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THESEUS

Hub4Circularity

A First of a kind Hub for circularity demonstrator for Attica and peripheral regions

Grant Agreement No 101178059

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Exploitation Strategy v1

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Publishable summary

The **Theseus project**, funded under Horizon Europe, takes the lead in deploying a first-of-its-kind **Hub for Circularity *(H4C)*** in Greece's Attica region, with the aim of scaling up its impact at the national level. The project advocates **Industrial-Urban Symbiosis *(I-US)*** through the interlinking of digital, material, and governance innovations to enable the circular utilisation of resources along multiple streams of waste. These include textiles, packaging, construction and demolition waste, energy, and water.

The current deliverable with the title "***D11.7 Exploitation Strategy v.1***" lays out the **core elements** of Theseus exploitation strategy. The strategy covers the project's **key results** to exploit, the **target market** as the **customers** that the key results are addressed, the **exploitation objectives**, the **evaluation mechanisms** for risks and results, **business model developing** methods, ways to protect the project's results and a **roadmap** for future actions. These elements **cumulatively** will contribute in maximizing the understanding that consortium partners have on the related actions and explicate all the mechanisms to be established for achieving the ultimate goal of the project: the widest adaptation by the market and the generation of societal impact. Future versions of **Exploitation Strategy deliverable** will detail actions carried out within T11.3 Exploitation, Business models and IPR Management each reporting period and shall include any necessary additions / adjustments to the project's exploitation strategy.

D11.7 is part of WP11 assignments and is a **public deliverable** which also includes information about the project's scope and a short description of the work package in order to ensure that no prior knowledge related to the project, the Description of Action *(DoA)* and the other WP11 deliverables is requested from the reader.

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Abbreviations

Abbreviations	Full name
BMC	Business Model Canvas
CA	Consortium Agreement
DEC	Dissemination, Exploitation and Communication
D11.7	D11.7 Exploitation Strategy v1
DoA	Description of Action
GA	Grant Agreement
I-US	Industrial-Urban symbiosis
IP	Intellectual Property
IPR	Intellectual Property Rights
KERs	Key Exploitable Results
KPIs	Key Performance Indicators
Mx	Month x
WP	Work Package

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1 Introduction

1.1 The Project: Theseus

Industrial-Urban Symbiosis (I-US) is a sustainability approach in which cities and regions collaborate with industries to optimize resource use, waste management, energy efficiency, water conservation, infrastructure, and transport systems. The Horizon Europe project "Theseus" goes a step further by developing first-of-a-kind Hubs4Circularity (H4C) in Greece, starting with the capital region of Athens in the Attica region and replicating nationwide. The long-term goal is the realization of closed resource loops through I-US, energizing climate neutrality by 2050 in alignment with Processes4Planet (P4P) partnership targets. Theseus will develop novel solutions for water, energy, and material flows, founded on regional needs and breakthrough technologies. The project introduces novel governance and collaboration models, enabling pilot deployment, scaling up solutions, and ecosystem development.

1.2 WP11: Exploitation and Dissemination Activities of Theseus

WP11 is assigned to map the market landscape, identifying opportunities and obstacles for commercialization and upscaling; Develop an efficient exploitation and IPR management plan towards sustainability; Shape a tailored dissemination and communication plan and activities. It is consisted of 6 tasks which namely are:

- Task 11.1 Dissemination and communication activities M1-M60 *(HSRT, CERTH, All WP partners)*
- Task 11.2 Policy recommendations and barriers M1-M60 *(LiU, Imperial, All WP partners)*
- Task 11.3 Exploitation, Business models and IPR Management M6-M60 *(HSRT, All WP partners)*
- Task 11.4 Commercialization of solutions and trading opportunities M21-M60 *(EMVIS, HSRT, All WP partners)*
- Task 11.5 Standardization of novel technologies and activities M6-M60 *(DS, SN, All WP partners)*
- Task 11.6 Stakeholder engagement and Theseus bubbles M6-M60 *(Imperial, LiU, RISE)*

1.3 The Deliverable: D11.7 Exploitation Strategy v1

This deliverable consists of the first version of the Theseus deliverables that report the activities implemented in T11.3 Exploitation, Business models and IPR Management. D11.7, submitted in M6 (May 2025) at the launch of T11.3 activities, sets the basis for the exploitation strategy to be followed by the Theseus consortium.

Particularly, it outlines the core elements of the exploitation strategy i.e. results to exploit, target market and customers, exploitation objectives, evaluation of risks and results, business model developing methods, ways to protect the project's results and a roadmap for future actions. These elements cumulative will contribute in maximizing the understanding that consortium partners have on the related actions. Moreover, D11.7 explicates all the mechanisms to be established for achieving the ultimate goal of the project: the widest adaptation by the market and the generation of societal positive impact.

The upcoming versions of Exploitation Strategy deliverable will detail actions carried out within each reporting period and include any necessary additions / adjustments to the project's exploitation strategy.

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1.4 Structure of D11.7

D11.7 consists of **nine chapters** and **two appendices.** The **first chapter** briefly explains the project, the tasks included in WP11, the specific scope of this deliverable, its intended readership, and its relationship with other WP11 deliverables. The **second** chapter describes the Theseus results considered as the key exploitable ones *(KERs)* and the **third** analyses the market and the potential users of Theseus solution. The **fourth** chapter details the exploitation objectives that the project has and the **fifth** the mechanisms for evaluation of risks and results. The **sixth** chapter describes the methods and approaches to be employed for business model development while the **seventh** explains the strategies for IPR management, focusing on how the project's results will be protected. Lastly the eight chapter provides a roadmap for the future exploitation activities and **ninth** concludes this deliverable by summarizing its key aspects.

Regarding annexes, **Annex I** provides practical guidance on how to register a patent, and **Annex II** includes the templates *(screenshot)* for risk assessment and priority map.

1.5 Intended Readership of D11.7

Table 1 Intended readership

Target	Description
Theseus Partners	To create a common understanding amongst the Theseus consortium about the project's exploitation strategy and particularly its elements i.e. KERs, market, objectives, Evaluation, methods, protection of results and timeline of planned actions. This document serves as a guide to all partners for ensuring alignment of actions.
HADEA / European Commission	As the funding authority to assess the Theseus approach on exploitation actions, their feasibility and the timeline to be implemented. The deliverable describes how the project's results will be driven to the market.
Target Groups and Stakeholders	To acquire a clear understanding around the Theseus exploitation potential, its exploitable results and the potential benefits of specific sectors.
Other EU funded projects under similar thematic	To comprehend the Theseus expected results for exploitation, identify common ground for potential collaboration, and overall expand their innovation network. The deliverable can also serve as a best practice on exploitation methodology for EU funded projects, particularly the Theseus approach on business modelling development.
General Public	To comprehend the Theseus approach for bringing its results to the real-world applications in society, market and science.

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1.6 Relation of D11.7 with other WP11 deliverables

Given the interlinked nature of WP11 actions and particularly the exploitation ones, the deliverable D11.7 is related to other WP11 deliverables, with the dependencies described in the table below.

