reused will return to the suppliers and will be reused by them. The value is related to the circular and thus more</p>

	<p>digital solutions to support the disassembly and eco-design of components.</p> <ul style="list-style-type: none"> - OEMs (e.g., CRF) for eco-design of vehicles and components within them. 	<p>components and their reuse. This business unit will move in 2-3 years to manage the proposed CBM.</p>	<p>be paid to the dismantlers. Initially, consortia (like ERION) will be a necessary support for dismantlers.</p>	<p>sustainable components mounted on the tires. This helps OEMs in being compliant with current regulations, anticipating future ones, and being more sustainable in the eyes of consumers.</p>
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Table 10 - AUMOVIO Sustainable Circular Business Model Innovation: Business level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Collaboration with OEMs for eco-design of vehicles and components, to ease the recovery of broken sensors. - Set up a new relationship for the quality of the products with the customers. AUMOVIO will take responsibility for the quality of the repaired products. 	<ul style="list-style-type: none"> - OEMs (main customers mounting tire sensors on their cars). - After-market companies (tire dealers). 	<ul style="list-style-type: none"> - Traditional selling channels to OEMs and tire dealers. - Partnership with car dismantlers (e.g., Pollini) and consortia (e.g., Erion) to recover tire sensors from EoL vehicles. - Partnership with key suppliers (rubber valve suppliers, other plastic parts suppliers, PCBs suppliers, electronic components suppliers, and batteries suppliers) to perform reverse logistics of these components, so that they can be reused in new sensors. 	<ul style="list-style-type: none"> - Payment by the OEMs or tire dealers for the usage of AUMOVIO tire sensors on the cars. Deployment of a contract for a “lifetime” and not any more for a product (Including replacement, and recovery of the TPMS during the tire exchange) at OEMs and/or tire dealers (Aftermarket).

Table 11 - AUMOVIO Sustainable Circular Business Model Innovation: Business level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Materials and energy efficiency of the reverse logistics and repairing processes. 	<ul style="list-style-type: none"> - Decrease in the generation of waste. - Decrease in the raw materials consumption.

	<ul style="list-style-type: none">- Savings of environmental impacts thanks to the avoided production of new tire sensors.
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Table 12 - AUMOVIO Sustainable Circular Business Model Innovation: Sustainability Impact

ANNEX 4.4: Business Model for POLIMI’s Disassembly Activities

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - Growing concerns and legislation (e.g., CRMs Act) related to the criticality of materials (moreover, in Europe and North America), often encouraging a circular approach for products embedding them. - Growing awareness, concerns, and legislation related to sustainability issues. - Growing attention and legislation related to circularity practices. - Growing geopolitical tensions are making the sourcing of Critical and Strategic Raw Materials used in electronic components more uncertain. 	<ul style="list-style-type: none"> - Governments and institutions (making legislation about CRMs management and secondary raw materials and components recovery, moreover for WEEE). Besides, interest in activities that can support the EU in offsetting its dependence on the external CRMs supply. - Other Universities, Research Centres, and companies working on robotic-supported disassembly solutions, that may develop relevant solutions potentially useful for POLIMI, to be investigated. - Other entities (e.g., universities and research centres) are developing and publishing criticality assessment solutions and mitigation strategies.

Table 13 - POLIMI Sustainable Circular Business Model Innovation: business ecosystem level

Business Level					
Costs structure	Key partners	Key resources	Key activities	Value proposition	
<ul style="list-style-type: none"> - Capex costs for equipment purchase (EEE rework and remanufacturing equipment, ovens for PCBs treatment, automation items). - Opex costs for skilled labour (AI 	<ul style="list-style-type: none"> - Suppliers of components for testing solutions. They can coincide with the customers. They are usually dismantlers (e.g., Pollini), OEMs (including 	<ul style="list-style-type: none"> - Skilled workforce. - Specialised equipment. - Concurrent and synergetic expertise in circular economy, CRMs, AI, and Robotics. 	<ul style="list-style-type: none"> - Development of tailored optimised automated disassembly solutions (AI image recognition solutions development, most suitable tools identification, detailed disassembly process definition). - Pre-assessment of most valuable sub-components or components to be 	Developing and providing tailored solutions for automated disassembly of EoL electronic components from cars and mass electronic goods. This includes indications for Design4Disassembly, as well as development of proper and fine-tuned disassembly processes to be then up-scaled by customers. The developed process will be optimised in terms of throughput time,	

<ul style="list-style-type: none"> - specialists, robotics experts, WEEE experts, Circular economy and CRMs management experts). - Opex for robots' energy consumption. - Bureaucratic costs to establish and maintain a spin-off. - Patenting costs for component-tailored end-effectors. 	<ul style="list-style-type: none"> - Tier-1 and 2, e.g., CRF, CONTI, BOSCH, BEKO, TracXon), or end-users. - Suppliers of robotic solutions and tools. - Suppliers of software solutions enabling AI development (usually open source) 	<ul style="list-style-type: none"> - Direct access to POLIMI's internal network of know-how and expertise. 	<ul style="list-style-type: none"> - recovered for reuse/repair/remanufacturing/recycling, in terms of economic value, saved environmental impacts, and criticality of embedded raw materials. - Continuous update about the latest novelties in the field. - Offering services about raw materials criticality assessment and mitigation - Offering services for PCBs eco-design. - Performing disassembly of electronics at an industrial level for limited amounts (i.e., a maximum few hundred thousand per year). 	<ul style="list-style-type: none"> - energy efficiency, error rates, precious materials/components recovery, and capex expenditure. - This will help customers develop and enhance their own circular business models and actions, support their ESG strategy and supply security, and automate and optimise their asset-maintenance processes. - The spin-off will also be able to support companies in managing CRMs and in developing CBMs. - The benefits of the reduction of supply risk and compliance with ESG criteria. For limited amounts of components (i.e., a few hundred thousand per year), the disassembly activities can be performed at an industrial level, being offered as a service
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Table 14 - POLIMI Sustainable Circular Business Model Innovation: business level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Close communication with the customers for the entire duration of the project is necessary to tailor the solution for them in the best possible manner. - Customers' contribution is necessary as 	<ul style="list-style-type: none"> - Dismantlers of WEEE and cars willing to enhance their role and importance in circular value chains (e.g., Pollini). - OEMs (including Tier-1, e.g., CRF, CONTI, BOSCH, BEKO, TracXon) that 	<ul style="list-style-type: none"> - Online advertisement. - Conferences. - Networking exploitation. 	<ul style="list-style-type: none"> - Consultancy projects about tailored automated or semi-automated disassembly processes definition, that may include, without an extra price, support in identifying the most valuable components or sub-components to be recovered. Each consultancy will receive a single payment according to its duration and complexity. Identification of the most critical

<p>they need to supply the components to be disassembled. The supplied components will be used for testing for the development of the optimised disassembly process.</p> <ul style="list-style-type: none"> - Customers will need to share sensitive information about the volumes they aim to recover, about product details (e.g., material content), and about their supply chain structure (even when they are not requiring services of disassembly at an industrial scale). 	<p>need support in implementing their circular business models and value chains.</p> <ul style="list-style-type: none"> - End-users of assets with a long life, needing the repair of electronic components. - Companies, including SMEs, that manage CRMs and/or are willing to implement CBMs. 		<p>components for the company to recover would require an extra fee, while design4disassembly consultancy would be included.</p> <ul style="list-style-type: none"> - Consultancy projects about raw materials criticality assessment and mitigation, and about circular business modelling. Each consultancy will receive a single payment according to its duration and complexity. - Disassembly services at an industrial scale of electronic components in limited amounts (i.e., not more than a few hundred thousand per year). Payment will be quantified based on the quantity of pieces to be disassembled and the complexity of necessary operations. Identification of the most critical components for the company to recover would require an extra fee. The same goes for design4disassembly consultancy.
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Table 15 - POLIMI Sustainable Circular Business Model Innovation: business level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Disassembly process energy consumption minimization. - Considering also the minimisation of environmental impacts in selecting components and sub-components to be recovered. - Considering environmental impacts in the process of raw materials criticality assessment and mitigation actions, as well as in the CBMs development. 	<ul style="list-style-type: none"> - Decrease in the generation of waste. - Decrease in the raw materials consumption. - Savings of environmental impacts thanks to the avoided production of new electronic components.

