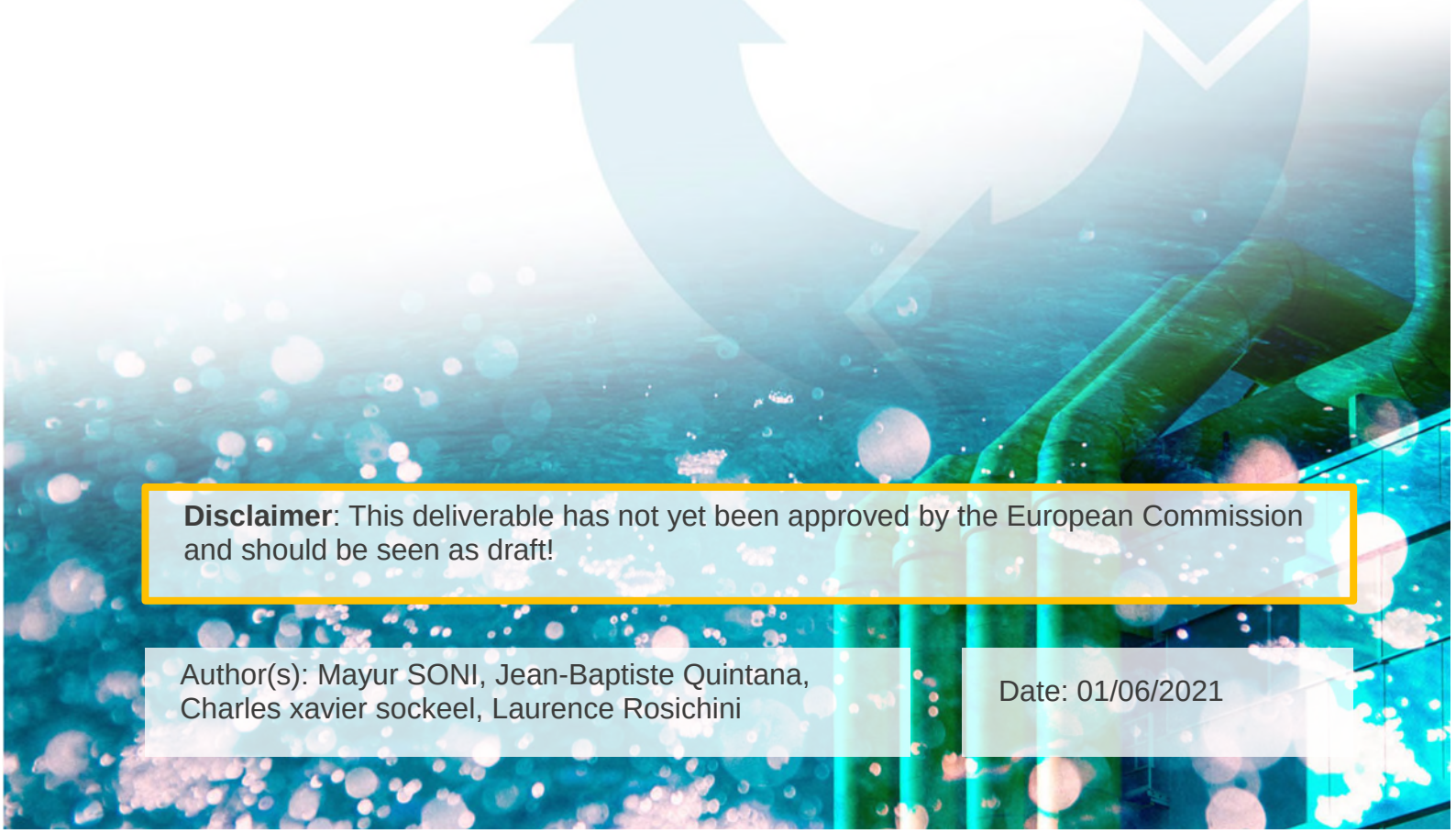
ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

D5.3 ULTIMATE Plan for exploitation during project lifetime



Disclaimer: This deliverable has not yet been approved by the European Commission and should be seen as draft!

Author(s): Mayur SONI, Jean-Baptiste Quintana, Charles xavier sockeel, Laurence Rosichini

Date: 01/06/2021

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Technical References

Project Acronym	ULTIMATE
Project Title	ULTIMATE: indUstry water-utiLiTy symbIosis for a sMarter wATer society
Project Coordinator	Gerard van den Berg KWR
Project Duration	01.06.2020 – 31.05.2024 (48 months)

Deliverable No.	D5.3
Dissemination level [1]	PU
Work Package	WP5
Task	T5.3
Lead beneficiary	STRANE
Contributing beneficiary(ies)	ALL
Author(s)	Mayur SONI, Jean-Baptiste Quintana, Charles Xavier Sockeel, Laurence Rosichini
Quality Assurance	Marika Fantoni, Cecilia Bruni, Francesco Fatone (UNIVPM)
Due date of deliverable	31.05.2021
Actual submission date	31.05.2021

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Document history

V	Date	Author(s) /Reviewer(s) (Beneficiary)	Description
0.1	10/05/2021	Mayur SONI	First draft
0.2	11/05/2021	Nathalie VALLEE	Review of the first draft
0.3	12/05/2021	Mayur SONI	Revised
0.4	17-27/05/2021	Marika Fantoni/Cecilia Bruni/Francesco Fatone (UNIVPM)	Quality assurance (contents)
0.5	27-31.05.2021	Mayur SONI, Jean-Baptiste Quintana Sandra Casas	Revision of the document following the quality assurance review
1	31.05.2021	Mayur SONI, Jean-Baptiste Quintana	Document for submission

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Executive Summary

Summary of Deliverable

This deliverable 5.3 is about the exploitation strategy during the project lifetime of ULTIMATE (hence the suffix "(During)" to its title). It identifies the key exploitable results and the methodology that will be implemented in duration of the project to achieve the objectives. It defines the different types of exploitable entities (knowledge, methods, agreements, technologies, and networks) and their expected added value for key stakeholders. It provides assurance that the impact of the project is set out to have in between and once the end of the funding period is achieved. It discusses the project partners' commitments and responsibilities in the exploitation activities to be carried out. It presents an overview of how the exploitable results will be utilised by key stakeholders.

The ULTIMATE plan for exploitation during the project lifetime is a public document and also dedicated to members of the ULTIMATE consortium. The content was built upon the insights and inputs provided by the whole consortium in order to gather and rationalise the dissemination activities and to identify a list of the first key exploitable results of the ongoing project.

The document first describes the project with its relevance to current water related problems and how ULTIMATE project can enable the different stakeholders to cope-up with water management challenges by implementing innovative WSIS solutions. This section also deals with the purpose of this document and detail all interactions with other work packages and deliverables.

The table of key exploitable results and technologies to be developed during the project is presented. This table gather key information on targeted markets, exploitation routes and IPR pathway. A second table describes TRL progression with demonstration level. Preliminary analysis of exploitable results and technologies has been carried out to provide some insights and highlight the key results of ULTIMATE.

The core content of the deliverable focuses on the methodology to be applied for exploitation activities during the project lifetime. It details the methodology that has been used to identify the key results that can be marketed and the next steps of the exploitation methodology (webinar, bilateral interviews, further upcoming investigations, etc.).. The main objective behind the process is to collect the data on key exploitable results with crucial parameters and characteristics to be tested during the market exploration (technical parameters, scope of application, potential diverted uses, economics, strategy, Strategy, Commercialisation, Willingness to exploit the results and create a startup).

The current identified results have been discussed together with the partners. The detailed strategy remains to be designed. The section four includes global individual strategies for each partner with their KER. The identified KER will be later assessed during dedicated interactive workshops and webinar held during the next GA consortium meetings. Additional interviews and assessments will be performed to

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

apply characterisation and prioritisation techniques. These results will be disseminated with the dedicated communication strategy.

A dedicated section focuses on a first couple of startup concepts: Seitiss, an industrial synergies builder and manager, and the solution developed by Greener than green by providing the startups background, concepts, technologies, maturity, differentiating aspects, initial possible business models and other relevant information related to the project result exploitation.

The first deliverable on exploitation sets up the basis in terms of potential exploitable results and strategy, and a second will be built upon detailed evaluation of each exploitable result, provide details, and fill the gaps step by step to improve the exploitation strategy and increase the granularity level of the information provided (IPR management, exploitation format, pricing strategy, etc).

The deliverable pointed out that the partners have not developed a clear view of the exploitation landscape surrounding the project yet. Most partners feel that they will be more prepared to contribute to developing the exploitation strategy and plan towards the end of the project, when the concepts and technology will be more mature. One of the lessons learned is that it is crucial to open up the discussion on exploitation with partners early in the project. It takes time to develop a profound understanding of the full spectrum of exploitation and to formulate a take on it. It is, therefore, important to encourage partners to start thinking about their stance as early as possible. ULTIMATE, and WP5 in particular, provides the consortium partners with the methods and the means to perform this in a EU wide context.

The next steps start with involving all partners in the joint effort of developing the final exploitation strategy to ensure successful exploitation of the results of the project. All partners have committed to contributing to and engaging in exploitation activities to achieve this objective. A major phase of market exploration will be launched in the upcoming period for the first startup concepts. The deliverable details upcoming action to be done to reach a maximum impact for WSIS solutions.