Table 2 Dependencies with other WP11 deliverables

WP11 Deliverable	Relation to D11.7
D11.8 Exploitation Strategy v2 *(M24)*	The deliverable D11.8 forms a report of the actions held within T11.3 during the period M7 - M24 of the project's lifecycle and it is based upon the exploitation strategy explicated in the D11.7.
D11.9 Exploitation Strategy v3 *(M36)*	D11.9 is a report of T11.3 actions implemented from M25 until M36. The strategy of the activities stem from deliverable D11.7 and consists of an update of D11.8.
D11.10 Exploitation Strategy final *(M60)*	D11.10 consists of a report of T11.3 activities carried out during the period M37 - M60 and forms an update to the deliverable D11.9. The strategy to be followed for the activities made during the aforementioned period stem from deliverable D11.7.

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2 Theseus KERs: Which Results to Exploit?

The **Theseus consortium** has adopted a multi-level strategy for managing the knowledge generated throughout the project lifecycle. This approach ensures that the respective knowledge producer **retains** the **rights to the knowledge** they produce and provides the software and material implementation to the rest of the consortium members.

Building upon the project's exploitable results that Theseus consortium aspires to deliver by the end of its lifecycle, a total of **twenty-four Key Exploitable Results** *(KERs)* are described in the Grant Agreement *(GA).* These KERs are strategically clustered into **five distinct pillars**, aligning the specific research outputs along with the responsible Theseus partners who will drive their delivery. The following sections of this chapter give an overview of **each KER** without disclosing any confidential information of the project.

2.1 Innovation Pillar 1: *Collaboration*

Table 3 KERs | Pillar 1 *[KER 1- KER3]*

KER	Focus	KER name	Value Chain	Partner	Research output
KER 1	Projects & sites	Roadmap for collaboration i) between sites (GR, SWE, No) and ii) between Hub & CCRI & Replication Roadmap Tool	All	CIRCE, TUC	Report, software
KER 2	Projects & sites	Common hub circularity guidelines	All	A.SPIRE	Guidelines
KER 3	Citizens	AR for social awareness and acceptance	All	ICCS	Report / Framework

2.2 Innovation Pillar 2: Symbiotic Flows (Material)

Table 4 KERs | Pillar 2 *[KER4 – KER9]*

KER	Focus	KER name	Value Chain	Partner	Research output
KER4	Materials Circular	Circular construction material CDW	Textiles	SINTEF/TUD	Circular product prototype

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KER5	products / technologies	Biobased thin films for packaging	MSW	NCSR	Prototype
KER6		Electrospinning for thin films	MSW	NTUA	Technology
KER7		Biological recycling & spinning for upcycling	Textiles	CIRCE, HUD	Technology
KER8		Upcycled packaging, masterbatches	MSW	HMU	Prototype
KER9		Strategic Master Plan on Circularity	All	NTUA, EYDAP	Framework

2.3 Innovation Pillar 3: Symbiotic Flows (Water)

Table 5 KERs | Pillar 3 *[KER10 – KER14]*

KER	Focus	KER name	Value Chain	Partner	Research output
KER10	Water	Decentralized sewage mining and NBS for water reuse	Water	EYDAP	Technology / Report
KER11		Sewage sludge valorisation	Water	NTUA	Technological scheme
KER12		Centralized reclaimed water fertigation	Water	NTUA	Technological scheme
KER13	Energy	H2 for production of heat and electricity through a CHP	Energy/Water	CERTH	Technological scheme
KER14		New generation of HVFP solar thermal technology for greening District heating and covering cooling loads of buildings	Energy	CERTH, TVP, CLEAN	Technological scheme

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2.4 Innovation Pillar 4: Digitalization and Robotics

Table 6 KERs | Pillar 4 *[KER15 - KER21]*

KER	Focus	KER name	Value Chain	Partner	Research output
KER 15	Sorting	Automated textiles separation system	TEXTILE	ICCS	Prototype, algorithms
KER 16		Automated sorting for mixed waste and plastics	MSW	ICCS	Prototype, algorithms
KER 17		Industrial sorting systems: Glass/copper & metals sorting system	CDW & Industrial	ICCS	Prototype, algorithms
KER 18	Digital	XR for human-robot interactions/collaboration	MSW textiles	ICCS	Prototype, software
KER 19		Dynamic symbiotic maps, prediction models, DPPs and optimization for smart bins	MSW	ICCS	Framework, prototype, algorithms, aggreg. data
KER 20		H4C Marketplace with advanced matchmaking features & secure data exchange	All	IRIS/ICCS	Prototype
KER 21		Models: i) WEF nexus, ii) Cities climate & impacts	All	Imperial, NTUA	Algorithms, aggreg. data

2.5 Innovation Pillar 5: *Governance*

Table 7 KERs | Pillar 4 *[KER22 - KER24]*

KER	Focus	KER name	Value Chain	Partner	Research output
KER 22	Recommendation	Analysis of symbiotic flows in the context of EU and local regional plans. Regional and Intraregional development guidelines	All	ICCS, UAGENA, LiU	Report

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KER 23		Policy guidelines based on Material Flow Analysis, impact on the health and de-risking assessment	All	LiU	Report
KER 24	Standards	Contributions to CEN and/or ISO standards	All	DS	Standards

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3 Market: Who is about to use Theseus?

3.1 Preliminary Market Analysis

As already **identified in the GA**[1], EU generates over **2 billion tonnes** of waste annually, or approximately 4.8 tonnes per capita. Construction, mining, and industrial activities generate most of the waste. Yet despite that, half of the generated waste is not recycled and out of the half that is recycled only 10% of materials get back into the economy. In other countries like Greece, recycling is even lower at around 30%, as outlined in the **National Waste Management Plan** *(NWMP).* With global demand for raw materials projected to almost double by 2060, the environmental footprint from extraction, processing, and mismanaged waste will probably rise. This trend is largely responsible for 70% of global greenhouse gas *(GHG)* emissions and for more than 90% of biodiversity loss and water scarcity. Between **2015-2021**, EU circularity grew marginally by only 0.4% to reach **11.7% in 2021**. While more than the world average of 7.6%, it still shows improvement towards material loop closure. Against this backdrop, the **THESEUS project** analyses market drivers of special waste streams and symbiotic recycling potential.

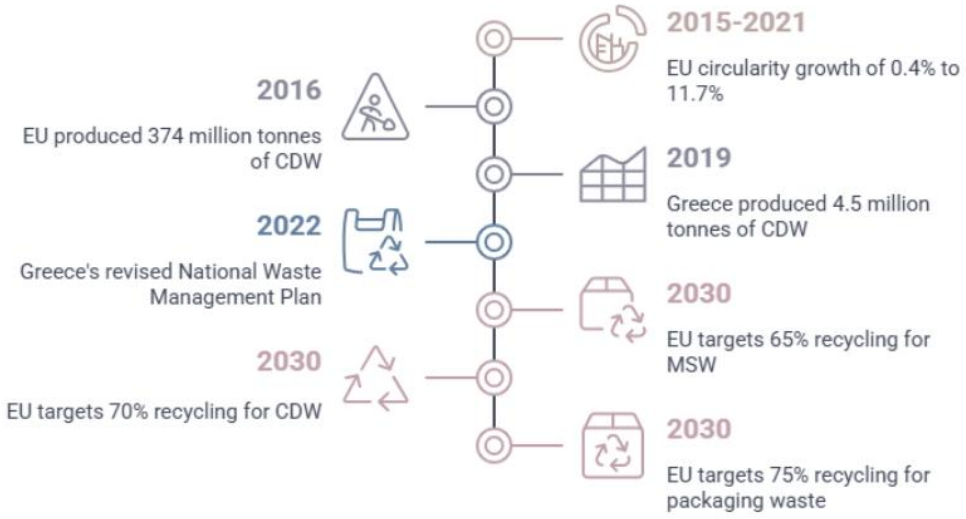


Figure 1 Key Milestones in EU waste management and circularity

Regarding the **textile sector**, waste generation across the EU-27 and Switzerland ranges between **5.8 and 7.5 million** tonnes **per year,** translating to **11.3–15 kg per person annually**. Separate collection rates remain low, ranging from 11% in Italy to over 70% in Germany. For the Theseus project, textile waste will be sourced from approximately 2500 purple collection bins in Greece, operated in collaboration with municipalities, along with residual mixed waste from blue recycling bins. Textiles currently constitute 11.8% of municipal solid waste, with recovery goals set at **27,778 tonne**s from **purple bins** and an additional **14,958 tonnes** from general recycling streams by 2030. Economically, textile reuse can significantly boost employment, creating **20 to 35 jobs** per **1,000 tonnes collected**, particularly when materials are resold or repurposed.