Table 16 - POLIMI Sustainable Circular Business Model Innovation: Sustainability Impact

ANNEX 4.5: Business Plan for POLIMI's Disassembly Activities

Optimized Disassembly/Rework Operations (POLIMI): Business Plan	
Problem	<p>Critical Raw Materials (CRMs) are a major concern for a growing number of industries and companies, as they threaten the survival of their business in a context of growing geopolitical tensions. However, most companies do not possess the skills and expertise to address issues related to CRMs in the proper manner. And they struggle even in defining sound circular business models (CBMs).</p> <p>In this context, to recover materials or components from secondary sources, disassembly is a mandatory step. However, even without considering the variability of the sizes and shapes, and types of components in input to disassembly processes, there are major inefficiencies, as well as technical barriers, making it extremely difficult to make the disassembly procedure feasible and economically convenient.</p>
Alternative solution	<p>The few solutions currently in place are mainly based on manual disassembly, which has relevant shortcomings in terms of error rate, efficiency, and costs.</p> <p>Other actors are focusing on developing automated or semi-automated disassembly solutions that could solve the major shortcomings of the manual disassembly procedures. However, these solutions are still at a low TRL and not yet ready to be exploited at an industrial scale.</p>
Unique Selling Point USP - Unique Value Proposition UVP	<p>POLIMI spin-off will be specifically dedicated to performing consultancy to support companies, including SMEs, in managing CRMs and developing new CBMs. Raw materials criticality assessment will be performed by exploiting tailored methodologies specifically developed for the company. At the same time, strategies to mitigate criticality will be developed and enabling technologies and actions will be identified.</p> <p>Automation-wise, the solution that POLIMI is developing has the potential of overcoming the main shortcomings of the manual disassembly procedures, making them more efficient in terms of errors, time-consumption, and operational costs.</p> <p>Concerning automated and semi-automated solutions currently under development, mainly by other research and innovation entities, it is currently impossible to assess what are going to be the main differences will be with the solution developed by POLIMI. Indeed, all of them will not reach industrial-level feasibility before a few years have passed. It is immediate to guess that solutions developed by different actors will present major differences, and each of them will probably have advantages and disadvantages compared to the others. However, right now it is impossible to precisely forecast the differences.</p> <p>POLIMI Spin-off, overall, would be able to combine a range of complementary services, making its proposal very complete. Such services include optimisation of automated disassembly procedures, design4disassembly consultancies, identification of the most critical components to be recovered for the company, raw materials criticality assessment, raw materials criticality mitigation, development of circular business models, and services of electronics disassembly at an industrial scale.</p>
Description	<p>Tailored tools and consultancies will be provided to support companies in assessing the criticality of the raw materials they exploit, and in defining mitigation strategies tailored for</p>

	<p>them, together with tailored CBMs. The tools developed for criticality assessment will be embedded in simple and user-friendly software coded internally in POLIMI Spin-off.</p> <p>The work performed in POLIMI will enable the development of tailored solutions optimising automated disassembly processes of electronic components. These solutions will be leveraging automated disassembly robots and collaborative robots, as well as artificial intelligence (AI) solutions. The exploited AI technologies lead the robots, so that they can autonomously perform the disassembly, with precision and at a speed not achievable by manual operations. In the POLIMI spin-off, customers will be provided with high customization and optimization of the automated disassembly procedures. In this way, they will be able to develop disassembly processes with minimised operational costs, error rate, and throughput time. Consultancy to improve the Design4Disassembly of the components would also be included.</p> <p>For limited amounts (i.e., a few hundred thousand pieces per year maximum), POLIMI Spin-off will be able to offer the service of disassembling the components at an industrial scale for its customers.</p>
<p>"Market" – Target market</p>	<p>The service offered by the POLIMI spin-off will address companies that are willing to recover electronic components to achieve circular business models. They will include both dismantlers of cars or waste electric and electronic equipment, willing to act as partners in circular business models of original equipment manufacturers (OEMs) and OEMs themselves, searching also for eco-design improvements (e.g., design4disassembly).</p> <p>The identified customer segments can be described as follows:</p> <ul style="list-style-type: none"> - Large OEMs needing to comply with regulations or willing to create a competitive advantage from circularity practices. They will be provided with optimisation of disassembly processes and indications to improve product eco-design. - Big dismantlers, willing to become crucial actors in the transition towards the circular economy, will be provided with optimisation of the disassembly process. - Companies owning big volumes of assets rich in electronic components, needing to optimise the disassembly of such assets for repairing / maintenance purposes. - SMEs involved in the production of electronic components that need support in developing better design4disassembly solutions of their products. - Companies of all sizes, managing CRMs and/or willing to implement a CBM, but struggling to perform either or both of the activities.
<p>"Market" – Early Adopters</p>	<p>Target early adopters shall be companies with whom POLIMI has already performed activities related to this KER (e.g., CIRC-UIITS Partners like BOSCH, AUMOVIO, and Traxon). The reasons why these actors shall be targeted as early adopters are the following:</p> <ol style="list-style-type: none"> 1. They have already been involved in circularity-related projects, thus their interest in solutions supporting circular business activities like those offered by this KER is proven. 2. They are already familiar with the type of solutions POLIMI can offer through previous collaborations and have already shown interest and appreciation for them. 3. Being in a closer relationship with POLIMI and already knowing this KER, they would be more likely to provide valuable feedback.
<p>"Market" - Size</p>	<p>The hypothetical market size of the advanced automation solutions developed by POLIMI spin-off involves all the European electronics and Automotive OEMs (including Tier-1), cars and waste electric and electronic equipment dismantlers interested in setting up or optimising their products disassembly processes, as well as European companies owning large amounts</p>

	<p>of assets with many embedded electronic components, and SMEs interested in improving their products design4disassembly.</p> <p>The hypothetical market size of the CRMs management and CBMs development consultancies involves all the European companies, of any size, that perceive themselves, respectively, as struggling in managing CRMs supply and struggling in defining effective CBMs.</p> <p>For both types of offered services, the theoretical market size is huge and is also variable and difficult to quantitatively forecast over time, since the perception of companies about their struggle with CRMs management and CBMs surely changes through the months and years. In the same fashion, the number of companies needing support for developing disassembly solutions or improving the design4disassembly of their products is expected to significantly vary over time.</p> <p>POLIMI Spin-off is expected to absorb only a minor fraction of this huge market demand. Concerning SMEs customers, it is more likely that they will be from the Italian and Lombardic territories, since the POLIMI network with SMEs is stronger there. Concerning large enterprises, POLIMI international network is expected to allow the Spin-off to get in touch with potential customers from all of Europe.</p>
<p>"Market" - Trends</p>	<p>Concerning CRMs management and CBMs development, the urgency of tackling these points effectively is becoming increasingly felt across many sectors. CBMs, in particular, are considered almost in every manufacturing industry. Fear of shortcomings in CRMs management is impacting more and more companies in sectors like Automotive, mass electronics, defence, and aerospace, heavily reliant on them for batteries and electronic components. Such a fear arises from increasing geopolitical tensions and technological trends, making products more and more reliant on CRMs. In these sectors, CBMs are a crucial criticality mitigation strategy to offset dependence on international CRMs supply.</p> <p>As a consequence of these trends, to implement CBMs, setting up effective disassembly processes and procedures is a necessary step. To achieve this, many companies are investigating how to implement and improve design4disassembly of their products. A few of them, moreover, larger enterprises, are also evaluating disassembly solutions leveraging advanced automation. However, the TRL of this kind of solution is still quite low and very challenging to implement on an industrial scale.</p>
<p>Settings – Acceptance</p>	<p>Public acceptance of any initiative related to the circular economy should be positive, as it typically involves the reduction of environmental impacts and near-shoring, i.e., creation of jobs in the same country where the company is operating. As for CRMs management outside circularity actions, at the public level there is no wide understanding about the topic. However, terms like “rare earths” and “rare metals” are starting to be used by mass media due to the rising geopolitical tensions related to the topic. Thus, public perception about CRMs is of something that is problematic and worrying. Thus, solutions to improve their management should be welcome. The only possible issue in terms of public acceptance can be related to the development of automated disassembly solutions, which may be perceived as substituting human jobs. However, it should be shown how these new technologies actually entail the need for new, highly skilled jobs, related to robots design, robots maintenance and so on, compensating for the loss of jobs related to manual disassembly.</p> <ul style="list-style-type: none"> - CRMs, and thus their optimal management at industrial level, bear huge social impacts. They are crucial for companies of strategic sectors like Automotive, Mass Electronics, Aerospace, and Defence. Thus, their indirect impacts, at the largest scale, are related to the entire European community. POLIMI Spin-off would play its small but hopefully precious role inside this big picture. Circular economy practices and tools, such as CBMs, advanced disassembly solutions, and design4disassembly are