Disclaimer

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table of Contents

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table of tables

Table of figures

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

List of Acronyms

AAT	*Immobilised high rate anaerobic system*
ABM	*Agent Based Model*
ABS	*Agent Based Simulation*
AOP	*Advanced Oxidation Process*
AnMBR	*Anaerobic Membrane Bioreactor*
ATES	*Aquifer Thermal Energy Storage systems*
B2B	*Business-to-business*
GA	*Grant Agreement*
WP	*Work Package*
KER	*Key Exploitable Results*
KPI	*Key performance Indicators*
BEFB	*BioElectrochemical Fluidized Bed*
CA	*Consortium Agreement*
CC	*Climate Change*
CE	*Circular Economy*
CoP	*Consortium partner*
CSR	*Corporate Social Responsibility*
CVGNP	*Coöperatieve Vereniging Glastuinbouw Nieuw Prinsenland*
EU	*European Union*
EC	*European Commission*
EI	*Expected Impact*
HMS	*Hybrid Modelling and Simulation approaches*
HTC	*High Temperature Combustion*
HSM	*Hybrid Simulation Modelling*
IEX	*Ion Exchange*
IPR	*Intellectual Property Rights*
IS	*Industrial Symbiosis*
KPI	*Key Performance Indicator*
LCA	*Life Cycle Assessment*
LLs	*Living Labs*
MBR	*Membrane Bioreactor*
MD	*Membrane Distillation*
MP	*Marketplace*
SO	*Strategic Objective*
WWTP	*Waste water treatment plant*
WSIS	*Water Smart Industrial Symbiosis*
CS	*Case Study*
KER	*Key Exploitable result*
TRL	*Technology readiness level*
UCoP	*Ultimate Consortium Partners*

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Introduction

1.1. ULTIMATE Project in a nutshell

European communities are in many ways uniquely placed to transition from a linear to a Circular Economy (CE) model. The project ULTIMATE aims at providing new "Water-Smart Industrial Symbiosis" solutions to water sector and water-intensive industries. WSIS solutions will enable reducing water intake, recycle and reuse wastewater as well recover energy and nutrients from treated streams. Indeed, water sector and water-intensive industries present linear production-consumption-disposal chains that exacerbate resource depletion, contributing to increasingly volatile raw materials and energy costs as competition for diminishing resources intensifies. European Industry is the largest water consuming sector after agriculture, with a significantly larger water footprint than residential/urban areas. They face a fierce competition worldwide, with limited domestic resources. Some regions of Europe have undergone the closure of major facilities, with painful social impacts over the long-term. At the same time, the EU is setting ambitious environmental political objectives, and European industry has led the way in decreasing its environmental footprint. Moving to a CE paradigm that valorises a wide range of water-related resources: water, energy, nutrients, and high added-value compounds, would future-proof European industries, climate-proof European society and safeguard the environment. Industrial Symbiosis (IS) as a particular form of CE applicable to industrial contexts promises a new potential by systematically looking to reuse wastes between industries as raw materials. IS limits the impact of current waste management and import dependency and can provide cost-competitive resources and diversification of supply for European industries. Symbiotic synergies across industries create fruitful, sustainable networks (often termed 'industrial ecosystems"). They may happen within an industrial cluster, between an industrial cluster and its service/resource providers in its vicinity (for example with municipal water companies) and across industrial facilities at a certain distance. Collectively these synergies can manage materials of (assumed) low monetary value (so-called "wastes") and turn them into resources with considerable economic impacts. IS can bring an outstanding contribution towards low environmental impact, economic growth and the subsequent job increases from the rejuvenation of local, national, and regional economic activity.

The project brings together 9 Water Smart Industrial Symbiosis (WSIS) cases (8 in the EU and 1 in IL) where it develops, tests, and demonstrates multi-layered water-energy materials reuse approaches, complying with strict health and safety requirements while showcasing novel water-related governance arrangements and business models. All cases build on direct industrial interest and investment, with ULTIMATE providing added value through additional expertise, novel technological ideas, software (process models and control optimisation analytics, whole system models, IS matchmaking algorithms and digital marketplaces), hardware (e.g. advanced treatment technologies, sensors), as well as business intelligence and market analysis. We facilitate the design, deployment, monitoring and control of these symbiotic systems and codevelop with the main stakeholders (from the industry and water service provision sides of the symbiosis) the business models required to make

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

them profitable - ensuring wide transferability and uptake. The project also leverages years of experience and millions in investment in industrial symbiosis, by learning from additional mature high-profile cases (incl. cases in the UK and China). All demonstrations place emphasis on the valorisation of resources, addressing key challenges in scale of production, quality and costs.

1.2. Objective

To ensure clear focus, ULTIMATE has specified 6 Strategic Objectives (SO) linked to one or more Expected Impacts (EI) measured by Key Performance Indicators (KPI)s (the EI links and KPIs are detailed in GA Section 2.1):

- SO1. Showcase, promote and learn from successful high profile WSIS Cases, where European Water and Industrial Sectors collaborate to deliver innovative resource-efficient, circular solutions, with special emphasis on cross synergies, transferability, and applicability of the WSIS concept in the EU and beyond.
- SO2. Develop, optimise, and demonstrate multi-layered water-related (water-energy-materials) resources reuse technologies and solutions within four key industrial sectors (agro-food processing, beverages, heavy chemical/petrochemical, and biotech industry), building on a solid industrial engagement.
- SO3. Assemble, further develop, and apply digital support tools to identify symbiotic opportunities, improve the design, control, and operation of industrial symbiotic schemes, as well as their medium- and long-term assessment, to enhance cross-domain interaction, resilience, replicability, and transferability of solutions.
- SO4. Develop and demonstrate novel exploitation/valorisation schemes (value chains) for these resources, through a range of business models and symbiotic arrangements and link them to ongoing investments and plans of industries and water utilities.
- SO5. To design, promote and accelerate business transformation to WSIS, through active stakeholder engagement and innovation co-creation, by drawing on transdisciplinary knowledge and capacities from Art, Technology and Digital Humanities (immersive experiences in multi-use play spaces), supporting business-to-business, citizen, and Living Lab engagement.
- SO6. Reduce existing barriers for recovery, reuse, and commercial exploitation of valuable water-related resources (incl. requirements and standards for reuse) through WSIS novel governance approaches and best practice guidelines supporting the transition to CE, the implementation of EU policies and UN SDGs.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

1.3. WP5: Task 5.3 Exploitation

1.3.1. WP 5 overview

Work Package 5 of ULTIMATE involves the main adoption of the exploitation strategy for the project. It seeks to maximize the impact of the other work packages and the development of the ULTIMATE technologies. It will do so by exploring new business models and arrangements, such as Industrial Symbiosis, the Chemical Leasing model, and other exploitation mechanisms, and applying them to water related industrial activities and wastewater treatment technologies. ULTIMATE targets a high-impact exploitation strategy during and after the project, especially with the exploration of the potential of creating spinoffs to widely commercialise the project technologies, based on STRANE's concept of start-up factory, on the models developed by STRANE's subsidiary Seitiss (linked third party) and the collective support of all partners. The most promising technologies, starting with the ones with the best track records to mitigate risk and whose owners are willing to investigate the potential for start-ups creation, will be assessed throughout the project.
Activities for WP5 started on M1 and will be carried out until the end of the project on M48.

1.3.2. Purpose of the deliverable

This deliverable aims to analyse the outputs of ULTIMATE and the enablers and barriers for exploitation, to detail the exploitation strategy followed and to report on the activities related to exploitation and the creation of startups in the project, and further to support the upscaling of large-scale water-based solutions. The target audience is the European Commission, project partners, public authorities, industrial organisations, and policy maker. This deliverable D5.3 ULTIMATE plan for exploitation during the project lifetime is public document and dedicated to members of the ULTIMATE consortium as well. D5.3 will be updated in terms of contents and adapted to suppress confidential information, as the deliverable is to be public. The upcoming deliverables D5.8 and D5.9 will be issued at M44 and M48 respectively.

The purpose of this deliverable is to create a business and exploitation plan that will explore the potential for the development and exploitation of the technologies and knowledge during and beyond the life of the ULTIMATE project. All partners have contributed to and will continue to be engaged in exploitation activity assessing the re-use potential, commerciality and applicability of the concepts and ideas central to the evolution of the guidelines.

This deliverable aims to:

- **Present a preliminary exploitation strategy for the project and provide a holistic overview of the exploitation landscape surrounding it;**
- **Introduce the actors, markets and sectors that are relevant in the context of exploitation, and to emphasise the importance of iteratively analysing their role, needs and potential;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **Serve as a step towards setting out clear and measurable exploitation targets, the results of which will be monitored and reviewed regularly;**
- **Serve as a guidance document for ULTIMATE project partners and to stimulate exploitation engagement among partners;**
- **Ensure that exploitable entities will be utilised in an optimal way and that the desired impact is achieved;**
- **Act as a preliminary document that will be developed further in the last year of the project**

1.3.3. Relationship with other deliverables

This deliverable is closely linked to other deliverables in work package five as well as deliverables in other work packages across the project. Having to do with the exploitation of the results, it is essentially connected to all deliverables discussing the identification and analysis of stakeholders, requirements and the use and re-use of the results.
D1.1 Assessment of baseline conditions for all case (M12, KWB)
D1.3 New approaches and best practices for water recycling in symbiosis cluster (M44, EUT)
D1.6 Technology Evidence Base concept and integration (M18, KWB)
D1.7 Technology Evidence Base final version (M46, KWB)
D2.2 LCA, cost and risk assessment for WSIS (M44, KWB)
D2.5 A KPI Tool for WSIS performance assessment (M44, NTUA)
D3.2 WSIS-Living Labs: Gap analysis and recommendations (M28, WE)
D3.4 Protocol and tools for business-to-business co-creation (M18, NTNU)
D3.5 Results and insights from co-creation exercises in ULTIMATE CS (M30, KWR)
D5.1 Short-list of synergies for ULTIMATE Cases (M12, STRANE)
D5.7 Technical and marketing feasibility for exploitation of ULTIMATE Water Smart Industrial Symbiosis (M16, STRANE)
D6.1 Dissemination, Communication & Collaboration Master Plan (M3, ESCI)

In addition, this deliverable has a strong relationship with D5.9 Overall exploitation Strategy (M44, STRANE), D5.8 ULTIMATE Plan for exploitation beyond, project lifetime (M48), which will build on this deliverable and contain the final business and exploitation plan that will explore the potential for the development and exploitation of ULTIMATE technologies beyond the life of the project. This deliverable also draws on elements covered in D6.1 and D5.3 both of which describe the planning and execution of the dissemination and exploitation strategy.

This deliverable will also be important for the creation of the deliverable D5.8 & D5.9 exploitation and external collaborations strategy.

1.3.4. Relation with other work packages

The outputs from the other work packages are extremely important for WP5, because this task is associated with exploitation and business creation. The actions of the WP5

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

are interdependent on the other WP's activity. This activity is closely linked to other's activities and their progress and outputs in WP5 as well as actions in other work packages across the project. Having to do with the exploitation of the results, it is essentially connected to all partner's actions discussing the identification and analysis of stakeholders, requirements and the use and re-use of the key exploitable results. As it is mentioned in the below Figure 1 and interaction between other WP's.