[1] GA, Annex I, part A, p.31

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Environmentally, extending the lifespan of garments—*e.g., doubling the number of times they are worn*—could reduce their GHG footprint by up to 44% compared to producing new garments.

Municipal solid waste *(MSW)* is **3.2 billion tonnes**, 47% of which is landfilled, 31% recycled, and 22% incinerated. Thus, about 70% of waste has not yet been recovered or reused. **EU 2030 targets** aim to raise **recycling to 65%** for **MSW**, **70% for construction** and **demolition waste** *(CDW)*, and **75% for packaging waste**, mainly based on industrial symbiosis and eco-design principles. **Theseus project** will enable more circular urban waste flows through material flow analysis and new reuse channels for packaging, organic waste, plastics, and industrial by-products. Collection will encompass municipal infrastructure and waste streams supplied by project partners, in line with **Greece's revised 2022 NWMP targets**. CDW is the single largest waste stream in the EU and makes up 30% of the total waste. The EU produced approximately **374 million tonnes of CDW** in 2016, while Greece produced approximately **4.5 million tonnes** in 2019 alone. However, Greece's rate of recovery is low at **12–15%**, and only the mineral fraction is typically treated. The remaining materials -*metals, plastics, and glass*— are typically diverted to specialized facilities.

By leveraging this **initial market analysis**, Theseus will actively capture these opportunities through the creation of vital cross-sectoral synergies, enabling sustainable value creation from currently under-utilised waste streams, and ultimately fostering systemic change towards a more circular economy. The **Hubs4Circularity *(H4C)* model** will be instrumental in facilitating this transformation by actively promoting stakeholder collaboration, ensuring policy coordination, and co-creating robust circular value chains that can effectively address the identified market challenges and contribute to a more sustainable future.

It should be noted that **further investigation** of the current market landscape, emerging trends, competitive forces and barriers to entry, the analysis will provide the strategic intelligence required to inform go-to-market decisions. Insights jointly taken from **T11.3** and **T11.4** will refine business models, as they move from conceptual frameworks *(initially developed under T11.3)* to practical, market-aligned commercialization strategies.

3.2 Target Groups & Potential Customers

Following the preliminary market analysis presented in section 3.1, the exploitation actions of Theseus shall be directed to particular target groups and potential customers to ensure their success and optimal use of project's resources. The spectrum of identified target groups and stakeholders for THESEUS is diverse, encompassing actors across the entire circular economy value chain.

This includes, but is not limited to, **municipalities and regional authorities**, **industrial partners** (*from SMEs to large enterprises in sectors like textiles, construction, and packaging)*, **waste management companies**, **technology providers**, **research and academic institutions**, c**ivil society organizations**, and **policymakers**.

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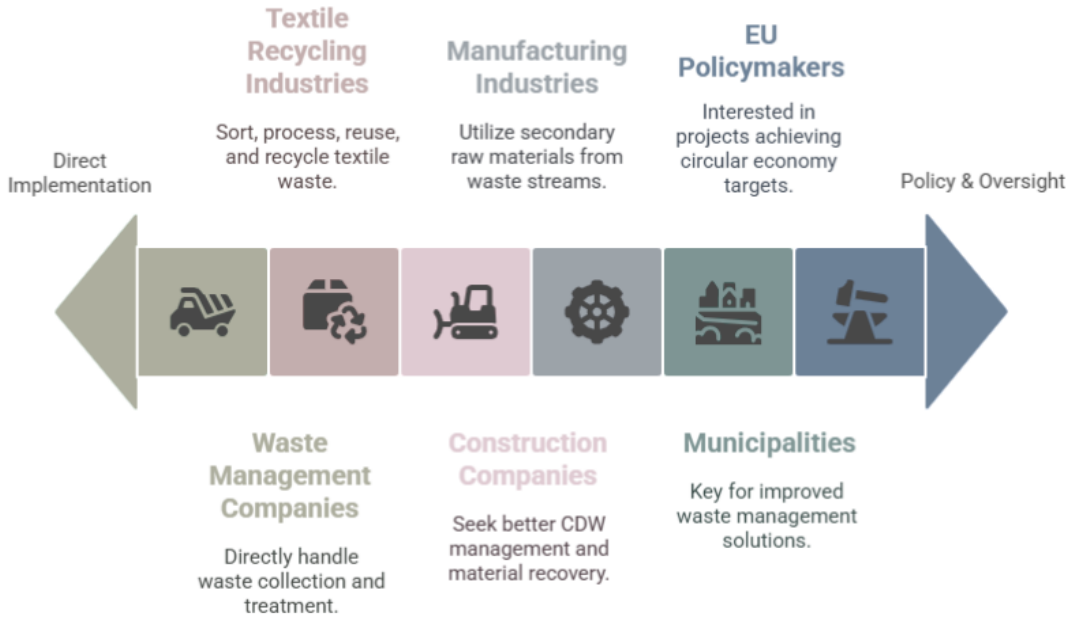


Figure 2 Targeted groups for Theseus Exploitation activities

Engaging the diverse mixture of groups is anticipated to contribute to the quicker adoption of the Theseus solution, leading to successful market uptake and broader replication. Consequently, this initial mapping of specific target groups and potential customers directly relevant to THESEUS's exploitation actions is presented below. It should be stressed that collaborative efforts for thorough mapping of stakeholders will be made together with T2.2 and T1.6 for enriching, refining and detailing those groups.

Table 8 Theseus Exploitation Activities Target Groups

Targeted Groups	Reasons for inclusion in Theseus Exploitation actions
Municipalities and Local Authorities in Greece	Facing low recycling rates (around 30%) and the need to meet the revised 2022 NWMP targets, they are key stakeholders for improved waste management solutions, particularly for textile waste collection and potentially for more circular MSW flows.
Waste Management Companies (Public and Private) in Greece and potentially the EU	These companies are directly involved in the collection, sorting, treatment, and disposal of various waste streams (MSW, textiles, CDW). They could be interested in innovative technologies and approaches for increasing recycling rates and material recovery.
Textile Recycling and Repurposing Industries	Businesses involved in sorting, processing, reusing, and recycling textile waste generated from municipal collections

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	(purple bins and general recycling). They could be customers for improved sorting technologies or sources of feedstock.
Construction and Demolition Companies in Greece	Facing low recovery rates for CDW (12-15%) and seeking solutions for better management and recovery of non-mineral fractions (metals, plastics, glass).
Manufacturing Industries in Greece and the EU	Particularly those that could utilize secondary raw materials derived from the targeted waste streams (textiles, plastics, metals, glass from CDW, organic waste for potential bio-based products). This aligns with the broader goal of increasing material loop closure.
EU Policymakers and Environmental Agencies	While not direct customers in a transactional sense, they are key stakeholders interested in projects that contribute to achieving circular economy targets, reducing landfilling, and lowering GHG emissions. The data and methodologies developed by THESEUS could be valuable for informing policy and best practices.