	<p>functional to optimise the management of CRMs. Furthermore, circular economy practices are expected to create billions of additional revenues and employing hundreds of thousands of skilled workers in EU in the next 5-10 years.</p> <ul style="list-style-type: none"> - The support that POLIMI Spin-off would bring to implementing circular economy paradigm at micro-level and meso-level (i.e., at company and value chain levels) shall bring important benefits in decreasing environmental impacts associated with raw materials mining and shipment from distant countries, as well as environmental impacts due to the production of components ex-novo, which, with the support of POLIMI Spin-off, may be recovered and reused or remanufactured. - Under an economic perspective, a better management of CRMs, and better disassembly solutions enabling CBMs significantly decreases the supply risk. Furthermore, they enable shorter and closer supply chains for the procurement of materials and electronic components. Prolonging the life of the products and components bears massive cost savings for enterprises.
<p>Settings – Legal and regulatory aspects</p>	<p>The legal and normative requirements to be compliant with are those related to the creation and management of a university Spin-off, for which POLIMI has extensive internal experience.</p> <p>No significant ethical requirements are identified, besides those of ethical business and welfare common to any spin-off.</p>
<p>Go to Market – Use model</p>	<p>The Spin-off will deliver consultancy services to its customers. The consultancies will revolve around the transfer of know-how developed specifically for the company (optimisation of automated disassembly procedures and related training, design4disassembly suggestions, development of tailored tools and methods to perform raw materials criticality assessment and criticality assessment performing, definition of tailored criticality mitigation measures, definition of CBMs).</p>
<p>"Market" – Competitors</p>	<p><i>The existing competitors developing automated disassembly solutions include:</i></p> <ul style="list-style-type: none"> - <i>ALEC:</i> Alec Electronics is a pioneering company specializing in automated remanufacturing solutions for mobility components. By leveraging advanced robotics and expert technical oversight, Alec delivers high-quality, efficient, and sustainable remanufacturing services tailored to the needs of industries such as automotive, agriculture, and machinery. The company's technology-driven approach ensures consistent product quality while reducing environmental impact, offering businesses cost-effective and future-proof solutions. With a commitment to innovation and sustainability, Alec helps clients streamline operations, minimize waste, and extend the lifecycle of essential components, reinforcing its role as a key player in the circular economy. - <i>eCircular:</i> a specialized provider of electronic waste (e-waste) management and data destruction services, dedicated to optimizing material recovery while ensuring secure disposal of sensitive data. By offering comprehensive solutions for electronics recycling and dismantling, eCircular enables businesses to maximize value recovery from obsolete telecom and IT equipment. Through meticulous material separation and compliance with industry standards, the company guarantees efficient resource utilization while mitigating environmental impact. Additionally, eCircular prioritizes secure data destruction, employing certified methods to safeguard client data and uphold regulatory compliance. - <i>Stena Recycling:</i> a leading provider of sustainable waste management solutions, specializing in electronic waste collection, recycling, and reuse. By offering comprehensive services tailored to businesses, the company plays a crucial role in facilitating the transition towards a circular economy. Through a combination of manual disassembly, decontamination, and advanced automated sorting, Stena Recycling maximizes resource recovery while minimizing environmental impact. By

	<p>supporting companies in achieving their sustainability goals, the company contributes to reducing waste, conserving raw materials, and promoting a greener industrial landscape.</p> <ul style="list-style-type: none"> - <i>Apple Daisy</i>: Apple has always been at the forefront of technological innovation, and its efforts in the area of environmental sustainability are no exception. The company's Daisy robot represents a key part of its commitment to creating a more sustainable future. Daisy is a highly advanced disassembly robot designed to break down iPhones from models 5 through 12, recovering valuable materials that can be reused in future products. This process is an important step in Apple's goal of creating products using only recycled or renewable materials, ultimately reducing e-waste and helping to preserve the planet's resources. Through Daisy, Apple demonstrates how innovation in recycling technology can lead to substantial environmental benefits while also aligning with the company's long-term sustainability goals. <p>Compared to the potential size of the market, the known potential competitors are few. Furthermore, their value proposition has a smaller scope compared to that of POLIMI Spin-off, which also aims to support customers in developing their own disassembly procedures and processes, and in improving their CRMs management, while the listed competitors aim only to perform the disassembly themselves for their customers. Therefore, POLIMI Spin-off will be offering a more complete and varied offering. Furthermore, even for what concerns disassembly activities at an industrial scale, the offering by POLIMI would be more flexible and customizable to particular components, making their recovery more efficient in terms of timing and costs.</p> <p>Concerning the part of the POLIMI Spin-off offer related to CBMs and CRMs criticality assessment and mitigation, the following potential competitors have been identified:</p> <ul style="list-style-type: none"> - <i>Sphera</i>: Sphera collaborates with regulatory bodies and sustainability organizations to ensure compliance with industry standards. The company partners with consulting and service firms, material suppliers, and IT solution providers to enhance its offerings and provide a comprehensive suite of risk management solutions. - <i>iPoint</i>: iPoint-Systems is a leading provider of digital solutions that drive the transition to a circular economy by enhancing transparency and providing actionable insights across the entire product lifecycle. Through its suite of compliance, sustainability, and risk management tools, the company helps businesses streamline regulatory processes and achieve sustainability goals. By integrating compliance and environmental data into a seamless system, iPoint-Systems enables organizations to make informed decisions and reduce their environmental impact. - <i>Sustainable Minds</i>: it is a cloud-based software company dedicated to helping businesses integrate environmental performance into their product development processes. Through its powerful Eco-concept and Life Cycle Assessment (LCA) tools, the company provides manufacturers with the ability to assess, compare, and improve the sustainability of their products. By making environmental impact analysis more accessible, Sustainable Minds enables businesses to streamline design processes, reduce costs, and meet increasingly stringent regulatory and market demands. - <i>3DEXPERIENCE</i>: The 3DEXPERIENCE platform by Dassault Systèmes is an integrated, cloud-based suite of applications designed to help businesses innovate, design, and produce products collaboratively across industries. This platform combines advanced technologies such as simulation, data management, and collaboration tools, with a particular emphasis on Digital Twin capabilities, supporting the entire product lifecycle from design to recycling. By providing cutting-edge tools, the 3DEXPERIENCE platform enables organizations to improve creativity, operational efficiency, and sustainability, helping them meet the demands of a rapidly evolving digital economy.
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	<ul style="list-style-type: none"> - Ansys Granta MI™: it is a leading material data management platform that helps businesses centralize, manage, and optimize material information across various systems. By offering smart material selection tools, such as Granta Selector, and integrating seamlessly with CAD, CAE, and PLM systems, Ansys Granta ensures that businesses make more informed decisions when it comes to selecting materials for their products. The platform aids in product optimization, ensuring consistency and improving overall performance. Ansys Granta also provides extensive training and technical support to help organizations fully leverage the power of its software. <p>In addition to the listed companies, it should be considered that other large consultancy companies (e.g.: McKinsey, Accenture, BCG, etc.) may decide to include consultancies related to raw materials criticality assessment and mitigation, as well as CBMs implementation, if tensions and issues related to CRMs were to rise. Compared to these companies, POLIMI Spin-off does not have the same experience and efficiency in planning and performing consultancy services. However, it can be more flexible in the type of service that is delivered.</p> <p>Compared to the listed competitors, which leverage standard software tools and solutions, POLIMI Spin-off will provide more tailored services by developing ad-hoc methods, tools, and strategies to support its customers.</p>
Go to Market – IPR Background	No IPR Background is present.
Go to Market – IPR Foreground	POLIMI Spin-off will be developing tailored solutions leveraging already existing technologies. However, the tailored-designed end-effectors will be patented.
Go to Market – Timing	The time to market of this spin-off can be estimated between 2 and 3 years, when the advanced robotics disassembly solutions will have reached a high enough TRL.
Go to Market - Channels	Early adopters will be reached through the large international POLIMI network.
Go to Market - Pricing	<p>It is very challenging at the moment to quantify the break-even point, given the still low TRL of advanced robotics disassembly solutions. However, some estimations can be performed. The following figures are tentative and may vary in the future:</p> <ul style="list-style-type: none"> - Price of a consultancy for the optimisation of the automated disassembly procedures, ranging between €100.000 and €200.000 depending on the complexity. The identification of the most critical components for the company to recover would involve an extra fee of €10.000. - Price of a consultancy for raw materials criticality assessment, mitigation, and development of circular business models, ranging between €15.000 (only criticality assessment or only criticality mitigation), €17.500 (criticality assessment and circular business models development), €25.000 (criticality assessment and mitigation), and €26.000 (the whole package). - Service of disassembly at an industrial level, ranging significantly according to the number of pieces to be disassembled, with a pricing between €0,5 and €5 per single piece, depending on the complexity of the recovery. Identification of the most critical pieces to be recovered would involve an extra fee of €10.000. Design4Disassembly consultancy would involve an extra fee of €10.000.
The Team	<ul style="list-style-type: none"> - Prof. Sergio Terzi: Co-founder. - Dr. Paolo Rosa: Co-founder and CEO.