- **ULTIMATE tool-box used to identify business and investment opportunities**
- **CoPs form alliances to support local business creation**
- **Business model proposed within current and future regulatory and governance context**
- **Experiences shared with key markets beyond EU (CHINA) coordinated by WP6**
- **CS experiences highlight challenges to address**
- **International experience and leveraged**

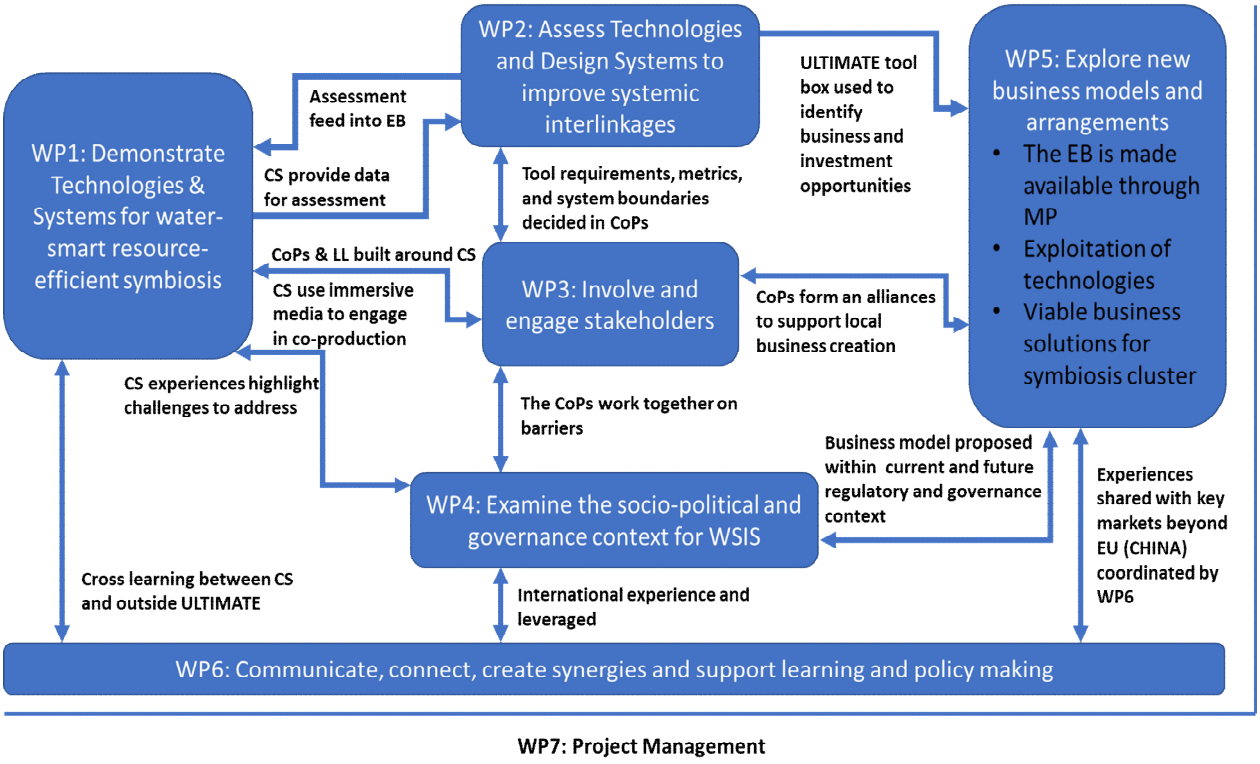


Figure 1: Work Package 5 interaction with other WP's (Source: GA)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

2. Analysis of outputs of ULTIMATE

2.1. Table of Key Exploitable results

Table 1 shows the ULTIMATE key exploitable results as listed at the beginning of the project. This list is to be updated in the course of the project to include any new KER that would be added, to assess the application of these technologies in the project and to report on the final TRL reached for those already listed. The work in T5.1 and T2.3 related to the assessment of ULTIMATE technologies will be especially relevant and will be studied later during this project.

The table lists the following information:

- Name of the key exploitable results and responsible organisations
- Value proposition
- Targeted Market ((1) Water utilities; (2) Public authorities; (3) Consultancies; (4) Standardization bodies; (5) Industry (Agro-food, chemical, manufacturing, biotech); (6) Industrial park operators; (7) Energy utilities;)
- Exploitation forms ((1) follow-up research, (2) Feasibility/Design studies (3) Policy change / Standards /guidelines (4) Demonstrators and prototypes, (5) new spinoff/Start-up/Joint venture (6) consulting service, (7) equipment sale (8) patent licensing / transfer agreement)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table 1: Key Exploitation Results (Source: GA)

Character/Key Exploitable Results	Main owner	Value proposition / value for outbidding competition (Added-value, direct benefits)	Targeted market	Exploitation Forms
O1. Technology Evidence Base	KWB, KWR, NTUA	Access to technology showcases	1,2,3,5,6,7	1,4,5,7
O2. nZLD system for industrial water reuse	EUT, AITASA	Improved industrial wastewater recovery	1,5,6	1,4,5,7,8
O3. Zeolite adsorption for ammonia removal	EUT	Reduce energy consumption of WWTP	1,2,5,6	1,4,5,7,8
O4. Closed loop greenhouses with water and nutrient recycling	CVGNP	Reduction of costs and reduction of primary resource use.	5,6	1,4,5,7
O5. Real-time data driven monitoring and process control for salinity management	ARETUSA, WEST	Provision of fit-for-purpose water quality	1,2,6	1,4,5,7,8
O6. Data-driven matchmaking platform for water reuse	ARETUSA, WEST, UNIVPM	Increased yield of provision of fit-for-purpose water quality	1,2,3,5,6	1,3,4,6
O7. Mobile WWTP for use in fruit processing	GtG	Reduced wastewater treatment costs	1,5,6	4,5,7
O8. AnMBR (with post-treatment) for beverage WW treatment	Aqualia, AquaBio	Fit-for-purpose water from WWTP	1,5,6	1,4,5,7
O9. Treatment of biotech WW based on novel membranes in combination with pre-treatment	XFLOW	Reduction of high fouling load of biotech WW, facilitation reuse	1,5,6	1,4,7,8
O10. High-Temperature ATES methods	KWR	Exploitation of residual heat	2,3,5,6,7	1,5,8
O11. Biogas production in anaerobic bioreactors	Aqualia, AGB	Maximised methane and biogas yields	1,3,5,6,7	1,4,7,8
O12. Heat recovery from AnMBR effluent	AquaBio	Exploitation of residual heat	5,6,7	1,4,7,8
O13.Data driven cloud-based control system for WWTP operation	Kalundborg	Increasing WWTP energy efficiency	1,3,5,6	1,4,6,7
O14. Extraction process for value added compounds in olive mill wastewater	GtG	Creation of new income streams from selling added-value compounds to superfood industry	5,6	1,4,5,7,8
O15.Ammonia recovery methods	EUT, AquaBio	Resource recovery and reuse, reduced water treatment costs	1,5,6	1,4,5,7,8
O16 Method for recovery of sulphur from flue gas	SUEZ-RR	Decrease emissions and produce marketable products replacing primary raw materials	5,6,7	1,4,5,6,7,8
O17. Recovery of metals from the flue gas cleaning water	SUEZ-RR	Decrease emissions and produce marketable products replacing primary raw materials	5,6	1,4,5,6,7,8
O18. WSIS Ontology	EUT	Identify opportunities for WSIS at local and regional scale	1,2,3,4,5,6,7	1,3,5
O19. HMS Simulation & Stress-Testing	UNEXE	Assess symbiosis paths under different conditions to enhance transferability	1,2,5,6,7	1,4,5,6
O20. Interactive Gamified Visualisation Tool	UNEXE	Improved collaborative decision-making	1,5,6,7	1,4,5,6
O21. Immersive media experiences	NTUA	Co-production and Learning	1,3,5,6,7	2,5,6
O22. Synergy identification Tool	STRANE	Tool to identify geolocalised synergies	1,2,5,6,7	5
O22. Synergy identification Tool	STRANE	Tool to identify geolocalised synergies	1,2,5,6,7	5
O23. KPI Assessment Tool	NTUA	Link performance assessment of individual industries to contracts and investments	3, 4, 5,6	1, 2, 5, 6
O24. WSIS Living Labs	WE	Networking	1,2,3,5,6,7	2,6
O25. Governance tools	KWR	PPP	2,3,4,5,7	2,3,6
O26. WSIS Digital Marketplace	KWR, NTUA	B2B matchmaking	1,5,6,7	2,3,6

Target Sectors: (1) Water utilities; (2) Public authorities; (3) Consultancies; (4) Standardization bodies; (5) Industry (agro-food, chemical, manufacturing, biotech); (6) Industrial park operators; (7) Energy utilities;
Exploitation routes: (1) follow-up research, (2) Feasibility/Design studies (3) Policy change / Standards /guidelines (4) Demonstrators and prototypes, (5) new spinoff/Start-up/Joint venture (6) consulting service, (7) equipment sale (8) patent licensing / transfer agreeme

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The different outputs presented in the table 1 can be sorted in different categories:
- Digital solutions: O1; O18 to O23
- Water reuse: O2 to O9
- Energy recovery: O10 to O13
- Material recovery: O14 to O17
- Social Governance and Business: O24 to O26

These categorizations will help to set up synergies between the same category or envisage cross category association for the exploitation purpose

2.2. Preliminary Targeted Market

Most of the results are associated with targeted market, namely Industrial park operators and Industry (Agro-food, chemical, manufacturing, biotech) which account for about 48% of total results. The remaining 50% is covered by other market segments, including Water utilities; Public authorities; Consultancies; Standardization bodies; Energy utilities. Water utilities and energy utilities cover 17% and 14% of the total results respectively, as represent in the below Figure 2.

As indicated in a EEA' multiple research report "Water Use in Europe", chemical and food industries have a higher consumption of raw water after agriculture[1]. This leads these results to more industrial bias, so this development will potentially benefit the industrial sector rather than public authorities.

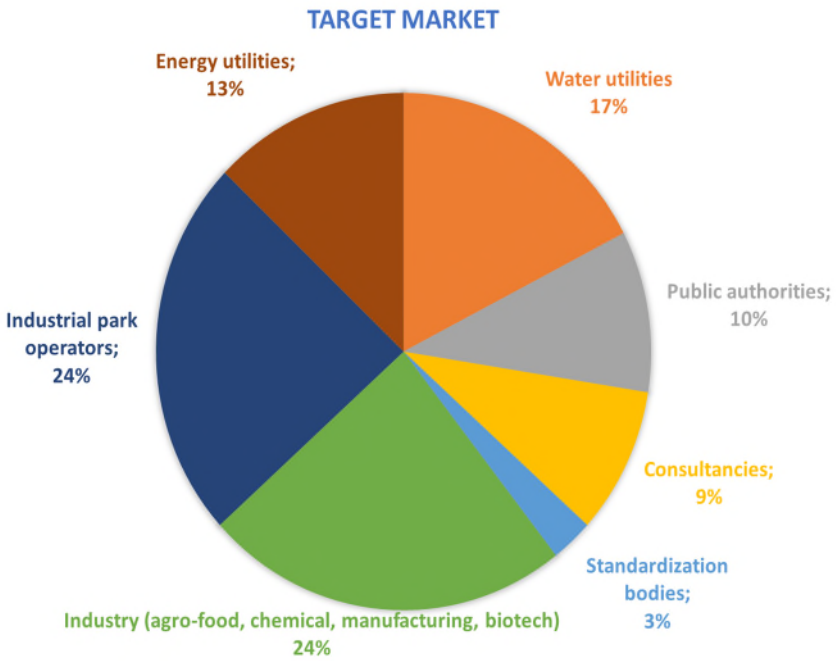


Figure 2: Targeted market

[1] European Environmental Agency : water use in Europe; 08/2018

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The Figure 3 below describes the potential routes of exploitation for key exploitable results. As shown in the figure, 18% of the total KER can be exploited through a new spinoff/start-up/joint venture, whereas 15% can be commercialised through equipment sales. These two results cover 33% of the total KER and can be implement on ground level to achieve the objective of the project.