The initial market analysis, available from the Grant Agreement (GA), has enabled the identification of specific examples of potential customers for THESEUS. These examples, presented below, serve as a foundation for the ongoing mapping process, which is essential for driving the exploitation activities



Figure 3 Customers Mapping of Theseus solution (Initial version)

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Table 9 Mapping of potential customers for the Theseus solution

Customer segment	Mapping of Customers
For Textile Waste	• Municipal waste management departments in Greek cities collaborating on the purple bin collection. • Private textile sorting and recycling facilities operating in or interested in expanding to Greece. • Companies that manufacture recycled textile products *(e.g., insulation, new fabrics, cleaning cloths).* • Second-hand clothing retailers and repurposing businesses.
For Municipal Solid Waste (MSW)	• Municipalities seeking to improve their recycling rates for packaging, organic waste, and plastics. • Waste-to-energy plants *(though THESEUS focuses on reuse and recycling).* • Composting facilities for organic waste. • Plastic recyclers and manufacturers using recycled plastics
For Construction and Demolition Waste (CDW)	• Construction companies looking for cost-effective and environmentally sound ways to manage and recover value from CDW. • Specialized facilities that process metals, plastics, and glass from CDW. • Manufacturers that can utilize recycled metals, plastics, and glass in their products.
Cross sectoral	Companies in different sectors located in proximity that could utilize each other's waste streams as resources *(e.g., a food processing plant providing organic waste to a composting facility, or CDW metals being used by a metal fabricator).*

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4 Exploitation Objectives: *What to achieve?*

The overarching aim of the exploitation actions of THESEUS is to translate the project's research findings and **Key Exploitable Results** *(KERs)* into tangible impacts across **societal**, **commercial,** and **scientific domains**. "Exploitation" in this context encompasses the diverse ways in which the project's outputs will be applied, developed, marketed, or enhanced, ultimately contributing to a more circular economy and fostering sustainable practices. This includes not only the **direct commercialization** of innovative products or processes but also broader **societal benefits** through policy influence, increased public awareness, and advancements in **scientific knowledge**.

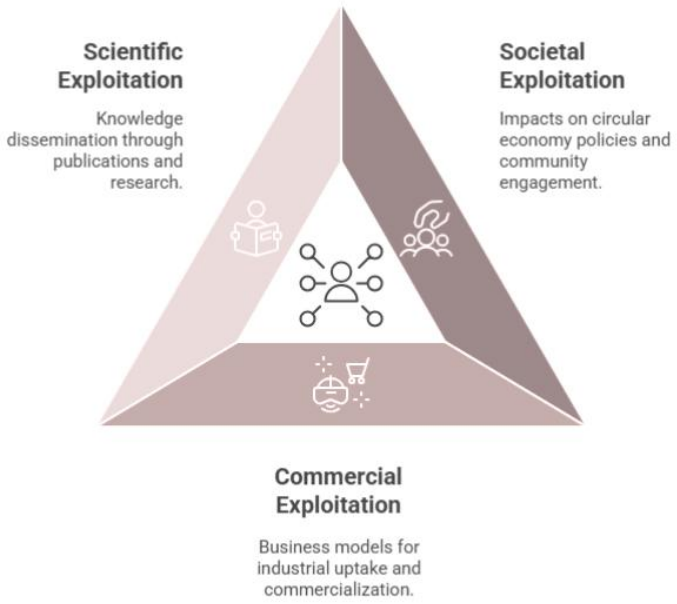


Figure 4 Pillars of Theseus Exploitation Objectives

Building upon this understanding of exploitation, the specific objectives for THESEUS's exploitation activities are multifaceted and interconnected:

- To drive **societal impact**: THESEUS aims to significantly contribute to adaptation and advancement of the principles of circular economy. This involves informing and influencing **circular economy policies** at local, national, and European levels by providing evidence-based findings and best practices derived from the project's analysis of special waste streams and symbiotic recycling potential. Furthermore, the project seeks to foster greater **community engagement** in sustainable waste management practices and increase public awareness regarding the environmental and economic benefits of a circular economy through targeted dissemination and outreach activities.
- To facilitate the **potential commercialization** and **market uptake**: A key objective of project's exploitation actions is to identify and develop viable business models that will enable the industrial uptake of Theseus' innovative solutions and technologies. It includes opportunities for exploration for commercializing new recycling processes, material recovery techniques, or software tools developed within the project. The exploitation activities will focus on **examining pathways** *(incl. spin*

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offs) for project partners to bring **market-ready** products and services to fruition, contributing to economic growth and job creation within the circular economy sector.

- To advance **scientific knowledge** and foster **collaboration**: THESEUS will disseminate its scientific findings through high-quality **publications** in peer-reviewed journals, submit **patents** *(if available)* to protect novel innovations, contribute to **standardization** landscape through technical proposals and *(if possible)* to elaborate documents of proposing new standards, actively participate in **scientific conferences** and workshops. Furthermore, the project aims to establish new **research collaborations** with academic institutions, industry partners, and other relevant stakeholders to build upon the project's outcomes and further advance the knowledge base in circular economy and sustainable waste management.

With the pursue of these interconnected objectives, Theseus aims to ensure its findings will be converted into real world applications that will bring value to **society,** science and the **European market** and **economy** towards a more sustainable and resource efficient future.

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5 Evaluation: *How to measure risks and results?*

The pathway from the production of KERs to the actual economic and societal exploitation is often multifaceted with considerable hurdles. Critical mechanisms for identifying and mitigating potential risks should be placed as a best practice for ensuring that any miscalculations, barriers, risks and so on are traced. Towards this goal, a framework to monitor the progress, proactively identify risk and collect mitigation actions will be introduced to the Theseus consortium with the launch of T11.3 in M6 and beyond. By systematically addressing potential barriers and tracking key indicators, the consortium will handle complexities of bringing the Theseus results to market.

This chapter is divided into **two parts,** where in **5.1** the reader is introduced to the identification and management of risks associated with each KER and in **5.2** the metrics to be included in the monitoring system of Theseus are listed.

The **described framework** within chapter 5 shall employ a combination of quantitative and qualitative metrics to assess progress against defined milestones, measure the impact of exploitation activities, and gather valuable feedback for continuous improvement. The ultimate goal is to ensure that each KER is effectively guided towards market readiness and contributes to the overarching objectives of a more circular economy and sustainable waste management practices.

5.1 Risk Assessment and Prioritization

A significant procedure for the exploitation actions to be held is the proactive identification of risks related to each KER. Recognizing the innovative results that Theseus aspires to deliver and the scientific research which precedes, potential obstacles are anticipated as normally in every endeavour. For this reason, after the identification of risks, mitigation strategies will be developed in a timely manner. This approach ensures that potential challenges are not only defined but also tackled on time when arisen throughout the project's lifecycle.

The **risk management process** is a structured approach designed to proactively address uncertainties. It starts with the "**Risk Identification" phase,** a crucial one focused on systematically pinpointing potential sources of risk and identifying specific risk events that could impact the project's objectives and the Theseus KERs per se. The "**Risk Analysis" phase** follows for evaluating the risks described by assessing the likelihood of each foreseen risk occurring and the potential severity of its impact. Based on this analysis, the "**Response Plan**" phase takes place where in this stage the specific measures to address them are developed and the responsibilities for these actions *(who?)* and the frequency of monitoring *(when?)* is defined.