	<ul style="list-style-type: none"> - Lorenzo Francesco Gandini: Project manager and developer of advanced robotics AI-based solutions. - Daniele Perossa: Project manager and developer of CRMs assessment, mitigation, and CBMs services. - Laura Pomo: Project manager and communication manager. - Laila El Warraqi: Project manager and CRMs assessment software tools developer.
The Team – External providers	External providers will include the lab equipment suppliers

Table 17 - POLIMI Business Plan

Exploitation Roadmap for POLIMI	
Actions	<p>After the end of CIRC-UIITS, in the following months will be continued the already ongoing activity of elaborating project proposals to capture further funding to continue the research and development activity needed to reach a satisfactory level for both advanced robotics AI-supported solutions and CRMs management methodologies at a level ready for the market.</p> <p>In the meantime, research and development actions will continue in parallel.</p>
Roles	<p>The only partner involved in these actions is POLIMI, which is working on developing new proposals to gain the needed funds, in some cases partnering again with some of the partners from CIRC-UIITS (e.g., CRF, SAT, BESU, SUPSI, MARAS).</p> <p>R&D actions are performed by POLIMI with some collaboration from CIRC-UIITS pilot leaders.</p>
Milestones	<p>The first milestone should be about acquiring a minimum customer base to secure the initial investment. Being an innovative activity, it is of paramount importance to receive direct feedback from the target market. To this extent, at least one big customer should be reached. (M1-M6)</p> <p>The second milestone is the awarding of a sufficient amount of funds to proceed with the activities. This would eventually happen in about 10 months. The KPIs for enough funding to bring on the activity are around €430.000 in the next three years. (M6-M18)</p> <p>The third milestone, following the raising of necessary funds, is to create a network of other high-tech companies that can support in carrying out some process activities that would be uneconomical if internalized. (M6-M12). At this point, the spin-off could be officially launched.</p> <p>The fourth milestone concerns the marketability of the offered solutions (achievement of TRL 9) and the expansion of the customer base to achieve economic sustainability of the entire business model. (M12-M24)</p>
Financials Costs	<p>Considering about 3 skilled researchers working on the needed research and development activities, it would cost around €80.000 for 1 year and €240.000 for three years.</p> <p>Considering the costs for lab equipment and lab maintenance in the next 1 year and 3 years. It would cost around €130.000 for 1 year due to the purchase of equipment (robot, 3D printers, reman tools, automated actuators). Then €30.000 each year for the design of the disassembly and effectors, and custom solutions. In total, it would be €190.000.</p>

<p>Revenues</p>	<p>In the next two years, no revenues are planned, as the Spin-off will not have been launched yet, according to POLIMI's expectations.</p> <p>In the third year, the aim would be to acquire two large customers (i.e., performing large projects related to disassembly at an industrial scale or optimisation of disassembly procedures) and 5-10 small customers (i.e., performing only consultancies related to criticality assessment and mitigation and CBMs development). Thus, the expected revenues would be between €350.000 and €650.000 in the third year alone.</p>
<p>Other sources of coverage</p>	<p>The monetary resources detailed above and highly skilled human resources, knowledgeable about advanced robotics, AI, and related coding, Electronics, Circular Economy practices, Circular Business Modelling, and raw materials criticality assessment and mitigation.</p>
<p>Impact in 3-year time</p>	<p>In 3 years ' time, the advanced robotics usage for disassembly TRL will have advanced thanks to the research and innovation activities conducted in POLIMI aimed at developing the Spin-off. The same will be for managerial practices and approaches to mitigate raw materials criticality, and methodologies for tailored corporate-level raw materials criticality assessment methods and tools. By then, it is expected that POLIMI's solution will be available on the market, contributing to making EU supply chains for CRMs more resilient, secure, and sustainable.</p>

Table 18 - POLIMI Exploitation Roadmap

ANNEX 4.6: BESU’s Video Game Business Model

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - General increase of emphasis on circularity topics. - Need for education about circularity topics. - Advancement in digital distribution platforms to reach a wider audience. - Regulations and policies for sustainable gaming industrial solutions. - Need for professionals with expertise in the circular economy. 	<ul style="list-style-type: none"> - Institutions, government agencies, and regulators - Gaming community - Sustainable investors

Table 19 - BESU Video Game Sustainable Circular Business Model Innovation: business ecosystem level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Website hosting - Videogame development - Videogame maintenance & updates - Marketing and promotion: advertising costs. 	<ul style="list-style-type: none"> - Owner of a hosting platform. - Brands for sponsorships and partnerships, and case-data providers. - Networks for European gaming or similar to distribute the content. 	<ul style="list-style-type: none"> - Developers - CE knowledge and expertise - Educational theories, knowledge, and expertise 	<ul style="list-style-type: none"> - Videogame development - Videogame maintenance and updates - Partnerships and/or collaborations - Fund-raising (direct or indirect). 	<p>Providing education about relevant sustainability topics entertainingly and effectively, and stimulating career paths related to the circular economy</p>

Table 20 - BESU Video Game Sustainable Circular Business Model Innovation: business level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Social media channels - Official website where the game is hosted. - Circ-Uits dissemination 	<ul style="list-style-type: none"> - Private customers (individuals and families, both parents and kids) - School teachers 	<ul style="list-style-type: none"> - Platform hosting the video game. 	<ul style="list-style-type: none"> - Small fee for each download. - Sponsorships by brands providing case data. - Funding from donors.

Table 21 - BESU Video Game Sustainable Circular Business Model Innovation: business level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Energy efficiency for hardware requirements. 	<ul style="list-style-type: none"> - Raise awareness and impart knowledge about circular economy, eco-design, and sustainable strategies to provide information to a broad range of target groups to elevate intrinsic motivation - Educate young people about sensitive topics needing professionals in the future, thus indirectly stimulating the circularity transition - No raw materials consumption needed (compared to traditional “board” serious games)

Table 22 - BESU Video Game Sustainable Circular Business Model Innovation: sustainability impact

ANNEX 4.7 BESU's video game Business Plan

BESU Video Game	
Problem	Circular Economy is currently a massively impacting topic, pivotal for EU strategy (e.g., CEAP, CRMA). Consumers and their behaviour are key to a successful transition towards the Circular Economy. However, very often, they are not aware of this topic, its benefits, or their role in achieving a more circular consumption paradigm. This is caused by a lack of education for the general public about the circular economy.
Alternative solution	Most of the consumers are not aware of this issue, and are not searching for any means to better educate themselves. There are only a few exceptions of more proactive citizens who autonomously try to educate themselves by searching for information, <i>usually on the Internet</i> .
Unique Selling Point USP - Unique Value Proposition UVP	This KER will enable simple and engaging education of families and private citizens. Furthermore, it will see the indirect involvement of product-selling companies, bringing together consumers and industry in the challenge of transitioning towards a circular economy.
Description	The KER under development consists of an online video game, presenting challenges related to transitioning towards more circular products. The products shall be realistic examples provided by real companies.
"Market" – Target market	<p>The target users are families and private citizens. The target customer segments are those people who are more sensitive to environmental sustainability topics and willing to learn more about the circular economy. Furthermore, teachers of primary and secondary education may use the video game in engaging classes or homework assignments. The revenues shall come from downloads and advertisements.</p> <p>Proper customers, paying BESU, shall be the companies advertising themselves through the video game.</p>
"Market" – Early Adopters	<p>Expected early adopters will be people sensitive to sustainability themes and keen on playing online video games. Creative first and second-level education providers interested in these themes are also expected.</p> <p>Companies sponsoring the video game are expected to be large enterprises committed towards the Circular Economy, willing to make consumers sensitive towards environmental sustainability aware of their commitment.</p>
"Market" - Size	The number of people currently playing online video games in Europe is estimated to be around 80-90 million. This is based on a 2023 study by Videogames Europe, which estimated that nearly 125 million people in Europe play video games daily. Furthermore, according to another study, 68% of gamers in the UK play online games. Assuming the same percentage in Europe, results in 80-90 million people. Considering that most of the gamers are young people, and that according to a 2021 survey by ActionAid Ipsos, 84% of the young Europeans (15-35 years old) considered climate change as the greatest global threat and were very or extremely concerned about it, the potential market size is huge.
"Market" - Trends	The mentioned relevance of environmental sustainability topics among young European people is a major trend impacting positively on this KER. In the last few years, the number of

	serious games about the circular economy present on online platforms like Steam has been increasing, a symptom of a growing interest in this kind of offer.
Settings – Acceptance	<p>The public acceptance of a serious game educating about topics of environmental sustainability is expected to be very high. The same can be said for the acceptance on the political side, as this KER is consistent with politics like the EU Green Deal, the CEAP, and the CRMA.</p> <p>Some concerns may be raised by the usage of advertisements of partners companies in a video game about sustainability. These aspects should be carefully managed. To do so, at the start of the game, it is important to openly state how it has been developed thanks to funding from the EU, and that only passive branding is present in the game.</p>
Settings – Legal and regulatory aspects	Copyright will be pursued to protect the software, graphics, text, music, manuals, and characters.
Go to Market – Use model	The KER will lead to the development of an online video game that will be made available open-source as a browser game. Companies sponsoring the game will be able to show their brands in a video game about the circular economy and sustainability.
"Market" – Competitors	<p>The following competitors, already offering serious games related to the Circular Economy paradigm, have been identified:</p> <ul style="list-style-type: none"> - In The Loop Game: In the Loop offers a unique, gamified approach to learning about complex ecosystems and circular economy principles. By combining educational games and engaging content, it transforms abstract, challenging topics into interactive and memorable experiences. Its guiding philosophy—"Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand."—emphasizes the importance of active involvement for deeper understanding. This makes the offering suitable for professionals, educators, and sustainability enthusiasts alike. Its customer segments are overlapping with those targeted by BESU. - Circula: Circula empowers individuals and teams to understand and adopt sustainable business models and responsible lifestyles through an engaging and creative game. By fostering self-awareness, building on individual and team strengths, and inspiring hope for a sustainable future, Circula offers a unique gamified learning experience. Its focus on wellbeing without overconsumption aligns with global sustainability goals, making it highly relevant for businesses, educators, and individuals alike. The customer segments are overlapping with those targeted here by BESU. However, BESU differentiates from Circula with a game revolving around more technical and business learning content, more designed for professionals upskilling/reskilling. - ecoCEO: ecoCEO provides an engaging and educational platform aimed at secondary school students, enabling them to understand and explore the principles of the circular economy. The game fosters awareness of resource management, sustainable entrepreneurship, and circular business strategies by simulating real-world challenges and decisions. Players gain insights into recycling, reuse, repair, and other sustainable practices while managing a virtual company. Compared to the proposed KER, ecoCEO is targeting different customer segments. However, there can be an overlap since this game is also centered around managerial and business skills. BESU can differentiate by offering the learning of more advanced skills and knowledge about the Circular Economy compared to ecoCEO, also thanks to the official expansion. - Achab Group Ecogame: Achab Group promotes sustainability by fostering awareness, education, and engagement. Its offerings inspire audiences of all ages to embrace sustainable behaviors, blending education with creativity through interactive games,