It is also shown that 19% of the total KER will be used in further follow-up research. The rest exploitation routes consisting of consultancy services, patent licensing, feasibility and design studies, policy change standards and guidelines, and demonstrators and prototype account for 11%, 11%, 5%, 4%, and 17% respectively.

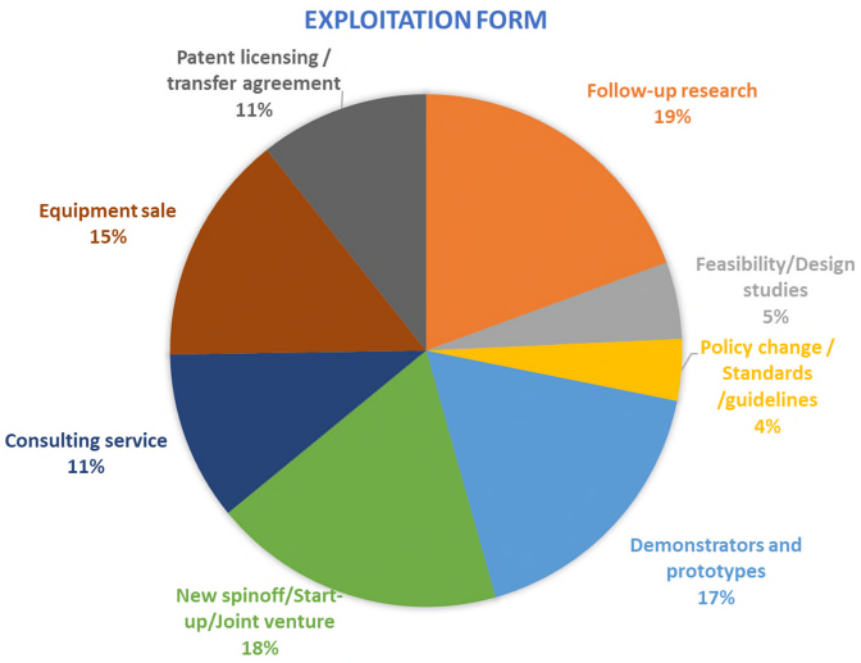


Figure 3: Exploitation Form

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

2.3. TRL assessment of technologies

Table 2: TRL assessment of ULTIMATE technologies (based on an inventory in WP1)

Technolgy	Start TRL	End TRL	Demonstration level	Type of technology
T1. zero liquid discharge (ZLD)	5	6	Prototype demonstration at pilot scale	Nutrient & Material Recovery
T2. Zeolite adsorption for ammonia removal from urban reclaimed water	6	7	Treated WW from water reclamation plant	Water Reclamation And Reuse
T3. High-temperature ATES for use in greenhouse horticulture.	5	7	Prototype pilot scale to full scale replication	Energy & Heat Recovery & Reuse
T4. Water treatment solution for recycling of drain water in greenhouses horticulture.	4	6	Prototype with real greenhouse wastewater	Water Reclamation And Reuse
T5. Closed loop greenhouses with water and nutrient recycling	4	6	Prototype with real drain water and test-bedding in demo greenhouse	Nutrient & Material Recovery
T6. Use of industrial by-products as wastewater treatment process chemicals (e.g. bentonite, H2O2).	4	7	Prototype pilot scale in operation environment	Nutrient & Material Recovery
T7. Real-time data driven monitoring and process control for salinity management in water reuse	5	7	Full scale	Digital Tool
T8. Data-driven matchmaking platform for water reuse to manage demand and supply	5	7	Full scale	Water Reclamation And Reuse
T9. Extraction of added-value compounds from WW by filtration, adsorption and supercritical fluid	5	7	Prototype pilot scale in operation environment	Nutrient & Material Recovery
T10. Mobile wastewater treatment unit for use in seasonal food processing and water reuse	5	7	Prototype pilot scale in operation environment	Water Reclamation And Reuse
T11. AnMBR with fit-for-purpose post-treatment (NF, RO or Ozone/GAC)	7	9	Prototype large scale in proven operation environment	Water Reclamation And Reuse
T12. BEFB reactor with membrane filtration for increased biogas yield	5	7	Prototype large scale in operation environment	Energy & Heat Recovery & Reuse
T13. AnMBR with improved methane extraction from the water phase	7	9	System in proven operational environment	Energy & Heat Recovery & Reuse
T14. Online monitoring system for control of pre-treatment steps to reduce membrane fouling in AnMBR	5	7	Prototype large scale in operation environment	Water Reclamation And Reuse
T15. Immobilised high rate anaerobic biofilter (AAT) for biogas	7	9	Large-scale pilot proven in operational	Energy & Heat Recovery & Reuse

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

production from WW with poorly degradable organic matter.				
T16. Combine AAT with membrane filtration and activated carbon to prevent biomass inhibition from shock loading	5	8	Prototype pilot scale in operation environment	Water Reclamation And Reuse
T17. IEX for ammonia recovery from distillery WW	5	7	Prototype demo at pilot-scale in operational environment	Nutrient & Material Recovery
T18. Heat recovery from AnMBR effluent.	5	7	System complete and qualified in operational environment	Energy & Heat Recovery & Reuse
T19. Flue gas scrubbing & dust removal for sulphur recovery as sodium bisulphite	4	6	pilot scale with real industrial fumes	Nutrient & Material Recovery
T20. Combination of novel ultrafiltration membranes with pre-treatment for treatment of Biotech WW with high non-degradable organic matter content.	5	7	New UF modules prototype in operational environment Municipal + biotech wastewater))	Water Reclamation And Reuse
T21. Data driven cloud-based control system for WWTP operation	5	8	System complete and qualified for combining operation of two full-scale WWTPs	Energy & Heat Recovery & Reuse
T22. WSIS Ontology Tool	4	6	Ontologies Extension, background methods and modules integrated into tool prototype	Digital Tool
T23. HMS Simulation & stress testing platform	4	6	Simulation tools and modelling tools to assess process symbiosis.	Digital Tool
T24. Interactive Gamified Visualisation Tool	5	7	Gamification engine that will be repurposed for WSIS.	Digital Tool
T25. KPI Assessment Tool	4	6	Methodological components from past work enhanced by work in the project and coded into a tool prototype.	Digital Tool
T26. XR/Multi use play spaces technology	5	6	Technologies enhanced and customized for different stakeholders and coproduction settings linked to existing LLs	Digital Tool

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

T27. WSIS Digital Marketplace	5	7	Existing marketplace from the NextGen project extended towards WSIS	Digital Tool
T28. Model and Matchmaking algorithm generating ideas for synergies	5	7	Demonstration on all cases and development of water smart matchings	Digital Tool

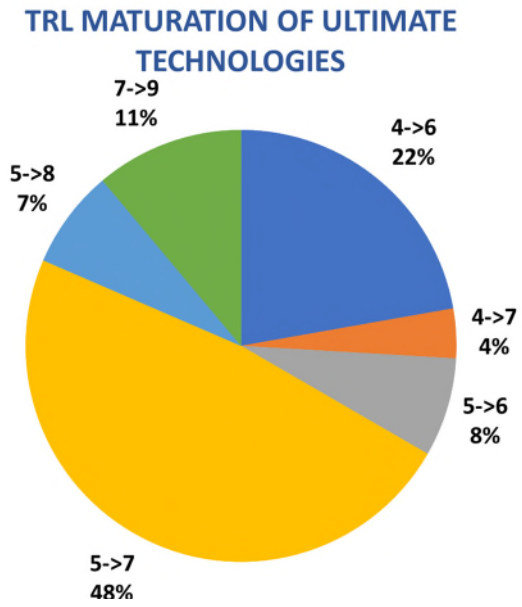


Figure 4: TRL Maturation of Ultimate Project

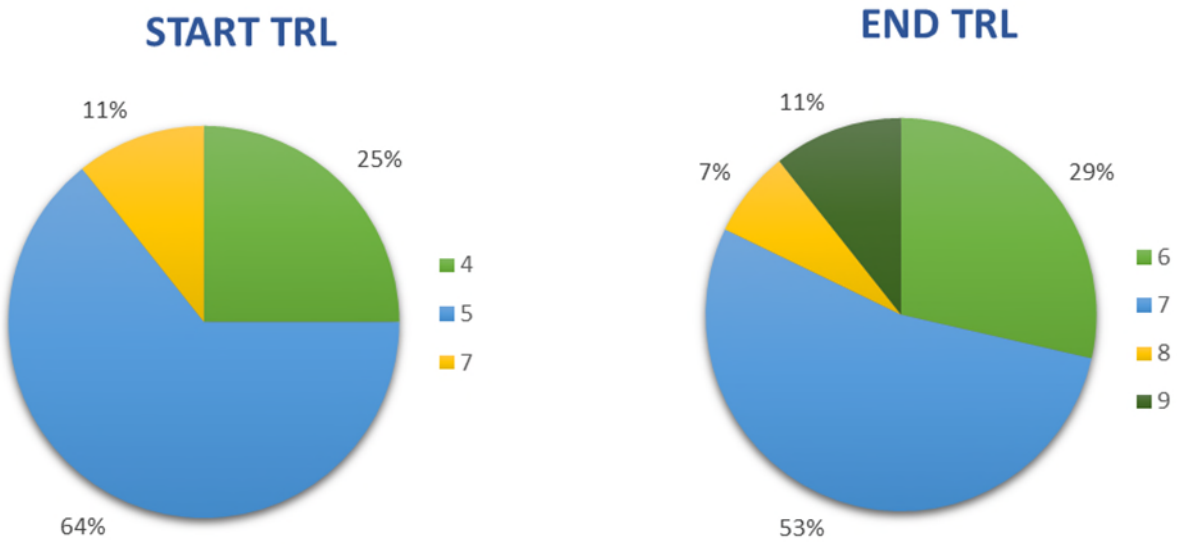


Figure 5: Overview of TRL maturation of ULTIMATE Tools (left), and distribution of the estimated TRL at the start and end of the project (right)

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Half of the ULTIMATE technologies have a mid-level technology readiness level (TRL) of 5-7. The other quarter of the technology are a starting technology readiness level (start TRL of 4-7) and 18% of the technologies are more mature (Start TRL level 5 --> 8 and 7-->9). Over the course of the project, 53% of the technologies will increase their TRL by 2, 11% by 5, 29% by 2 and 7% by 1. Most of the technologies will have reached at the end of the project a TRL of 5 to 7 and some of will be at initial level.
From TRL 7 to TRL 9, the technologies are considered enough mature to be commercialised and industrialized which is important to envisage a proper exploitation strategy for the project. Here 71% of the technologies developed inside the ULTIMATE project will reach a minimum of TRL 7 including 18% above TRL 8. This leads to several possibilities of optimal exploitation strategy with the creation of potential startups.