Finally, the "**Risk Monitoring**" phase puts the plan into action by implementing the defined monitoring activities and response measures, ensuring ongoing oversight and adaptation as needed throughout the project or activity lifecycle.

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Figure 5 Risk Management process

Considering the significance in what Theseus is trying to attempt, it is important to enumerate concerns about barriers, risks, and corresponding solutions to prevent unwanted outcomes within the project and bring its results to life. For **each identified KER** a relevant risk management plan will be provided, offering a detailed **description of the risk,** its assessed **probability** and **impact** and the resulting overall risk level. Based on the risk level **adequate intervention** in terms of potential actions to manage a risk factor will be described.

The risk levels derived from these KER-specific assessments based on both probability and impact will contribute to formulating an overall risk priority map for the project's exploitation activities. The templates to be used in their full version are provided by **Horizon Results Booster** to EU funded projects as a best practice for knowledge transfer and support. These templates, acquired through the consortium's extensive prior involvement and experience in projects, are available in **Annex II** as screenshot. The related actions to be implemented in the next period *(M7-M24)* will be described in D11.8.

5.2 Monitoring and Evaluation

Effectively guiding the THESEUS Key Exploitable Results *(KERs)* towards market uptake and achieving their intended societal impact relies on a structured and continuous approach to monitoring and evaluation. The mechanisms and indicators to track and evaluate the implementation of the Theseus exploitation strategy are delineated in this section. The goal is to ensure that the KERs will be effectively guided to market readiness, with progress tracked against clearly defined milestones, impact indicators, and feedback mechanisms. The **monitoring system** of Theseus will include **quantitative** and **qualitative** metrics *(KPIs)* to assess progress of exploitation *(e.g., industrial collaboration arrangements established, readiness level enhancements, IP registrations, stakeholder engagement)*, monitoring of the TRL of each KER in order to track any technological maturity and market readiness gaps, and market uptake indicators. The following can be monitored:

- **TRLs of KERs** from current state to expected maturity.
- Number of **stakeholder engagements.**

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- Number of **licensing** or **partnership** discussions initiated.
- Number of **IP registrations** *(patents filled, copyrights etc.)*
- Number of **market studies** completed.
- **Business model developmen**t progress per KER.
- **Go-to-market strategy** development, including feedback from end-users or investors.
- Progress of **standardization actions** *(e.g., contributions to standards bodies, development or proposals for new standards, participation in relevant technical committees).*
- Alignment with **policy** and **regulatory framework**s relevant to circular economy and waste management.
- Effectiveness and implementation status of **risk mitigation actions.**

For iterative and continuous monitoring and evaluation of the applied strategy and its activities, specific tools and methods will be employed. These include

- **KERs progress** traction such as TRL progress per KER, ownership status,
- Examination of potential **exploitation routes** periodically
- Recount of **standardization action**s linked per KER
- **Completion of Exploitation Risk Log** periodically,
- **Feedback loops** *(e.g. interviews with potential customers, co-creation sessions with end users etc.)*

Theseus partners will be requested to provide such information to the **T11.3 leader** via related templates circulated a priori. The findings from these monitoring and evaluation activities will be collected, assessed, consolidated and put in use throughout the exploitation actions aiming to have a strategic alignment of consortium's collaborative actions.

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6 Business Model Development: *Which Methods?*

The current chapter explicates the methodologies that the Theseus consortium will employ to reflect, study and develop effective business models for the project's KERs. Recognizing that successful market entry and long-term sustainability depend on a careful study of the external and internal environment, the customers' needs and how they are satisfied along with the ability to generate revenues, the methodologies outlined in this chapter will guide Theseus's analysis in these critical areas. Given that each method studies different aspects the combination of the exercises to be made will navigate the consortium to market-oriented actions.

6.1 SWOT Analysis

SWOT analysis is a strategic method widely used for identifying an organization's key internal and external factors that influence its potential for success. It involves assessing **four core element**s:

- **Strengths and Weaknesses**: They refer to an organization's **internal environment** where strengths are positive attributes and capabilities, while weaknesses are areas lacking or requiring improvement.
- **Opportunities and Threats:** Related to the **external environment,** opportunities are favourable external conditions or trends that can be exploited, while threats are external challenges or risks that could negatively impact the organization.

In this framework, **strengths and opportunities** are viewed as **favourable aspects** that can be leveraged, while **weaknesses and threats** are considered unfavourable aspects that might require mitigation actions or careful management. The SWOT analysis will provide a strategic overview of the internal and external factors that could influence the successful exploitation of the Theseus outcomes.

6.2 Porter's Five Forces

The term **Porter's Five Forces** refers to a tool used to analyse a market or industry and determine its **competitiveness**[2]. These five forces were developed by Harvard business professor Michael Porter who wrote about the strategic analysis model in the Harvard Business Review in 1979[3]. According to Porter's model, the **competitive landscape** of an industry is **not solely** determined by the direct rivalry among existing players. Instead, it is shaped by the interplay of **five fundamental competitive** forces:

- Competitive Rivalry
- Bargaining Power of Suppliers
- Bargaining Power of Buyers
- Threat of Substitution
- Threat of New Entrants

[2] https://www.investopedia.com/terms/p/porter.asp
[3] https://hbr.org/1979/03/how-competitive-forces-shape-strategy

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In our project's case, the **Porter's Five Forces** will help the consortium to assess the competitive dynamics in which Theseus KERs will be deployed. An **initial sketch** of those forces has been performed for Theseus and will be enriched in regular intervals according to the consortium's collaborative reflection.

Table 10 Analysis of Porter's 5 Forces for Theseus solution

Porter's Forces	Probability	Analysis
Competitive Rivalry	High	The industry rivalry might be high. The waste management sector is seeing rapid innovation, especially with AI-driven solutions and smart logistics. However, few integrate industrial-urban symbiosis, giving THESEUS a potential niche advantage.
Threat of New Entrants	Moderate	The threat of new entrants might be moderate. While the circular economy is gaining attention, the technical and infrastructural complexity of Theseus solutions act as a barrier, requiring strong partnerships and policy alignment.
Bargaining power of suppliers	Low	The bargaining power of suppliers might be low. Theseus relies largely on public waste streams and digital infrastructure developed in-house or within the consortium, reducing dependence on external suppliers.
Bargaining power of buyers	High	The bargaining power of buyers might be high. Municipalities, industrial users, and service providers have a wide array of waste management solutions to choose from, so Theseus must clearly demonstrate superior cost-benefit and policy alignment.
Threat of Substitution	High	The threat of substitutes might also be high. Incumbent technologies like incineration or low-cost landfill disposal- although unsustainable- still dominate the market due to entrenched habits and low upfront costs.

Conducting this analysis, Theseus can identify the most viable commercialization strategies for each KER based on market dynamics, develop competitive positioning strategies to highlight the unique benefits of Theseus solutions, anticipate industry challenges and market barriers, allowing for proactive mitigation, and align business models with market realities, ensuring financial sustainability post-project.