	<p>art, and events. The tools provided encourage active learning and actionable change for a more sustainable future. Compared to BESU’s KER, the learning content appears more generic (overall focus on sustainability), as well as the target audience.</p> <ul style="list-style-type: none"> - Inchange: The Blue Connection by Inchange offers an engaging, team-based learning experience designed to empower businesses and professionals in transitioning from linear to circular value chains. Through its immersive, web-based simulation game, it fosters collaboration, critical thinking, and real-world problem-solving. The platform helps participants understand the complexities and benefits of circular business models by offering tailored experiences that align with specific learning objectives. It promotes a no-waste mindset while equipping teams with the tools to address sustainability challenges effectively, bridging the gap between theory and actionable strategy. The targeted customer segments overlap with those of BESU. <p>While it is true that there are already a few products on the market that are competing for the same customer segments targeted by BESU, it is also true, as already discussed in the “trends” section above, that the demand for workers skilled and knowledgeable about the circular economy transition in Europe is already high and expected to further grow in the future. Therefore, there should be enough room in the market for all the listed competitors and BESU.</p>
<p>Go to Market – IPR Background</p>	<p>The sole background IP is BESU’s brand and logo (Trademark).</p>
<p>Go to Market – IPR Foreground</p>	<p>The developed video game will be subject to copyright by BESU. Copyright will be pursued to protect the software, graphics, text, music, manuals, and characters. The name and logo of the video game will be registered as trademarks. The graphic design will also be registered. Graphics and coding of the game will be developed internally by BESU. The embedded music will also be composed by BESU. If need open source (free) content will be used and referenced accordingly. Thus, no licenses or rights will have to be granted externally to BESU.</p> <p>Personal data protection will be guaranteed through compliance with the GDPR (EU 2016/679) Regulation. Informed consent for cookie usage will be issued according to the current legislation. More stringent rules about consent will be put in place for users below 16 years old of age. The EU Directive on consumers’ rights will also be considered whenever applicable. No e-commerce or in-game transactions shall be used. The cybersecurity by design principle will be adhered to while developing the video game.</p> <p>The level of the taught content will be valid, thanks to the experience gained through the CIRC-UIITS Project. The interface, design, and language will be inclusive (e.g., avoiding dark patterns, loot boxes, and rewards that might generate addiction). A fair equilibrium between game time, break time, and learning time will be ensured. The Accessibility Act will be considered whenever applicable.</p>
<p>Go to Market – Timing</p>	<p>The time to market, in the case of the video game, is dependent only on the development of the game itself and the conclusion of the agreements with the companies sponsoring it. For this reason, October 2026 is the target for the launch of the game to the market.</p>
<p>Go to Market - Channels</p>	<p>Online advertisement</p>
<p>Go to Market - Pricing</p>	<p>15€/per download</p>
<p>The Team</p>	<ul style="list-style-type: none"> • Full Stack Developer for Front- and Backend Application Programming • Media- and Communication Designer

	<ul style="list-style-type: none"> • Game Designer • Environmental Engineer for Content Creation
The Team – External providers	None is needed

Table 23 - BESU's video game business plan

BESU's Video Game Exploitation Roadmap	
Actions	Immediately after the end of the project, BESU will move to finalise the technical preparation of the video game. Concurrently, BESU will set up the web-hosting of the game and start looking for companies willing to sponsor the game in order to appear inside it.
Roles	Within the 3-6 months after the end of CIRC-UIITS, discussions with companies for sponsorship agreements will be initiated. Their role will be to understand BESU's objectives and offer benefits, and evaluate whether they are of interest.
Milestones	<ol style="list-style-type: none"> 1- Finalization of the technical part of the video game (by the end of the project, December 2025). €25.000 financing is needed. 2- Testing of the videogame, bug fixing, and fine-tuning (within June 2026). 3- Setting up the steam platform product site for the video game (by June 2026). €6.000 of financing is needed. 4- Finding companies' partners to finance the videogame, definition of the role of their brands in the game, and signature of the related contracts (Within September 2026). 5- Launching of the video game (within October 2026).
Financials Costs	<p>The main financial costs to undergo in the next 1-3 years will be as follows:</p> <ul style="list-style-type: none"> - Finalisation of the videogame: €35.000 - Steam-hosting setting up: €9.000 - Videogame maintenance: €15.000
Revenues	<p>Revenues shall come from two main sources:</p> <ul style="list-style-type: none"> - Revenues from downloads of the video game: 50 downloads in 2026, leading to €800 in revenues, 150 downloads in 2027, leading to €2.300 in revenues, 200 downloads in 2028, leading to €3.000 in revenues. - Sponsorship from partners companies: €53.000 (non-profit-distribution)
Other sources of coverage	Sources from external investors (green investors) will be needed. ESG investors and business angels will be the targeted type of investors in the first 3 years after the end of CIRC-UIITS.
Impact in 3-year time	The video game is expected to educate consumers and citizens about the circular economy paradigm. It will be raising awareness among users about the relevance of circular transition, its expected benefits, the challenge it represents, and their role in it. This kind of awareness among consumers is crucial to enable the circular transition.

Table 24 - BESU's video game exploitation roadmap

ANNEX 4.8: BESU’s board game business model

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<ul style="list-style-type: none"> - General increase of emphasis on circularity topics. - Need for training on circularity topics. - Need for regulations and policies to reduce waste and promote circularity. 	<ul style="list-style-type: none"> - Institutions – (e.g., to include the game in educational programs). - Sustainable investors - NGOs (to support the development of the game). - Gaming community engagement and participation.

Table 25 - BESU board game Sustainable Circular Business Model Innovation: business ecosystem level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Game development - Game update (Outsourced) game production - Advertising costs (marketing and promotion of the game) 	<ul style="list-style-type: none"> - Physical producer of the game: manufacturers (printing company using sustainable material) - Packagers (design and producer). 	<ul style="list-style-type: none"> - Circular economy knowledge and expertise. - Education science knowledge and expertise. 	<ul style="list-style-type: none"> - Game development considering CE know-how, expertise, etc., and education science theories. - Game assistance, moderator-style, in physical presence on demand. - Directly offering workshops about the Circular Economy centred on the game itself. - Train the trainer. 	<ul style="list-style-type: none"> - Education about topics relevant to sustainability and business provided in an entertaining way (future base version) - Training about topics relevant to sustainability and business provided in an entertaining way (standard version of the game).

Table 26 - BESU board game Sustainable Circular Business Model Innovation: business level (Part 1)

Customer relationship & collaboration	Customer stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Endorsements by academia to be used as an advertisement for the game. - Universities and research centres in academia are to provide insights to keep the game evolving, updating, and expanding. - Hackathons - Workshops - Social media channels - Recycled/neutral carbon footprint product certification - Circ-Uits dissemination 	<ul style="list-style-type: none"> - Professionals (both standard and future base versions) (including people in start-ups or in incubators). - Trainers, coaches, and consultants. - University professors of base-level classes. about CE (base version) - University professors of high-level classes about CE (standard version). - Organisers of events (conferences and hackathons, both game versions). 	<ul style="list-style-type: none"> - Direct distribution at the beginning, then specialised retailers if numbers increase. - Traditional e-commerce channels (Amazon, etc.) (when numbers increase) - Redistribution to schools after you have ended using it (advertising it properly). - For the future base version of the game, bookstores. 	<ul style="list-style-type: none"> - Selling board game - Leasing the game - Workshops provided by BeSu itself. - Offering assistance in person by BeSu itself during hackathons and other big events as moderators.

Table 27 - BESU board game Sustainable Circular Business Model Innovation: business level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Materials: usage of sustainable materials, recycled paper for the cards, and the game. Also, sustainable inks and alternative materials are even more sustainable than recycled paper. - Minimal packaging (if possible, recyclable) - Physical producer of the game being certified ISO 14001 or similar/equivalent. - Reduction of carbon footprint (distribution of cards) 	<ul style="list-style-type: none"> - Raise awareness and impart knowledge about circular economy, eco-design, and sustainable strategies. - By improving knowledge and raising awareness about circularity practices among professionals, the circularity transition is stimulated.