3. Exploitation strategy during the project lifetime

This section explains how ULTIMATE defines successful exploitation of its results and how this translates into exploitation objectives. This section will also address the parameters of this exploitation plan and the methodology used to arrive at the preliminary exploitation strategy.

3.1. Exploitation Objective & Strategies

The main objective of ULTIMATE Exploitation WP5 is to implement and execute an exploitation strategy to ease the successful exploitation and adoption of results and benefits within industrial services, research communities and policy advisers. Exploitation activities in the ULTIMATE project seek to ensure the permanence and stability of the project's results through either policy uptake, further research, or commercial applications.
Task 5.3 in particular, aims to explore the potential enlargement of the project results and to plan the following exploitation process. According to the Grant Agreement exploitation is in fact a compulsory activity, as each beneficiary must —up to four years after the period set out in end of the project —take measures aiming to ensure exploitation of its results (either directly or indirectly, in particular through transfer or licensing, or Spin-off).

Based on this requirement, Task 5.3 aims to address exploitation in a coherent manner throughout the project and to support the beneficiaries in eliciting and coordinating their exploitation strategies, thus increasing the chances for the results of the project to become, through appropriate exploitation measures, innovations that can produce tangible benefits and satisfy specific needs and wants. Support is provided to:

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- Elicit the key exploitable results of the project, intending them as concrete objects that are able to survive and be used after the end of the project;
- Identify the added value of the project and boost further scientific developments;
- Define the market potential, barriers, the target end-users and potential competitors;
- Define the partner's exploitation strategies.

Partners have different exploitation strategies. In general, their strategies can be classified into four categories:

- New research: when the results are intended to be used for publications and to be involved in new research projects and activities.
- Commercial exploitation: when the partner intends to use the result according to a market-oriented strategy, based on offering a new service or a new product on the market.
- Standard-setting: when the partner intends to propose the adoption of the result as a standard.
- Internal adoption: when the partner plans to use the results internally to improve the knowledge within the organisation or improve the internal procedures.

3.2. Methodology and process applied for Exploitation

ULTIMATE targets a high-impact exploitation strategy during and after the project, especially with the exploration of the potential of creating spinoffs to widely commercialise the project technologies, based on STRANE's concept of start-up factory and the collective support of all partners.

Strane aims to focus on the creation of new sustainable economic activity, a spinoff that could survive beyond the end of the project. The main objective of a spinoff is to transfer knowledge from academia/research to the industrial sector/business. In general, a spinoff from a company or an institution tries to take advantage of several purposes, such as retaining talent, developing and exploiting new services and technologies discovered at the entity of origin and seeking new business opportunities. Spinoff allow large companies or organisations to recover the agility and attractiveness of a startup without endangering their corporate culture.

Project spinoffs can be an independent startup funded by any partner who wants to develop any innovation. A start-up is a company that explores, who is looking for a business model, a market, customers and tries to innovate. It tends to exploit a market niche with great potential. A startup has a potential of exponential growth on emerging markets based on an innovation, a unique value proposition (often technological). It

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

usually looks for a large market ("scalable / extensible"). Startup is a vehicle that will be studied by Strane to exploit results along the project.

In exploitation activity, spinoffs can be created based on the KERs of the project, but the origin identification is not set in stone. Other parameters can influence the potential spinoff creation like the willingness of consortium partners to collaborate, the complementarity of services between partners or the opportunity to replicate good practices in another country part of the project. Some examples are shown in the Figure 6

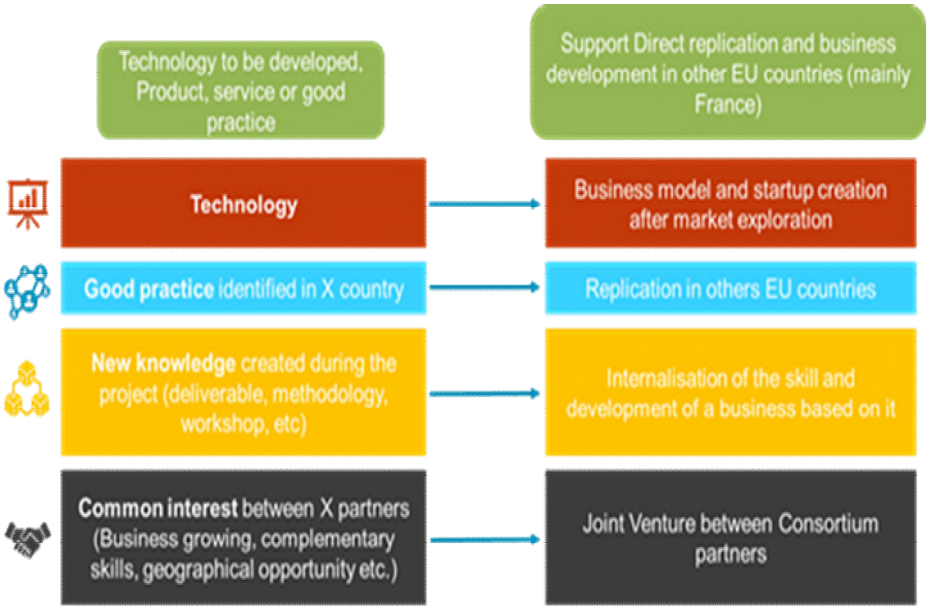


Figure 6: Main Exploitation Pathways possible for Ultimate technologies (Source: Strane)

Strane will seek the possibility to create spinoffs in collaboration partners during the project lifetime by starting the process with two methods:

- **Standard KERs identification method**
- **Partners willingness assessment (exploitation workshop)**

Both starting points will support the spinoff concept identification which is followed by the Strane iterative process to test and validate these concepts before consolidating them and creating the spinoff.

Steps of this process is briefly presented in the Figure 7 with the limitations to achieve the spinoff creation. These limitations for the exploitation and the replication of technologies/concept will be assessed during the project lifetime.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Figure 7: Technologies and concept selection process (Source: Strane)

This section presents the exploitation methodology and how partners will be involved in the task 5.3

3.2.1. Identification of Spinoffs based on KERs

3.2.1.1. Survey shared to consortium members

The process of exploitation strategy definition started by providing a support to each individual partner in identifying exploitable results. A specific survey has been designed for each partner of the project in order assess the level of exploitability of its results. After asking a short introduction of the partner, the survey follows the organisation below.

3.2.1.1.1. Key Exploitation Results (KERs) table

This part aims to check if all KERs have been identified at the beginning of the project. Types of KERs are reminded as below:

- *Methodology or method*
- *Product*
- *Service*
- *Demonstrator*
- *Algorithms*
- *Invention*
- *Software*
- *Scientific article*
- *Design of a product*
- *Name of a product, service/project*
- *Know-How*
- *Website*

Partners are invited to check and modify their pre-completed KERs table. An example of this table is shown in the Table 3

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Table 3: Key Exploitation Results table example

Project result title	Added value	Users, sectors of application	Partner	Ownership & exploitation pathway
Technology Evidence Base	Added value of the KER: *Access to technology showcases*	• The user and sector targeted for the KER: • *1,2,3, etc*	Partners involved in the KER	Type of ownership: 1,2,3, etc

If one KER can be added to the table, consortium members have the possibility to highlight this absence and rate the exploitability level according to the following criteria:

- ***0 for "not exploitable" :*** *it will be difficult to fully exploit the result and/or barriers have been identified preventing the exploitation over the duration of the project and/or further research is needed;*
- ***1 for "weakly exploitable" :*** *these results have not been abandoned yet, but it is unlikely that they will turn out to be exploitable by the end of the project.*
- ***2 for "moderately exploitable" :*** *the exploitation potential is not the highest in the main areas of the project; however market potential exists and future opportunities will be investigated;*
- ***3 for "highly exploitable" :*** *for those results concrete possibilities of exploitation exist.*

3.2.1.1.2.Individual exploitation strategy during the project

Based on the previous table, the partners are invited to answer several questions to assess their individual exploitation strategy in the project. The following questions are asked for each partner KER during the project:

- **What will be the benefits of the KER in terms of commercial for your organisation?**
- **How does the KER support your Research & Development?**
- **Do you plan to make publications with the knowledge you gathered?**
- **Do you plan to use the KER in other projects? Or will it help you to create another one?**
- **Does this KER lead to the creation of a partnership with another consortium member?**
- **Do you think that is possible to make a start-up with this KER? If yes, do you plan to create it?**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

According to these answers, Strane Innovation will plan and carry out interviews with the partners that show a high exploitation interest. Last questions focus on general exploitation strategy of the partners that will help to guide this interview between Strane Innovation and the partner.

1 **The prioritisation of the partner in terms of exploitation results;**
2 **The synergies between the project and the own partner organisation strategy;**
3 **The expectation of the partner from the WP5.**

3.2.1.2. KERs prioritisation

The second step of the methodology consists in organising an open discussion with two objectives: i) to present and discuss the information collected through the exploitation survey and ii) to complete the definition of the exploitation strategy by performing a prioritisation analysis.

The outcome of the prioritisation process is a list of exploitable results ordered by the impact they can have in the market or industry. Its aim is to facilitate the selection of some exploitable results, between three and five, to make a more in-depth evaluation of them during the project.

Strane Innovation plan to prioritise the exploitable results based on 3 criteria:

- **Innovation and circularity:** refers to exploitable result's degree of innovation
- **Exploitability:** refers to the condition of being exploitable, which means, profit can be made from this exploitable result
- **Impact on industry:** refers to the impact that the exploitation of this project result will make in the industry

A table will be shared and completed by all partners in order to prioritise KERs. The results will give the three KERs that will pass through all the exploitation process driven by Strane Innovation.

If some KERs have the same result, another prioritisation process will be carried out to these specific KERs with more criteria.

3.2.1.3. Exploitation discussions

The objective of this part will be to determine how the KER can be exploited. A common vision will be defined with the owners and the entrepreneurial team, most likely made of Strane's start-up makers but also involving as far as possible staff from other partners willing to entrepreneur, and/or partner organisations in the capital of the company.

The spinoff concept will be drafted in collaboration with partners based on the KER and their involvement. The status of each partner involved in these exploitation activities will be defined.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

In the meantime, a new agreement and/or NDA in terms of foreground knowledge could be signed between parties according to their involvement, their IP ownership and the need of rights transfer for the exploitation work.