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6.3 Business Model Canvas *(BMC)*

The exploitation actions of Theseus shall include the preparation of initial business models to support the consortium's entry to market. Thus, a core **framework** for those activities will involve leveraging the Business Model Canvas (BMC) methodology as developed by **Osterwalder** and **Pigneur**[4] for project's **Key Exploitable Results** *(KERs).* The BMC provides a structured, visual framework that helps describe, design, assess, and pivot business models in a clear and collaborative way.

The methodology is built around the following nine segments:

1. **Customer Segments** – *Who are the target users and stakeholders?*
2. **Value Propositions** – *What value is delivered, which problems are solved?*
3. **Channels** – *Through which means are customers reached and served?*
4. **Customer Relationships** – *How is each segment engaged?*
5. **Revenue Streams** – *What are the expected income sources?*
6. **Key Resources** – *What assets are essential to deliver value?*
7. **Key Activities** – *What core actions must be performed?*
8. **Key Partnerships** – *Who are the strategic collaborators?*
9. **Cost Structure** – *What are the major costs in the business model?*

A **visual representation** *(template)* of the mentioned above **BMC method** is provided below.

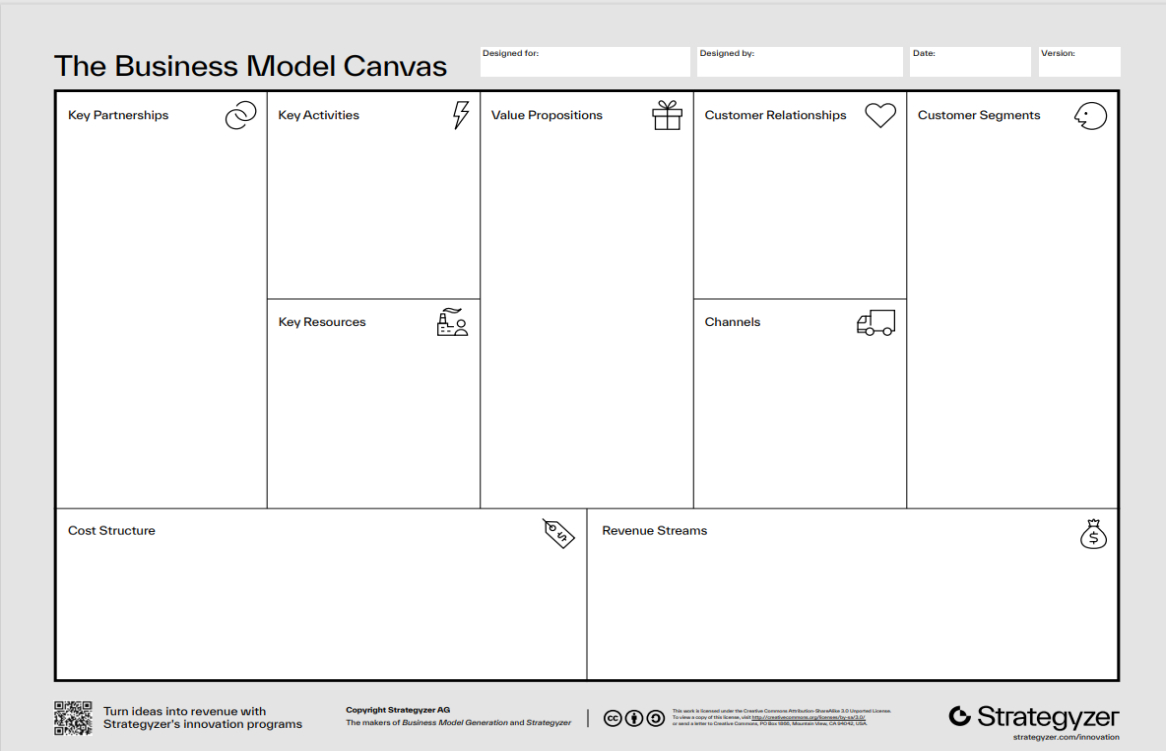


Figure 6 Business Model Canvas (official template)

[4] https://vace.uky.edu/sites/vace/files/downloads/9_business_model_generation.pdf

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Complementary to the business modelling activities, **theoretical exercises** amongst the consortium shall be included in scheduled meetings either online or physical ones that will consider aspects of ownership, Technology Readiness Level *(TRL)* of KERs, potential upgrading costs, expected return of potential investment, and user readiness.

6.4 Value Proposition Canvas

The Value Proposition Canvas, derived from **BMC methodology** *(see 6.3),* is a framework which can help ensure that a product or service is positioned around what the customer values and needs[5]. This framework will assist the Theseus consortium in the initial stages of business modelling development per KER.

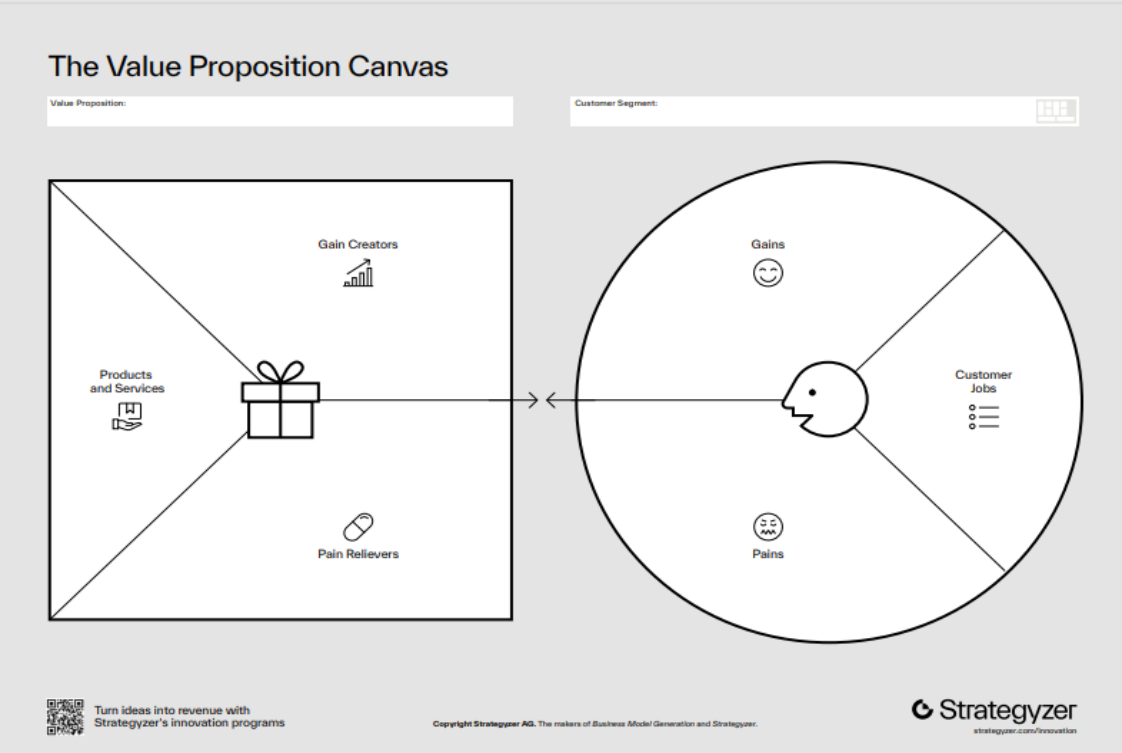


Figure 7 Value Proposition Canvas (official template)

This approach will provide a structured and iterative process to align the promising innovations emerging from Theseus with the specific needs and values of potential customers. By first focusing on the **Customer Profile** of the canvas, there will be a thorough understanding of the jobs that particular KER stakeholders have to **perform day-to-day**, the **challenges** *(pains),* and the **expected benefits** *(gains).*

On the other side of the template, the **Value Map** details the specific *"Pain Relievers"* offered by the Theseus KER to alleviate those stakeholder pains and the *"Gain Creators"* that will enable them to complete their jobs more efficiently and achieve their expected benefits.