Table 28 - BESU board game Sustainable Circular Business Model Innovation: sustainability impact

ANNEX 4.9: BESU's Boardgame Business Plan

BESU's Board Game	
Problem	<p>Circular Economy is currently a massively impacting topic, pivotal for EU strategy (e.g., CEAP, CRMA). However, besides involving a disruptive change in consumers' behaviour, the Circular Economy also requires an unprecedented change in the skills and expertise needed by industrial actors. Such a change tackles different levels: conducting circular business requires novel types of expertise, the needed eco-design of products requires new technical skills, and the processes needed to perform recovery and reuse of product, components, and materials require complex and cross-disciplinary knowledge.</p> <p>In this challenging context, companies struggle to adequately reskill their personnel. Thus, it is required external help in teaching both basic and more advanced notions and skills necessary to transition into a circular production and business paradigm. Companies needing this type of support can belong to different sectors and be of different sizes. The need for upskilling is felt for different types of people inside an organization, including both blue-collar and white-collar. In this specific case, it has been opted to focus on white-collar, including both middle-management and high-management levels.</p> <p>The need for professionals skilled in circular economy practices and business is not limited to the impact on the reskilling existing workforce, but is also extended to the need for training future generations of practitioners. For this reason, teachers (moreover, in third-level education) will be targeted as potential customers. This KER will indeed enable them to teach circular economy-related business and managerial skills to their students more simply and engagingly compared to the traditional lecturing style.</p>
Alternative solution	<p>So far, companies tend to solve the problem of the lack of internal skills by relying on external consultants from other companies or from academia for training sessions or to outsource the set of skills they lack. This kind of solution is typically very expensive in monetary terms.</p> <p>For training providers themselves, as well as teachers in universities, providing the know-how and skills companies need in managerial roles for a circular economy transition traditionally involves long and challenging lecturing sessions. It is difficult to keep a high level of engagement and, thus, to be effective in the aimed transfer of skills and notions.</p>
Unique Selling Point USP - Unique Value Proposition UVP	<p>This KER will enable simple and engaging learning of the managerial skills and notions needed for a company's circular transition. It provides companies with the possibility of (at least in part) re-skilling their managerial personnel in a cheaper manner than with alternative solutions.</p> <p>From the teachers and trainers' standpoint, this KER will significantly ease their job of notions and skills transfer, and will also make it more effective.</p>
Description	<p>The KER under development consists of a serious game about circular transition, aiming at enabling the learning by students and current company managers to learn the skills and notions. It will consist of a card game that will allow learning in a fun way. Two versions will be made available: a basic one, focused on fundamental skills and notions, and an official expansion, available at an extra price, that, by increasing the complexity of the game and including extra elements, will enable the transfer of more complex notions.</p>

<p>"Market" – Target market</p>	<p>The target market is twofold: on the one hand, companies willing to reskill their own workforce on circular economy topics. On the other hand, there are third-level education providers teaching topics related to the circular economy.</p> <p>For the first target, the addressed customer segments would be the following:</p> <ul style="list-style-type: none"> - Companies with less economic availabilities (e.g., SMEs) that are willing to improve the skills of their personnel about the circular economy but are not willing to pay high fees for consultancy training. - Companies (including large enterprises and generally enterprises with more economic resources) that already possess some skills about circular economy transition, but are confined in a very few people. With the support of this business game, these people could transfer their skills to others. <p>Concerning the second target, the customer segment shall be trainers and teachers who are more prone to use innovative teaching methodologies and strive to continuously improve their work.</p>
<p>"Market" – Early Adopters</p>	<p>Early adopters will likely be teachers in university teachers and trainers, feeling that they are currently struggling to effectively teach circular economy-related skills. Teachers, typically, are more prone to embrace this kind of innovation compared to companies, since teaching is their core job, and thus they are more up-to-date with new solutions, as well as constantly searching for new ways to improve their teaching performance.</p>
<p>"Market" - Size</p>	<p>The current market size of European companies needing reskilling to face the circularity transition and trainers and teachers providing these kinds of skills is impossible to quantify but is arguably already very large and expected to further increase in the future. This expectation is motivated by the more and more stringent EU regulations forcing companies towards a circular transition (e.g., CEAP, CRMA, CSRD) and by the maturing awareness in many consumers about circular products and their relevance.</p>
<p>"Market" - Trends</p>	<p>The mentioned increasing pressure on companies to transition towards more and more circular business and operations is pressuring companies to look for new skilled employees and reskilling their current ones. The former need to pressure universities and other types of education and training providers to adopt methods that allow them to effectively and efficiently teach circular economy-related notions and skills. The latter pushes companies themselves towards reskilling programmes and training centred around the circular economy.</p> <p>In terms of trends in the gaming industry, an interesting ongoing trend is the growing practice of selling small and cheap serious games even in book stores. This type of serious game is often utilised in workshops as well. Thus, in the case in which the first, more complete, and expensive version of the game is successful, a reduced version will be designed and produced, and sold even in books stores.</p>
<p>Settings – Acceptance</p>	<p>The public acceptance of serious games enabling an improvement of skills relevant for strategic jobs related to the sustainability transition is expected to be very positive.</p> <p>In terms of social impacts, the skilling of people for work needed for the Net Zero Transition, for which a great demand is currently on the rise in the EU and is expected to increase even more in the future to fulfil the targets of the EU Green Deal and FitFor55 Agenda, as well as the CEAP and CRMA.</p>

	<p>In terms of environmental impacts, this KER will allow the skilling of the managerial workforce to enable the circularity transition, leading to a decrease in environmental impacts expected by the circular economy.</p> <p>To further enhance public acceptance, the environmental impacts linked to the production of the card game shall be reduced by the usage of recycled materials for both the product and its package.</p> <p>In economic terms, this KER will be part of the training of a new skilled workforce, contributing to solving the long-term issue of the mismatch between work demand and supply. One of the major barriers to Green Transition is indeed the lack of needed skilled workers, able to lead companies towards a more sustainable future. Training them will contribute to creating many new workplaces, as well as making the companies they will be working for more competitive.</p>
<p>Settings – Legal and regulatory aspects</p>	<p>Copyright’s legal aspects will be investigated and evaluated carefully. Copyright will be the IPR protection tool adopted by BESU for this card game.</p> <p>The game will be compliant with the 2009/48/CE Directive on games for minors. The related mark will be obtained through testing and conformity declaration according to the law. Materials listed in the REACH and CLP will be duly avoided. The used paper and pulp will be recycled. Clear instructions, suggestions for the age to play the game, and adequate translations into different languages will be made available.</p> <p>The Circular Economy aspects will be clear, correct, and accurate, thanks to CIRC-IUT’s experience. Language and design shall be inclusive and non-discriminatory. Language, font, and usage of pictures will make the game accessible to anyone. The educational nature of the game will be valorised more than the competitive aspects. No manipulations of fears (e.g., fear of climate change) will be exploited.</p> <p>Vague and ambiguous green claims (e.g., “100% green”) will be avoided. For e-commerce sales, the OSS – One Stop Shop rules will be applied.</p> <p>It is expected that all game materials are produced from either recycled materials or recyclable materials such as FSC-certified papers or the European Ecolabeled ink and packaging. Distribution channels are to be climate-neutral.</p>
<p>Go to Market – Use model</p>	<p>The KER will lead to the manufacturing of a new product (a new type of card game). The use model will be based on the direct selling of this serious game to the described customer segments. In addition to the product itself, BESU will be offering, for an additional fee, a few services. In particular, the BESU team will be available to lead workshops centred around the card game and to act as a moderator of the game.</p> <p>For an additional fee, the buyers will also be able to purchase the official expansion of the game with additional features and elements, making the game more complex but also more enriching from a learning perspective. The purchase of the official expansion is suggested for customers who already possess a solid knowledge of at least the key elements of the circular economy paradigm.</p>
<p>"Market" – Competitors</p>	<p>The following competitors, already offering serious games related to the Circular Economy paradigm, have been identified:</p> <ul style="list-style-type: none"> - In The Loop Game: In the Loop offers a unique, gamified approach to learning about complex ecosystems and circular economy principles. By combining educational games and engaging content, it transforms abstract, challenging topics into interactive and memorable experiences. Its guiding philosophy—"Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand."—