A contribution-benefits matrix to complete by interested parties could be proposed to anticipate conflict between partners if the Strane team estimate the process necessary.

3.2.2. Identification of based on the exploitation workshop

The Exploitation Workshop has a twofold objective of i) presenting and discussing the information on exploitation and ii) complement the definition of the exploitation strategy by means of the execution of analysis.

The webinar held on 18th January 2021, aimed to provide a functional and methodological support for partners to understand Strane exploitation objectives and process to create spinoffs. It has been an opportunity for Strane to identify partners interested in creating a spinoff and what were their needs in terms of exploitation. The webinar is followed by bilateral interviews with interested partners to better understand their technologies and their needs.

3.2.2.1. Audience targeted and agenda

Three different audiences are targeted:

- WP leaders : the goal was to explain Strane methodology and give them ideas on how WP could work together to achieve the goals of the Ultimate project.
- Technology providers: the webinar provided an opportunity for technology providers to better understand exploitation pathways and how Strane could support them in the process.
- CS representatives: the webinar has been the occasion to differentiate synergies creation, exploitation process, and CS replication.

09:45-10:00	Registration & Welcome
10:00 - 10:05	**Introduction - Objectives of the interactive webinar** • Introduce exploitation activities • Present the exploitation process along the project • Identify partners interested in exploiting projects results
10:05 – 10:30	**Presentation of WP5 activities** • Introduction • Task description • List of Deliverables
10:30 – 11:15	**Focus on Task 5.3 Exploitation and spinoff** • Exploitation pathways • Task description • Process and steps (Flow chart) • Strane role and success indicators • How to test the technologies on the market? • Real world background • Synergies
11:15 – 11:30	**Conclusions: Questions & answers**

Figure 8: Agenda of the Webinar (Source: Strane)

3.2.2.2. Facilitation methodology and materials

Before the webinar meeting, a survey on the best date has been conducted and the invitation were shared with 50 members of the Ultimate consortium. Expected attendees were asked to fill up an online form to gather expectations on the webinar and tailor the content and materials to their needs.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The webinar was carried out virtually for under two hours and coordinated by Strane team. The presentation intends to be collaborative: participants were asked regularly to fill an online form in parallel of the webinar.

As part of the agenda, the Strane methodology and iterative process for exploitation within Ultimate was presented. This presentation aimed to give an overview of exploitation possibilities and criteria for technologies selection to all participants.

The all-start-up creation process were explained and provides a clear view of the goals and objectives of Strane when looking at Ultimate potential outputs.

The end of the webinar aimed to organise exploitation discussions with partners that have the willingness to create a spinoff with its own results, and/or in collaboration with another partner.

3.2.2.3. Spinoff brainstorming and action plan design

Strane plan to interview partners which are good candidates to create a spinoff based on their knowledge, know-how and KERs. These partners will be mainly selected according to their willingness to develop a spinoff. The partners will be invited to propose spinoff concept to Strane. Concepts will be co-modelled during the bilateral discussion. If necessary, a brainstorming will be conducted by Strane team.

During these interviews, a lot of information will be asked by Strane in order to evaluate the exploitability level and the scalability of the concept. At this first stage, the following success criteria will be assessed:

- **Technical limits:**
  - Technology Readiness Level
  - Risks
  - IPR issues
- **Market limits**
  - Regulation limits
  - Hard competition
  - Limited market

Once the concept drafted, these discussions aim to design a bilateral action plan to undertake the Strane iterative process of spinoff creation.

3.2.3. Spinoff creation process

A market exploration and start an iterative process to develop the spinoff as presented in Iterative process of startup development Figure 9.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

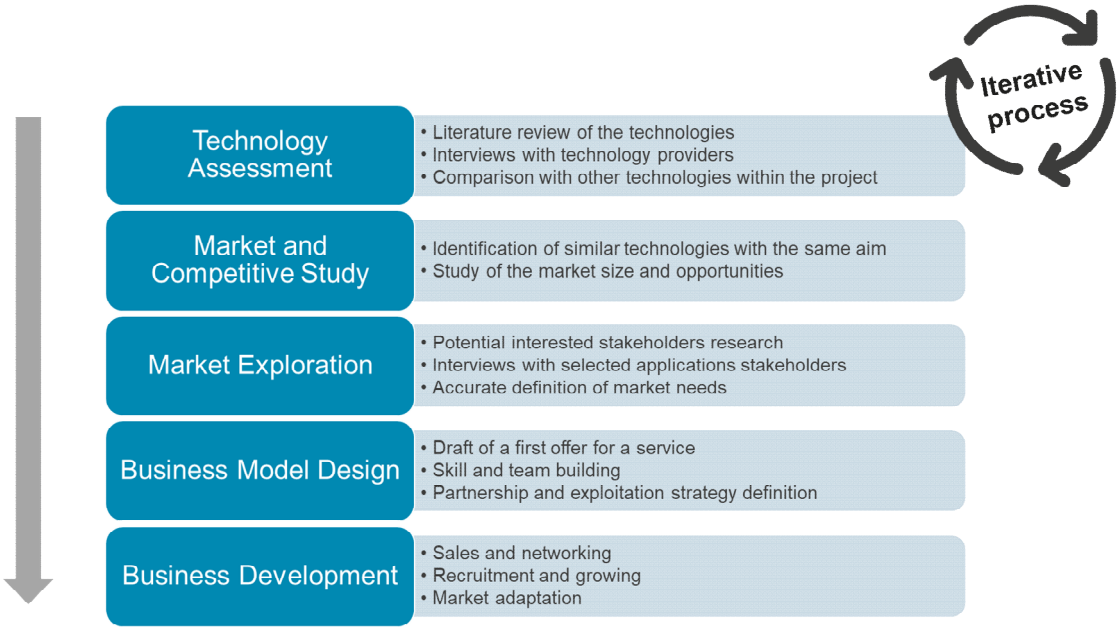


Figure 9: Iterative process of startup development

This process is an iterative methodology to develop a spinoff, which does not aim be followed step by step. Even if a kind of hierarchy can be highlighted from the technology analysis to the business development, the experiences show that all steps are interdependent, which implies that all actions will be undertaken by iteration until reaching a certain spinoff concept maturity.

3.2.3.1. Technology assessment

At this stage, Strane team will already have initiated the study of some technical aspects of the partner technology based on the information available early in the project.

According to the agreement between partners, all technical knowledge will be transferred to persons in charge of the exploitation. This transfer will help to study and design a commercial offer technically feasible in collaboration with the technology owner.

3.2.3.2. Market potential and competitor analysis

The objective of competitor analysis is to have a global vision about who are the main competitors and what are their characteristics and their products. This analysis will be carried out in collaboration with all voluntary partners.

A template will be shared by Strane Innovation to the consortium partners.
Competitors will be analysed in detail with all stakeholders involved. It will provide first pieces of information to define the value proposition and set an action plan for 6 – 9

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

months. Some business models will be imagined to be tested on the market. Based on this first concepts, Strane team and/or the partner(s) will start the market exploration to develop the spinoff.

3.2.3.3. Market exploration

According to the agreement defined previously, Strane team will undertake and/or coordinate the market exploration of the KERs selected and spinoff concept designed. This step aims to assess the market and competitive advantage. Initial contacts will be carried out with potential clients outside the consortium, starting as far as possible to pre-sell the technologies and/or services based on Ultimate knowledge.

Depending on the KER and the spinoff concept, proposals could be submitted to potential costumers/users in collaboration with other partners. These trials will provide feedbacks on the potential to create a startup/spinoff and will mature the concept during the project.

The market exploration will lead to iteration with other steps. A duration of 6 – 9 months of startup prototyping is planned. This step succeeds once the first proposal has been accepted.

Strane Innovation will report these feedbacks and will consider it for next steps beyond the project in the D5.7 “ULTIMATE Plan for exploitation beyond project lifetime”.

3.2.3.4. Business model design

If a commercial need is validated, which means that the concept met its first clients, then the process to create a start-up will be pursued. Strane Innovation will adjust the business model of the spinoff in collaboration with partners involved based on the lessons learned during the market exploration.

The following key elements of the business model canvas will be determined:

- **Customer segments**
- **Value proposition**
- **Competitors**
- **Channels**
- **Customer relationship**
- **Revenue streams**
- **Key partners**
- **Key resources**
- **Key activities**
- **Cost structure**

If the KER is a circular good practice or a “synergy” short-listed in the D5.1, Strane will propose an innovative business model thanks to its experience in other circular

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

projects. This will be part of the work to be carried out in the task 5.2 "Development of new business models"

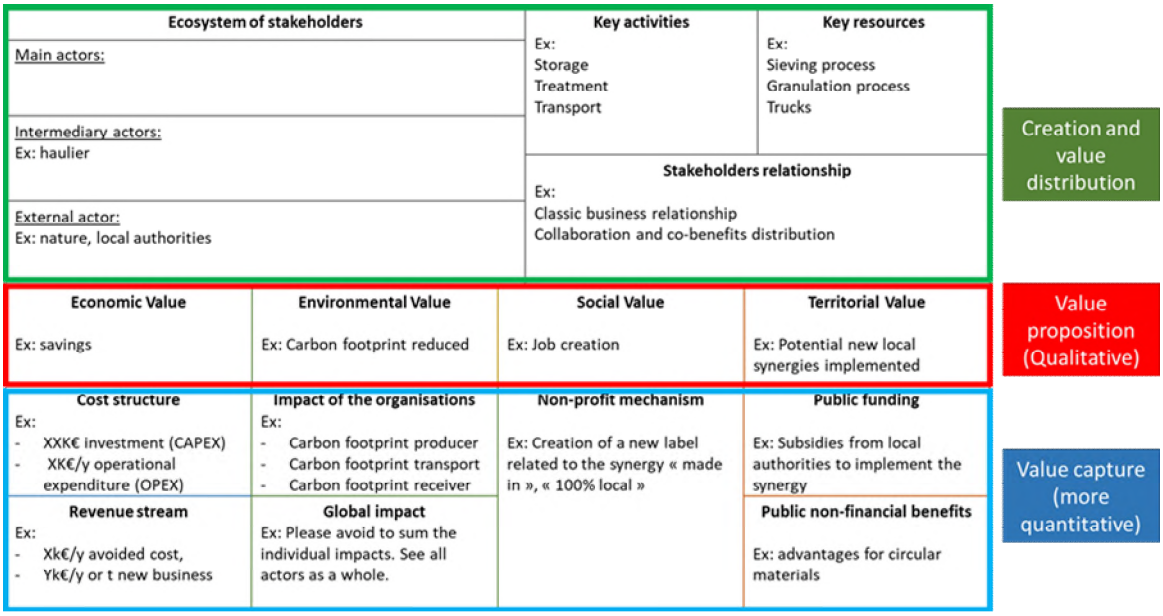


Figure 10: Business model canvas for synergies (Source: Strane)

In this case, these business models will be integrated to the organisation of the partner in charge of the replication.
These business models could be presented to the consortium members involved to bring a global vision and agree on the new business model.