[5] https://www.b2binternational.com/research/methods/faq/what-is-the-value-proposition-canvas/

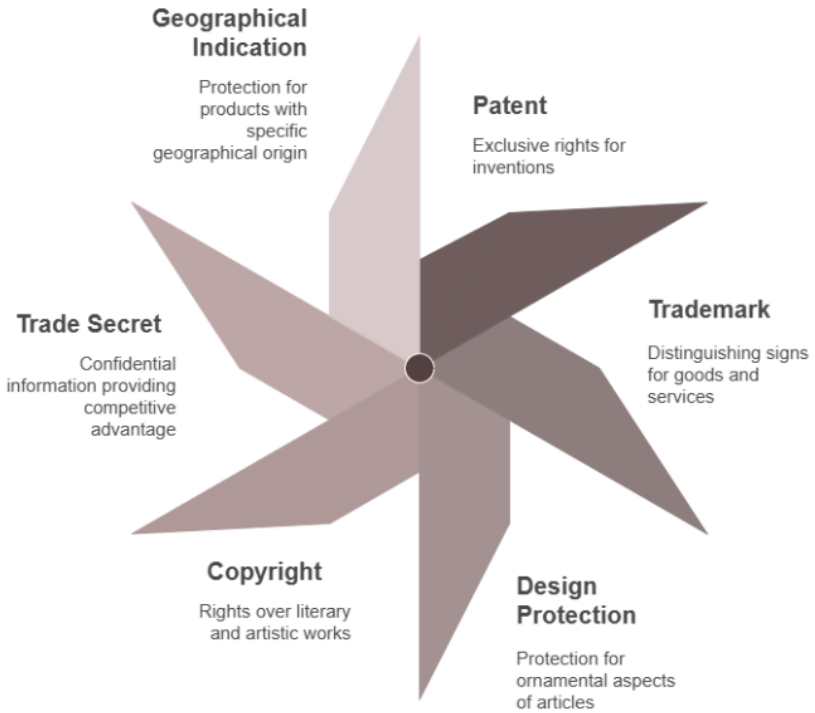
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7 IPR Management: *How to Protect the Results?*

Intellectual Property Rights *(IPR)* management in EU-funded projects refers to the systematic processes and strategies put in place to identify, protect, manage, and potentially exploit the intellectual assets generated during the project lifecycle. These assets, often referred to as "*Foreground Knowledge*," can include inventions, software, data, designs, know-how, and other creative outputs. According to the handbook entitled "*Intellectual Property Handbook: Providing IP Guidance Through the EEN Client Journey*" published by **European IP Helpdesk**[6] [2024], *"**Intellectual property** (IP) refers to intangible creations of the human intellect (inventions, literary and artistic works, designs, symbols, names, and images used in commerce, etc.) and may be protected by law. **IP rights** (IPRs) provide the legal framework by granting exclusive rights for a specified period, allowing creators to safeguard their ideas and creations from unauthorized use or reproduction. Another important feature of the IPRs is that they are territorial rights, meaning that they are valid only in the jurisdiction/s where they have been registered (or otherwise acquired). "*

The table below includes all the necessary information by the reader to acquire knowledge regarding the IPR categories of **copyright, trademarks, geographical indications (GI), industrial designs, patents, and trade secrets** as extracted from the aforementioned handbook. It should be noted that IPRs are part of the non-physical property of a business.



[6] DOI 10.2826/114860

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Figure 8 IPR Categories

IPR categories	Description
Patent / Utility model	Patent is an exclusive right granted for an invention - which is a product or a process - that either provides a new way of doing something or offers a new technical solution to a problem. The patent owner has the exclusive right to prevent or stop others from commercially exploiting the patented invention (generally for 20/10 years).
Trademark	Trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises - and whether registered - it confers an exclusive right to the use of the registered trademark (for 10 years, renewable indefinitely). The sign could be a word or a combination of words, letters, numerals or drawings, symbols, and non-visible signs (i.e., sounds or fragrances) among others.
Design Protection	Design protection refers to the ornamental aspect of an article: it may consist of three-dimensional features, such as the shape of an article, or two-dimensional features, such as patterns, lines or colours.
Copyright	A copyright (or author's right) represents instead the rights that creators have over their literary and artistic works such as books, music, paintings, sculpture, movies, computer programs, databases, advertisements, maps, and technical drawings. In the end, a rising topic is the protection of software: it refers to the protection of information stored on hardware and used by computer systems to execute several operations, and it includes the protection of algorithms, program codes and graphical interfaces.
Trade secret	A trade secret is a type of IP that encompasses confidential, proprietary information (such as manufacturing processes, formulas, techniques, customer lists, marketing strategies, software algorithms, data and more) that provides a business with a competitive advantage over others in the industry. Unlike patents, copyrights, or trademarks, trade secrets rely on maintaining their secrecy. To qualify as a trade secret, the information must meet certain criteria: • **Confidentiality:** The information must not be generally known or readily accessible to the public or competitors. • **Economic Value**: The information should have economic value specifically because it's not known to others and provides a competitive advantage. • **Reasonable Efforts**: The owner of the trade secret must take reasonable steps to keep the information confidential through measures like non-disclosure agreements, access controls, and employee training.

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Geographical indications (GI)[7]	A geographical indication (GI) protects a name of a product that has a specific geographical origin and owes its qualities and/or reputation to its particular origin. According to the EU GI legal framework, GI protection distinguishes between a '**protected designation of origin**' ('PDO') or a '**protected geographical indication**' ('PGI') depending on how strong the link between the qualities of a product and its geographical origin is.

As stated within the GA[8], the IPR provisions distinguish between **2 broad categories:**

- **Background Knowledge**: Access rights needed for application of the project will be made available on a royalty-free basis.
- **Foreground Knowledge**: Protection of IP of foreground, i.e., the new technologies and know-how developed in the project and their utilization will be engaged, owned and funded by the partner(s) who created the specific results

An IPR management plan will be developed during the project's lifecycle providing the baseline for managing and protecting IP after the Theseus completion. For **IPR knowledge management**, the following strategy will be adopted:

- **Intra-Consortium Knowledge Management:**
- Technical and scientific progress: document and archive documents to ensure all partners have access to them.
- Views on exploitation: the WP leader for exploitation will structure and map required knowledge and additional knowledge required to enhance exploitation *(i.e., patents, technology transfer agreements, potential users, other projects),* proposing an exploitation plan.
- **Extra-Consortium Knowledge Management:** The exploitation leader will be in charge of collecting and proposing to the consortium all matters relating to the results for dissemination and monitoring the project productivity in terms of knowledge publications *(scientific papers, posters, etc.).*

Regarding **patent applications** *(see **Annex I**)*, partners should inform the **Project Coordinator** *(ICCS)* and the consortium **4 weeks in advance** of submitting a patent application. Subject to the conditions that GA and CA are applicable, any owner of any outcome shall be entitled to use such findings and push it to the market. For joint ownership each owner is foreseen to be free to use such findings in its own organisation but adhere to the CA and exploitation approach to commercialisation.