	<p>emphasizes the importance of active involvement for deeper understanding. This makes the offering suitable for professionals, educators, and sustainability enthusiasts alike. Its customer segments are overlapping with those targeted by BESU.</p> <ul style="list-style-type: none"> - Circula: Circula empowers individuals and teams to understand and adopt sustainable business models and responsible lifestyles through an engaging and creative game. By fostering self-awareness, building on individual and team strengths, and inspiring hope for a sustainable future, Circula offers a unique gamified learning experience. Its focus on wellbeing without overconsumption aligns with global sustainability goals, making it highly relevant for businesses, educators, and individuals alike. The customer segments are overlapping with those targeted here by BESU. However, BESU differentiates from Circula with a game revolving around more technical and business learning content, more design for professionals upskilling / reskilling. - ecoCEO: ecoCEO provides an engaging and educational platform aimed at secondary school students, enabling them to understand and explore the principles of the circular economy. The game fosters awareness of resource management, sustainable entrepreneurship, and circular business strategies by simulating real-world challenges and decisions. Players gain insights into recycling, reuse, repair, and other sustainable practices while managing a virtual company. Compared to the proposed KER, ecoCEO is targeting different customer segments. However, there can be overlapping since this game is also centering around managerial and business skills. BESU can differentiate by offering the learning of more advanced skills and knowledge about Circular Economy compared to ecoCEO, also thanks to the official expansion. - Achab Group Ecogame: Achab Group promotes sustainability by fostering awareness, education, and engagement. Its offerings inspire audiences of all ages to embrace sustainable behaviors, blending education with creativity through interactive games, art, and events. The tools provided encourage active learning and actionable change for a more sustainable future. Compared to BESU’s KER, the learning content appears more generic (overall focus on sustainability), as well as the target audience. - Inchange: The Blue Connection by Inchange offers an engaging, team-based learning experience designed to empower businesses and professionals in transitioning from linear to circular value chains. Through its immersive, web-based simulation game, it fosters collaboration, critical thinking, and real-world problem-solving. The platform helps participants understand the complexities and benefits of circular business models by offering tailored experiences that align with specific learning objectives. It promotes a no-waste mindset while equipping teams with the tools to address sustainability challenges effectively, bridging the gap between theory and actionable strategy. The targeted customer segments overlap with those of BESU. <p>While it is true that there are already a few products on the market that are competing for the same customer segments targeted by BESU, it is also true, as already discussed in the “trends” section above, that the demand for workers skilled and knowledgeable about the circular economy transition in Europe is already high and expected to further grow in the future. Therefore, there should be enough room in the market for all the listed competitors and BESU.</p>
<p>Go to Market – IPR Background</p>	<p>Only Trademark about the BESU Logo and name is already in place.</p>
<p>Go to Market – IPR Foreground</p>	<p>The developed card game will undergo copyright. Thus, graphics, the instruction manual, texts, written rules, and original game landscape and storytelling will be protected by copyright. Then, a Registered Community Design (RCD) with EUIPO will be filed. It will also be evaluated to file the recording of the title of the game at the EUTM as an original trademark.</p>
<p>Go to Market – Timing</p>	<p>October 2026, according to milestones set below (then if successful, large channels in 2028)</p>



Go to Market - Channels	Direct sales, ppl form existing sales networks, existing customers, using other BESU small groups. They would then be references for others. Additionally, LinkedIn PaidAds campaigns will be employed.
Go to Market - Pricing	500€ for the initial big version, to cut down to 250€ if e-commerce is reached (in case 125-180 sets per year are sold). 30-40€ for the bookstore version (reachable in case 500-800 sets per year are sold).
The Team	There will soon be a need for persons experts in design and artwork, hardware, and content-related parts development. Marketing expertise will also be needed right from the start. BESU already possesses internally or can easily reach out to these kinds of expertise. A total of three persons will probably be needed.
The Team – External providers	External providers will be needed to build the packaging and the printing. External people doing the “proof-reading” will also be needed from external partners.

Table 29 - BESU's Board Game Business Plan

BESU's Board Game Exploitation Roadmap	
Actions	Immediately after the end of the project, BESU will move to further, larger testing of the serious game. If the tests are successful, investors will be contacted to scale up to the commercialization phase (which will not take place before 6 months after the end of the project).
Roles	Some partners will be involved in the first 6 months after the end of the project for the testing and fine-tuning of the serious game. They will be from organisations with fair expertise in the Circular Economy paradigm, so that they can also evaluate the level of the technical content touched upon by the game.
Milestones	<ol style="list-style-type: none"> 1. Finalization of the serious game (by the end of the project, December 2025). 2. Further testing of the serious game, and fine-tuning of it according to received feedback (within June 2026). 3. Search for investors interested in financing the commercialization of the game sales (between January 2026 and September 2026). €16.000 financing is needed. 4. Commercialization of the game through direct distribution channels (October 2026). 5. In case sales are satisfactory, reaching 800 games sold, search for further investments to upscale the production and distribution of the game (between January 2027 and December 2027). €25.000 further financing is needed. 6. Upscaling of the production of the game and exploitation of classic e-commerce sales channels (January 2028). The success KPI is reaching 1.000 units sold per year.
Financials Costs	<p>The main financial costs to undergo in the next 1-3 years will be as follows:</p> <ul style="list-style-type: none"> - Finalisation of product design: €8.000 - Outsourced production of the serious game: 13€/set - Direct distribution costs: €1.500 - Outsourced production of the serious game from 2028 onwards, with an expected volume increase: 5€/set - Costs for joining famous e-commerce platforms: <1€/set with an initially effort of €1.000

	<ul style="list-style-type: none"> - Overall advertisement costs: initial investment between €3.000 and €15.000
Revenues	<p>Revenues shall come from two main sources:</p> <ul style="list-style-type: none"> - Sold copies of the game: 800 (first year), 7.500 (second year), generating a total of €465.000 - Workshops held or supported by BESU through the game: 24 workshop days for professional customers, generating €72.000
Other sources of coverage	<p>Sources from external investors (green investors) will be needed. ESG investors and business angels will be the targeted type of investors in the first 3 years after the end of CIRC-UITs.</p>
Impact in 3-year time	<p>The society will benefit from the diffusion of an effective and well-designed serious game, supporting and improving training sessions aiming at up-skilling and re-skilling the workforce of companies that want to commit to circular economy practices, as well as students of third-level education who want, through their work, to become an active force for the Green Transition of the EU.</p>

Table 30 - BESU's Board Game Exploitation Roadmap

ANNEX 4.10: TXT’s EoL Suite Business Model

Business ecosystem level	
Trends and drivers: Legislation related to waste, consumer environmental consciousness, and resource scarcity	Stakeholder involvement
<ul style="list-style-type: none"> - Growing concerns and legislation (e.g., CRMs Act) related to the criticality of materials (moreover, in Europe and North America), often encouraging a circular approach for products, embedding them. - Growing awareness, concerns, and legislation related to sustainability issues (e.g., CSRD). - Growing attention and legislation related to circularity practices. 	<ul style="list-style-type: none"> - NGOs and Regulatory bodies (e.g., the European Union issuing new regulations). - Industrial associations and clusters

Table 31 - TXT EoL Suite Sustainable Circular Business Model Innovation: business ecosystem level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<ul style="list-style-type: none"> - Industrialization of the project prototype - Software maintenance and update (R&D). - IT infrastructure management costs (local or cloud, based on customer needs). - Costs for customer support activities. - Relationship costs with the CIRC-UIITS Toolbox team (detailed in Section 2 of the deliverable). - Marketing and promotion expenses. 	<ul style="list-style-type: none"> - CIRC-UIITS Toolbox team, presenting complementary services that might enrich the offering to the customers. - ERION as multiplier (potential new customers in its network) - CIRC-UIITS industrial partners (e.g., BEKO) as testers and early adopters of the proposed solutions. <p>The details of the relations with the key partners are illustrated in Section 2 of the deliverable.</p>	<ul style="list-style-type: none"> - IT and software engineering knowledge and expertise - IP developed in the project. 	<ul style="list-style-type: none"> - Industrialisation (including next steps of modules and functionalities updates). - Definition of the team around the suite (R&D, delivery, customer support, sales, and product manager). - Customer support service activities in using TXT’s suite effectively. - Contractualization of key partners. - Marketing campaign. 	<p>TXT’s EoL suite supports enterprises to increase reuse of components/parts of components, allowing:</p> <ul style="list-style-type: none"> - Decrease in supply chain dependency risks. Increase compliance with the latest national and international legislation related to CRMs - Decrease overall production costs <p>For WEE collecting plants and dismantlers, the EoL suite allows:</p> <ul style="list-style-type: none"> - The decrease of

				<p>throughput times, error rate, and labour costs for WEEE dismantlers in the disassembly procedures (AR module).</p> <ul style="list-style-type: none"> - Additional revenue streams derived from selling second-hand components. <p>These solutions will support the whole value chain in becoming more circular, and thus sustainable (ESG-compliant) and resilient against supply risk.</p>
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Table 32 - TXT EoL Suite Sustainable Circular Business Model Innovation: business level (Part 1)

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics (Direct and reverse)	Revenue streams
<ul style="list-style-type: none"> - Feedback acquisition and product support. - Technical assistance and ongoing support for software usage. - Services improvement and software 	<ul style="list-style-type: none"> - OEMs and other tier-suppliers (for the marketplace). - Recyclers (for the marketplace). - WEEE collectors, consortia, and other actors 	<ul style="list-style-type: none"> - Direct sales through specialized sales teams through the TXT's official website and at sectoral fairs and events. - Workshops. - Conferences - CIRC-UIITS Toolbox and collaboration 	<ul style="list-style-type: none"> - Project revenues, including valorisation/monetisation of the different modules. - Value-added services (consultancy around the software). - Access to the marketplace in exchange for a monthly or annual recurrent fee.