3.2.3.5. Business plan design

In order to prepare a business plan beyond the project, Strane will conduct further analyses before the end of the project for promising spinoffs. Following elements of analysis could be gathered:

- **Risk analysis aims to:**
  - Identify all risks related to the development of the spinoff and its operations (strategic, financial, operational and compliance risks);
  - Assess these risks with a risk index;
  - Propose a management plan.
- **Financial analysis: Once the costs and benefits assessed, the financial strategy will have to be set according to potential subsidies, incomes, investment, etc.**
- **Market analysis: Key figures about the customer segments can be assessed based on the business model selected previously.**

These pieces of information will help to design the business plan for the spinoff(s) selected at the end of the project in the D5.8 and D5.9.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

3.2.4. Individual exploitation strategy development

The final step of the methodology was dedicated to consolidating the exploitation strategy of the project. In this phase, the exploitation grids were revised and updated based on the discussions held during the exploitation interviews.
The output produced at the end of the process is the final exploitation strategy presented in the following section.

3.3. Exploitation webinar feedbacks

The exploitation workshop was held online on the 21th of January 2021. The complete list of meeting attendees is reported below:

Table 4: List of attendees

Name	Organisation
Alexandra Jaunet	Strane Innovation
Gerard van den Berg	KWR
Camillo Palermo	ASA Azienda servizi ambientali Spa
Antonio Gimenez Lorang	FCC Aqualia
Chiara Cusenza	Consorzio ARETUSA
Marc Pidou	Cranfield University
Dimitri Iossifidis	Greener than Green Technologies
Angel Aguilera	Aquabio Ltd.
Kleyböcker, Anne	Competence Center for Water Berlin
Stéphane DEVEUGHELE	SUEZ Smart Solutions
Isam Sabbah	Galilee Society and AgRobics
Georgios Karakatsanis	National Technical University of Athens (NTUA)
Myrto Touloupi	Greener than green technologies
Romain UTHAYAKUMAR	Strane

3.3.1. Expectations from participants

A survey has been sent to register attendees before the webinar and to gather their expectations and questions about exploitation. 15 answers were gathered, and the following expectations were collected:

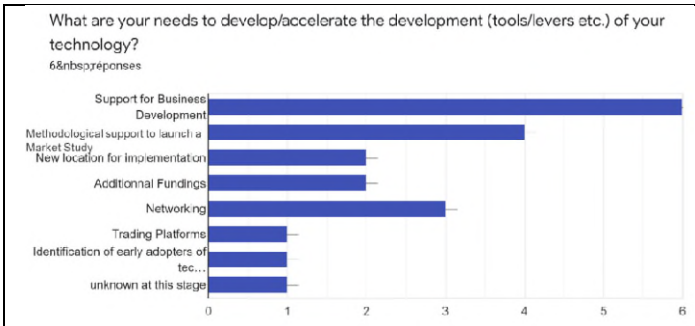
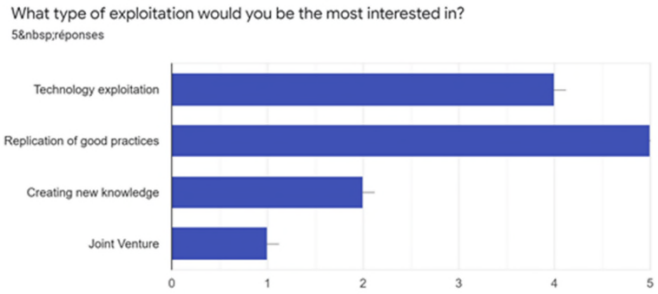
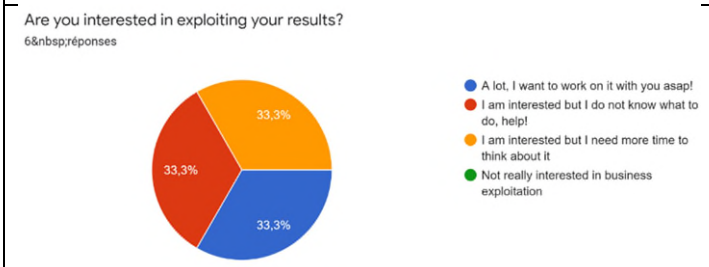
- Better understanding WP5 activities and identify interactions with other WP.
- Understanding what exploitation is, through real life examples and success stories Strane had from other projects.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

3.3.2. Interactive survey results

Another questionnaire has been used during and after the webinar, it collected 8 answers and aimed to identify promising technologies and interested partners. It also provided data on partners priorities and needs to start exploiting their solutions (technologies, services, CS replication etc.). It produced the following results:

Table 5: Interactives results

 Figure 11: Needs to accelerate the development of their technology according to participants (Source: Strane)	From respondents, support for business development is the main need to accelerate the development of their solution. It is followed closely by the lack of methodology to launch a market study and networking issues. Strane will be able to provide support for interested partners after bilateral interviews and technology screening.
 Figure 12: Exploitation pathways of interest for participants (Source: Strane)	Most of survey respondents were interested in replication of good practices or technology exploitation. Creating new knowledge would be a potential output in the long run of the project and might yet be difficult to imagine. Joint Venture require a good understanding of both technologies and market, as such it has been less cited than the other type of exploitation.
 Figure 13: Survey on the interest developed by participant for exploitation at the end of the webinar (Source: Strane)	No respondent has declared not being interested by exploitation activities. Two third of respondents were interested and wanted to start exploitation activities right away. A third was interested but did not think their solution was mature enough to start exploitation activities.

3.3.3. Q&A session

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

During the webinar, it appeared that the difference between identification of synergy creation (Task 5.1) and exploitation of technologies (Task 5.3) was not clear. It provided Strane with the opportunity to state the difference: to create synergies, the focus should be on a waste that has no other application but landfill or incineration and find a valorisation in another industrial sector. It is different from technology exploitation or replication processes among case studies, both belonging to Task 5.3. Synergy creation will be discussed in deliverable D5.1.

3.3.4. Set up of Interviews for further exploitation

Meetings have been planned with technology providers and partners to discuss exploitation activities. So, far Strane has organised four meetings with technology providers.

Table 6: Meetings with technologies providers

Partner interested	Date of the meeting	Name of the Solution	Proceedings
NTUA	12/02/2021	Chemical Leasing	Possible contribution to the T5.4 “Circular Economy Finance”
Greener Than Green Technologies	24/02/2021	Equipment sales	Strane will proceeding with market research for GTG technologies for French and European market to see the potential in the market.
Institute of Applied Research, Galilee Society & AgRobics Ltd.	04/03/2021	Start-ups	Strane will proceeding with market research for GTG technologies for French and European market to see the potential in the market.
SUEZ RR IWS CHEMICALS	30/03/2021	Sulphur valorisation process (from waste incineration)	Interest for a market analysis focused on sodium bisulphite. First results will be presented in the D5.1 and further research could be initiated by M18. No replication opportunities have been identified during this meeting.

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

4. Exploitation strategies

Strane perform some interviews with the partners in T5.1 & T5.3 to obtain the preliminary data on technologies and willingness of the partners towards exploitation. Partners filled the table of content for the exploitation strategy. Results are presented in this section.

4.1.1. KWR

Table 7: Exploitation strategy of KWR

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: KWR KWR Water Research Institute generates knowledge to enable the water sector to operate water-wisely in our urbanised society. At KWR, we have a sense of professional and social responsibility for the quality of water. Our scientific findings and the resulting practical innovations contribute, worldwide, to a sustainable water provision in the urban water cycle. 'Bridging science to practice' is KWR's motto. Our researchers work at the interface of science, business, and society. Their strength lies in their translation of scientific knowledge into applicable, practical solutions for end-users in the Dutch and international water sector. We have built a solid reputation as top-level innovation accelerators and international network builders, and increasingly play a coordinating role in national and international collaborations.	
Exploitable result	**1 Technology Evidence Base** **2 Closed loop greenhouses with water and nutrient recycling** **3 High-Temperature ATES methods (TRL5→7)** **4 Governance tools** **5 WSIS Digital Marketplace (TRL 5-7)**
Category	Marketable
Owner/Co-owners	KWR
IPR	**Patenting, Copyright, Trademark, Open Access Solution**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Public authorities;** • **Consultancies;** • **Industry (Agro-food, chemical, manufacturing, biotech);** • **Industrial Park operators;** • **Energy utilities;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Exploitation Form	• **follow-up research,** • **Feasibility/Design studies** • **Policy change / Standards /guidelines** • **new spinoff/Start-up/Joint venture** • **consulting service,** • **patent licensing / transfer agreement**
Benefits/competitive advantages	• **Access to technology showcases.** • **Reduction of costs and reduction of primary resource use.** • **Exploitation of residual heat** • **B2B matchmaking** • **PPP**
R&D	N/A
Exploitation Strategy	KWR will increase knowledge on circular solutions and industrial symbiosis and mature innovative technologies with demonstration activities. KWR's global outreach is supported by its coordination of the Watershare network, a global alliance of water companies, technology providers and research institutes. KWR will utilise the Watershare platform to gain additional traction for ULTIMATE applications and knowledge on a global scale.

4.1.2. EUT

Table 8: Exploitation Strategy for EUT

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: EUT EURECAT is a non-profit private technological centre whose aim is to efficiently contribute to improve the competitiveness and the technological and sustainable development of companies by providing specialized services and carrying out R&D and innovation projects. EURECAT has participated in numerous projects and individual contracts aimed at innovation, development, testing and optimization of water treatment and reuse technologies, in urban, agriculture, industrial and environmental sectors. Among its expertise fields, EURECAT has large experience and knowledge of the mechanisms involved in separation technologies and biological treatments for water and wastewater treatment. Furthermore, EURECAT has large experience in Life Cycle Assessment (LCA) and Life-cycle Cost (LCC) studies.	
Exploitable result	**1 nZLD system for industrial water reuse TRL(5→6)** **2 Zeolite adsorption for ammonia removal TRL(6→7)** **3 Ammonia recovery methods**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	4 WSIS Ontology TRL(4→6)
Category	Marketable
Owner/Co-owners	EUT, AITASA
IPR	**Patenting, Trademark, Open Access Solution**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **follow-up research,** • **Feasibility/Design studies** • **new spinoff/Start-up/Joint venture** • **consulting service**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **equipment sale** • **patent licensing / transfer agreement**
Benefits/competitive advantages	The demonstration of a nZLD scheme for industrial reclamation will allow EURECAT to gain knowledge on the application of technologies for brine minimization in water treatment (mainly the combination of RO and Membrane distillation). The knowledge will be useful for future projects and for providing consultancy services to other industries regarding brine management strategies. The use of zeolites for the removal of ammonia in reclaimed water will mainly provide knowledge to the Eurecat's unit on the application of this technology for water treatment at low inlet ammonia levels.
R&D	Desalination is one of the main areas of research of Eurecat. In particular in the Water, Air and Soil (WAS) unit, several projects dealing with brine management with different strategies are being conducted. It contributes to the research line of water treatment and recovery of products. The zeolite could be used to recover the ammonia from the tested streams and used as a by-product.
Exploitability Level	Low to medium (1-2 level)
Exploitation Strategy	EUT will exploit the knowledge in ZLD schemes for industrial water reclamation. Exploitation will be conducted by providing scientific consultancy services to the industrial and urban water sector. As expert in ICT4Water, EUT will exploit smart applications, semantic vocabularies and metadata to WSIS matchmaking through patents or granted licenses throughout EUT's customer network (Deltares, Suez Environment,

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	INCLAM, Stadtwerke Karlsruhe, ACA, AGBAR, BCASA, etc.) or by consultancy services. EUT envisions to contribute at least to 2 ICT water standards and pre- normative documents.