[7] https://www.euipo.europa.eu/en/gi-hub
[8] GA, Annex 1, p.32

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8 Exploitation Roadmap: *What 's the Plan for the Future?*

Every strategy element has a plan in it for guiding the implementation actions. Focusing on the Theseus exploitation strategy which aspires to push to market its results certain activities have been foreseen and listed towards this goal. The **exploitation activities roadmap** of Theseus has been strategically structured since the proposal phase, formulated into **three distinct phases** for achieving a smooth direction to the market which name are:

- **Phase 1** *(Exploration, M6 - M24):* Establishing the prerequisites for the business plan's investigation
- **Phase 2** *(Exploitation Agreement, M24 - M48):* Confirming that the solution created is market-aligned and preparing the go-to-market plan.
- **Phase 3** *(Final phase, M48 - M60):* Presenting the plan for commercialisation and sustainability.

The launch of T11.3 activities in **M6** signals the beginning of exploitation actions and the initial phase is the **Exploration phase** *(M6 - M24)* which will focus on identifying innovation opportunities and setting the necessary conditions for the exploration of the business plan. The next phase, **Exploitation Agreement** spans from M24 until M48 and will concentrate effort on validating the developed solution, align with market and prepare the go to market strategy. Lastly, the **Final phase** *(M48 - M60)* covers the last year of the project and aims to the maximization of results and launch to the market.



Figure 9 Theseus Exploitation Phases

Several activities will be surrounded during each distinct phase to drive successful exploitation of project's results. Each distinct phase will be surrounded by several activities for driving the successful exploitation of project's results. **Phase 1** *(M6 - M24)* shall include the definition of Theseus technologies, products, services and materials and moving to **Phase 2** *(M24 - M48)* the activities should be continued. However, **Phase 2** shall include the update of initial **market analysis** and the development of viable **business models** for Theseus results. Moreover, consortium partners will be requested to prepare their individual exploitation routes. Lastly, symbiotic **business flows** and **joint exploitation schemes** will be studied.

Phase 3 *(M48 - M60)***,** which consists of the last year of Theseus lifecycle, the activities will be focused upon commercializing results in Greek H4C, launching results to industries beyond Greek H4C and integrating Theseus KERs into products. Additionally, other sources of funding will be explored for acquiring additional

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funds. It should be noted that other actions such as capacity building, training, replication and follow up of research shall be included in the same period.



Figure 10 Timeline of Theseus Exploitation Action

In the table below, all the described actions are featured along with an **indicative timeline** and calendar for implementation which will be highly dependent upon the availability of results for examining them throughout the described roadmap.

Table 11 Timeline of Theseus Exploitation Actions (indicative)

Phases	Planned Actions	Actual Months of Implementation	Project Months
Phase 1: Exploration (M6 - M24)	Theseus Technologies, Products, Services & Materials Definition	**May 2025 - Nov. 2026**	M6 - M24
Phase 2: Exploitation Agreement (M24 - M48)	Theseus Technologies, Products, Services & Materials Definition	**Nov. 2026 - Nov. 2028**	M24 - M48
	Market Analysis and Business Models	**Sept. 2026 - Nov. 2028**	M22 - M48
	Individual Exploitation Routes of Partners	**Sept. 2026 - Nov. 2028**	M22 - M48

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	Symbiotic Business Flows & Sustainability	**Sept. 2026 - Nov. 2028**	M22 - M48
	Joint Exploitation Schemes	**May 2027 - Nov. 2028**	M30 - M48
Phase 3: Final phase (M48 - M60)	Results commercialization in Greek H4C	**Nov. 2028 - May 2029**	M48 - M54
	Launch results to industries beyond Greek H4C	**May 2029 - Nov. 2029**	M54 - M60
	Integrate Theseus KERs into products	**Nov. 2028 - May 2029**	M48 - M54
	Acquire Additional Funding and Establish operational schemes	**May 2029 - Nov. 2029**	M54 - M60
	Capacity Building, Training, Replication, Streamline Results, Follow up Research	**Nov. 2028 - Nov. 2029**	M48 - M60

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9 Conclusions

The deliverable D11.7, "Exploitation Strategy v.1," set the basis for the exploitation strategy to be followed by the Theseus consortium designed to ensure the widest possible adoption by the market and generate positive societal impact. It comprehensively analysed the core elements of this strategy focusing at first to the key results of the project that are expected to be exploitable (KERs) as consortium partners have a clear view on the activities that will be focused on their efforts. Complementary, an initial market analysis is laid out along with the users *(customers)* to be benefited by the Theseus solution.

The exploitation strategy of Theseus, is not limited to the above but also other elements cumulatively ensure the wide market adoption. The objectives of the strategy that drive the exploitation actions, the mechanisms to measure risks and results, the methods and approaches for business model development, ways of protecting the Intellectual Property *(IP)* of the project and a roadmap of related actions to be carried out articulate it.

Overall, D11.7 provided a comprehensive view on the Theseus exploitation strategy ensuring that all readers regardless of their prior knowledge can understand its core elements and future actions. The upcoming versions of Exploitation Strategy deliverable will serve mainly as a report of T11.3 action and shall include any necessary additions / adjustments to the project's exploitation strategy.

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10 References

1. *Intellectual Property Handbook: Providing IP Guidance Through the EEN Client Journey*
2. Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*. John Wiley & Sons.
3. Horizon Results Booster

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Annexes

Annex I – How to register a patent

In order to obtain a patent, an outcome, result, or generally speaking an invention must be something new and involve an inventive step. According to the EU procedures[9], the process starts by filing **one** or **more patent application(s)** with the relevant **patent office(s)**. The office will **review** the application, and based on their examination, they will decide whether to grant the patent or reject the application.

- For protection in only **one European country**, a patent application can be filed at the national level by contacting the relevant national patent office.
- For **protection across multiple European countries,** there are **two options**:
    - **European patent**: This is the traditional option. A European patent application can be filed with the **European Patent Office (EPO**). Should a European patent be granted, it must then "be validated" with the national patent office in each country where protection is being searched. Each country may have its own requirements, like translations or fees. Today, a European patent may cover up to 44 countries.
    - **Unitary patent**: For any European patent granted **on or after 1 June 2023** the new Unitary Patent System can be selected, by requesting 'unitary effect' to be attributed to that patent. Today this gives you **coverage in 18 EU countries** without any national validation requirements. A single annual maintenance fee will also be paid to the EPO rather than separate fees in each country. For countries not participating in the Unitary Patent System, the traditional validation process is mandatory.
- For **protection at international level**, an 'international application' can be filed under the Patent Cooperation Treaty ('PCT application') to seek protection in **up to 158 countries**. After the 30-month 'international phase', where feedback will be received on the invention's patentability, there is an option to move forward and apply for patents in the national or regional patent offices that best suit the applicant's goals.

More information on patent protection in the EU can be found here.

[9] https://europa.eu/youreurope/business/running-business/intellectual-property/patents/index_en.htm#inline-nav-3

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Annex II - Risk Assessment and Priority Map Templates *(Horizon Results Booster)*

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						
			0			Not Filled
Technological Risk Factors						
			0			Not Filled
Market Risk Factors						
			0			Not Filled
IPR/Legal Risk Factors						
			0			Not Filled
Financial/Management Risk Factors						
			0			Not Filled
Environmental/Regulation/Safety risks:						
			0			Not Filled



Summarizing Risks Table	
Number of "No Action" Risks	0
Number of "Control" Risks	0
Number of "Action" Risks	0
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0