<p>updating based on received feedback and customer requests.</p> <ul style="list-style-type: none"> - Industrial partners for modules testing and development, in terms of validation support and feedback (e.g., AUMOVIO, BOSCH, BEKO, etc.) 	<p>(for the whole suite).</p> <ul style="list-style-type: none"> - Consultants and other sustainability experts 	<p>with the team (see Section 2)</p>	
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Table 33 - TXT EoL Suite Sustainable Circular Business Model Innovation: business level (Part 2)

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Increase the reuse % of components/sub components of the products. 	<ul style="list-style-type: none"> - Support for materials and components recovery and waste minimisation. - Minimisation of critical abiotic resources depletion. - Environmental and Social sustainability enhancement of products and processes thanks to the enabling of circular solutions.

Table 34 - TXT EoL Suite Sustainable Circular Business Model Innovation: Sustainability impact

ANNEX 4.11: SUPSI's Spin-off Business Model

Business ecosystem level	
Trends and drivers	Stakeholder involvement
<p>Growing sustainability concerns in industry and society.</p> <p>Increasing requirements of sustainability reporting and product eco-design in the EU (CSRD, ESPR...).</p> <p>Not expert profiles, especially those found in SMEs, are required to assess, improve, and report on product sustainability performances, but existing tools are not easily accessible to them.</p>	<ul style="list-style-type: none"> - Manufacturing companies (especially SMEs) - Consulting companies - NGOs - Research institutes, Governments, standardisation bodies, and institutions (evolving landscape of sustainability regulations) - Programme operators and certification authorities for sustainability & circularity labels and reports

Table 35 - SUPSI Spin-off Sustainable Circular Business Model Innovation: business ecosystem level

Business Level				
Costs structure	Key partners	Key resources	Key activities	Value proposition
<p>Personnel Costs: SW developers, sustainability experts, sellers, maintainers/customer support, marketing managers, HR, social media manager, stager.</p> <p>Platform running costs: Server and ICT infrastructure, Licences, IoT, data security.</p> <p>Costs related to sub-revenue: resellers, partnerships' fee (i.e., SUPSI, CIRC-UIITS toolbox partners), external consultancy fees related to each new licence for GRETA they sell for the spinoff.</p> <p>Marketing and advertisement costs: conference participation and</p>	<p>Technology Partners: Collaborate with ERP, CAD, and PLM providers for integration capabilities; Server providers; CIRC-UIITS toolbox team.</p> <p>Consultancy firms & Third-party platform and ecosystem for a manufacturing company.</p> <p>SUPSI and other universities and research centres: SUPSI-ISTePS (source of know-how, scientific continuity, methodological updates), Other universities (LCA, AI, digital twin, circularity metrics)</p>	<p>Software applications: platform architecture, cloud infrastructure, AI-driven advisories.</p> <p>Human capital: ICT and software engineers, sustainability assessment & advisory/LCA experts, sales & marketing, customer support, Knowledge: Advanced expertise in the needs of several sectors, considered in the platform, including the automotive and mass electronics sectors, and academic partnerships.</p> <p>Data assets: product/process/recycle datasets, inventories, models, standards, and regulatory frameworks from different sectors, including the</p>	<p>R&D & AI-based development: continuous improvement of the platform, AI modules (advisory, model editor, chatbot), new functionalities.</p> <p>Data integration & valorisation: ERP/PLM/CAD interoperability, exploitation of customer data (sector, inventory, product).</p> <p>Customization & consultancy: tailored functionalities (including in the circular</p>	<p>Empowering organizations and service providers with intuitive, customizable, AI-driven advisory tools (e.g., chatbot) that embed sustainability & circularity assessment and advisory into strategy and operations – making it simple, actionable, and accessible to everyone, with scientific validation and certified with new regulations and standards (PEF, EPD, CSRD).</p> <p>In detail, users can:</p> <ul style="list-style-type: none"> • import processes modelled in OpenLCA • import BOM data from standard format files

<p>dissemination, website, and marketing campaigns. Facilities and related expenses: rent, insurance, IT equipment. Administrative and operational expenses: accounting company, travel.</p>	<p>Early adopters/validators co-creation (e.g. INTERROLL, BOSCH, AUMOVIO, TRACXON) → co-creation with a selected set of customers, which, in view of the release and development of new preview and customised features, support the validation phase Ecoinvent (the world's most recognized LCA database), we have defined a partnership relation Server and infrastructure providers.</p>	<p>automotive and mass electronics sectors ICT infrastructures</p>	<p>automotive context), adoption support, training, customer support & consulting (e.g., model creation). Case studies & validation & co-creation: industrial pilots with early adopters from CIRC-UIITS for adaptation and validation, feedback collection, proof of value. Participation in R&D projects. Marketing and sales.</p>	<ul style="list-style-type: none"> • Calculate LCS indicators (LCA, LCC, SLA, circular) • compare and improve scenarios via AI functionalities (hot spot identification, best customization) validated in CIRC-UIITS. • AI-agents and RAG-based chatbot for sustainability modelling • Circularity indicators engine (MCI) • Compare repair scenarios • Export reports (e.g., LCC and S-LCA results and reporting) • Data collection from production environment via IoT and middleware • Exploit a flexible integration mechanism enabling GRETA to be connected with external platforms (e.g., CIRC-UIITS toolbox, ERP ...) and allow third-party applications to exploit GRETA
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				<p>functionalities by means of a set of REST APIs.</p> <ul style="list-style-type: none"> • (To be developed) Purchase data to perform sustainability assessment activities.
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Table 36 - SUPSI Spin-off Sustainable Circular Business Model Innovation: business level part 1

Customer relationship & collaboration	Customer and stakeholder identification & understanding	Channels & logistics	Revenue streams
<p>Self-service & automation: FAQs, tutorials, webinars, an AI chatbot for basic support, demo version.</p> <p>Personalized support: tailored training, consulting, and continuous maintenance.</p> <p>Community & co-creation: user forums, feedback integration, co-development of new features, collaboration with professors and other academia/research staff</p> <p>Third-party ecosystem: relationships with software/app providers and integration partners for the company management ecosystem (e.g., CIRC-UIITS toolbox)</p>	<p>OEMs and supply chain leaders who need to aggregate sustainability data from suppliers and to perform sustainability assessments and advisories of their products.</p> <p>Components and materials (e.g., Alpha) suppliers to conduct sustainability analysis and showcase results to their customers or to improve their sustainability.</p> <p>Consultants and other sustainability experts who employ GRETA or provide it to their customers (“multipliers”).</p> <p>Recyclers.</p> <p>Academia: for projects, with SUPSI/SUPSI’s spin-off, or on their own.</p> <p>Third-party Application Providers: interested in integrating GRETA’s functionalities into their own applications.</p>	<p>Digital outreach: website, social media, newsletter, webinars, direct email, educational content.</p> <p>Direct sales: sales team, professional events, trade magazines.</p> <p>Industry networks: associations, collaboration with industry bodies.</p> <p>Partners & intermediaries: consultancy firms and third-party ecosystem</p> <p>Marketplace & pilots: GRETA marketplace, demonstration projects with early adopters.</p> <p>Dissemination, education on sustainability constraints and opportunities.</p> <p>Third-party platform: offers through a platform of which GRETA is a component (e.g., CIRC-UIITS Toolbox)</p>	<p>Subscription Fees: GRETA A² or GRETA Enterprise packages with upsell services (including those sold via CIRC-UIITS Toolbox)</p> <p>Pay per Use: single sustainability report, company report, environmental label, and declaration (including those sold via CIRC-UIITS Toolbox)</p> <p>Co-financed projects: EU, Innosuisse.</p> <p>Add-ons:</p> <ul style="list-style-type: none"> - Consultancy for model preparation; - Training, advisory, and consultancy services. - Integration of GRETA within existing software (e.g., ERP, CAD, PLM, etc.). - Sale of templates, plugins, databases, and data on the GRETA-related marketplace (in-house or third party). - Customized label and report; - EPD-ready label.

	<p>Industrial associations that may purchase GRETA to provide it to their associates (“multipliers”). CIRC-UIITS toolbox.</p>		
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Table 37 - SUPSI Spin-off Sustainable Circular Business Model Innovation: business level part 2

Sustainability impact	
Sustainability requirements	Sustainability benefits
<ul style="list-style-type: none"> - Minimization of the energy consumption for software running (e.g., modular functionality for the activation of individual sustainability services, such as DevOps, Lambda, etc.) - Optimization of the energy consumption related to AI-based functionalities (both hardware and software side). 	<p>Evaluation of environmental, economic, and social impacts (LCS&CA) of products in the manufacturing field (e.g., automotive and mass electronics industries).</p> <p>Support to designers and sustainability experts in creating alternative product designs with reduced impacts.</p> <p>Support benchmarking.</p>

Table 38 - SUPSI Spin-off Sustainable Circular Business Model Innovation: sustainability impact

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Quality of deliverable approval	
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