4.1.3. AITASA

Table 9: Exploitation strategy for AITASA

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: AITASA Aguas Industriales de Tarragona Sociedad Anónima (AITASA) is a company founded in 1965 to supply water to industries, mainly chemicals that were then beginning to be established in the Tarragona industrial estates. AITASA has an infrastructure that has become strategic to support the Public Administrations of the territory in times of crisis (the salinization of the decade of the 1970-80s, or the drought of 2007-08)	
Exploitable result	**1 nZLD system for industrial water reuse**
Category	Marketable
Owner/Co-owners	X-Flow/Pentair
IPR	**Patenting, Trademark**
End user	• **Water utilities;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Energy utilities;**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	The demonstration of a nZLD scheme for industrial reclamation will allow AITASA to gain knowledge on the application of technologies for brine minimization in water treatment (mainly the combination of RO and Membrane distillation). The knowledge will be useful for future projects and for providing consultancy services to other industries regarding brine management strategies.
R&D	Desalination is one of the main areas of research of AITASA. In particular in the Water, several projects dealing with brine management with different strategies are being conducted.
Exploitability Level	Highly exploitable level (3)
Exploitation Strategy	AITASA aims to build a tertiary treatment for the new industrial WWTP of the petrochemical complex with the new ULTIMATE scheme to increase reclaimed water production from 19.000m^3 /day nowadays, with an increase in overall efficiency of 20%. Increasing water availability in the chemical and petrochemical sector by demonstrating novel near ZLD schemes for water

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	reclamation. At least 40% of reclaimed water usage, substituting conventional water sources in the sector.

4.1.4. AQUABIO

Table 10: Exploitation Strategy for AQUABIO

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: AQUABIO Aquabio is a pioneering company born with a passion for innovation combined with a strong ethos for environmental sustainability. We provide some of the world's most advanced systems for the treatment and reuse of industrial wastewater at our customer facilities. We deliver solutions from concept development through to complete installation and operation.	
Exploitable result	**1 AnMBR (with posttreatment) for beverage WWtreatment** **2 Heat recovery from AnMBR effluent** **3 Ammonia recovery methods** **4 Phosphorus recovery methods**
Category	Marketable
Owner/Co-owners	X-Flow/Pentair
IPR	**Patenting, Trademark**
End user	• **Water utilities** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators** • **Energy utilities**
Exploitation Form	• **follow-up research** • **Feasibility/Design studies** • **equipment sale**
Benefits/competitive advantages	**AnMBR (with posttreatment) for beverage wastewater treatment**: A nutrient recovery stage, if required) to generate high quality water that can be reuse in this case at the distillery, to partially close the water loop. The successful demonstration of the integrated system may lead to implementation at full scale at the distillery, will enable the improvement/expansions at other existing sites with operational AnMBRs and the implementation in future designs. **Heat recovery from AnMBR effluent:-** this KER by using the knowledge developed to enable the design and implementation of more energy efficient and competitive systems.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	Ammonia Phosphorus recovery methods: the identification of the most appropriate technology for ammonia recovery from effluent with high concentrations of ammonia and phosphorus in terms of operational costs, performance and quality of products generated.
R&D	The development and manufacturing of fully integrated advanced systems for the treatment and reuse of industrial wastewater is the core business of Aquabio. It is essential for Aquabio to meet current and future market trends in water reuse, keeping leading companies ahead of their competition in a number of industries through sustainable innovation and technology development. The KER "Heat recovery from AnMBR" supports Aquabio's R&D strategy by the identification of possible uses for the recovered heat, by increasing the understanding on the energy balance of the advanced integrated treatment train and by identifying the optimum use of the heat available.
Exploitability Level	Highly exploitable level (3)
Exploitation Strategy	Exploitation of KER 'AnMBR (with posttreatment) for beverage WWtreatment' , KER 'Ammonia recovery methods' and KER 'Phosphorus recovery methods' through the equipment (systems/solutions) sale in the industrial sector (agro-food, chemical, manufacturing, biotech) and follow-up research.

4.1.5. AQUALIA

Table 11: Exploitation Strategy for AQUALIA

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: AQUALIA Aqualia is a private water management company that covers the whole water cycle, managing water and wastewater services more than 1000 towns and cities. Aqualia serves more than 25 million people in more than 20 countries, focusing on Portugal, Italy and the Czech Republic, as well as Latin America.	
Exploitable result	**1 Anaerobic food & beverage WW treatment including water reclamation/ reuse.** **2 Biogas production in anaerobic bioreactors**
Category	Marketable
Owner/Co-owners	X-Flow/Pentair
IPR	**Patenting, Trademark**
End user	• **Water utilities;** • **Consultancies;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	• **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **equipment sale** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	**Anaerobic food & beverage WW treatment including water reclamation/ reuse**:- Consolidation in the industrial wastewater treatment sector, specifically in the industrial water reclamation market, Deep know-how in design, engineering and realistic CAPEX/OPEX, OPEX optimization in existing WWTP based on MBR technology by means of online measuring of sludge filterability. **Biogas production in anaerobic bioreactors:-** Market presence with a fully commercial competitive technology in the F&B WW sector. Active reference at pre-commercial scale to demonstrate techno-economic validity or to do tests with potential end-users. Deep know-how in design, engineering and realistic CAPEX/OPEX. OPEX optimization in existing digesters by means of using fuel cell.
R&D	The R&D department in Aqualia is responsible of helping to develop, improve or demonstrate KER that meet a real need in Aqualia. Thus, the search of KERs are the engine that boost the R&D department..
Exploitability Level	Highly exploitable level (3)
Exploitation Strategy	Proposed technologies are close to commercial technologies in consolidated markets. Therefore, we are very confident to expect high level / possibilities of exploitation. New physical references based on the developed technologies in Ultimate would be one of the main priorities. Linked tools to achieve this increase in the market presence (like patents) may be also prioritize. Finally, developments like the filterability measurement in MBR installations or the use of fuel cells, should bring savings in terms of OPEX.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

4.1.6. ARETUSA

Table 12: Exploitation strategy for ARETUSA

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: ARETUSA ARETUSA Consortium is a no-profit consortium consisting of: ASA Azienda Servizi Ambientali Spa, which is the company for Environmental Services of Livorno, water utility; Solvay Chimica Italia spa, the local industrial site; and TME Termomeccanica Ecologia Spa, which is the technology provider, the one who designed the ARETUSA Water Reclamation Plant.	
Exploitable result	**1 Real-time data driven monitoring and process control for salinity management.** **2 Data-driven matchmaking platform for water reuse**
Category	Marketable
Owner/Co-owners	WEST, UNIVPM
IPR	**Patenting, Trademark**
End user	• **Water utilities;** • **Public authorities;** • **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech** • **Industrial park operators;**
Exploitation Form	• **follow-up research,** • **Policy change / Standards /guidelines** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **consulting service,** • **equipment sale** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	**Real-time data driven monitoring and process control for salinity management**:- The benefits for the organization from a commercial point of view would be linked to the advantage of being able to guarantee more reclaimed water to Solvay for the cooling processes, limiting the withdrawal of freshwater, and potentially aiming at trying to expand the use of reclaimed water even for other end-users as well (local industries, agriculture...).. **Data-driven matchmaking platform for water reuse bioreactors:-** A matchmaking platform is an important tool to facilitate relationships and contribute to the development of a new culture and new projects: it means new business through an intense research program
R&D	**Real-time data driven monitoring and process control for salinity management:-** It helps ASA to analyse any problems related to the quality of the sewage system and it will allow a

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	better management flexibility at the ARETUSA plant, with the aim of providing Solvay with a greater and more suitable water flow. Furthermore, the process control could allow to analyse potential solution even to improve ARETUSA WRP processes efficiency. **Data-driven matchmaking platform for water reuse bioreactors: -** This KER allow us to explore and assess more and more solutions and business opportunities. In general, the collaboration gives rise to original design ideas, multidisciplinary synergies, expansion of markets, new products and services, exchange of information and knowledge. This is critical in terms of development.
Exploitability Level	Highly exploitable level (3)
Exploitation Strategy	Right now, our priority is to implement the real time data monitoring systems, starting to assess the strategy for salinity management. After that we will be able to define our ambitions in terms of matchmaking platform, even improving the processes efficiency in ARETUSA WRP. Exploration of energy recovery.

4.1.7. UNIVPM

Table 13: Exploitation strategy for UNIVPM

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: UNIVPM UNIVPM is a Polytechnic University located in the Mediterranean area. At UNIVPM water science and engineering is addressed from sustainability, circularity and resilience of urban water services and infrastructure to surface and groundwater and to the coastal and seawater sustainable management and environmental protection.	
Exploitable result	**1 Data-driven matchmaking platform for water reuse**
Category	Marketable
Owner/Co-owners	UNIVPM
IPR	**Patenting, Trademark**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Public authorities;** • **Consultancies;** • **Industry (Agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Exploitation Form	• **follow-up research,** • **Policy change / Standards /guidelines** • **Demonstrators and prototypes,** • **consulting service,**
Benefits/competitive advantages	Possible business model for the exploitation of the matchmaking platform is mainly a service model and consultancy. The tool will facilitate design, feasibility studies, operation and optimization of Water Resource Recovery Facilities to replicate the approach validated in ULTIMATE to improve local and territorial management of municipal, industrial and agricultural demand and supply of water.
R&D	We will be able to interlink industrial needs with management of urban water infrastructure. As follow up we can design the superstructure that is able to optimize the urban water cycle services (e.g. wastewater treatment and collection) by considering also the interface with local industry and agriculture.
Exploitability Level	Highly exploitable level (3)
Exploitation Strategy	UNIVPM will gain knowledge on water-smart industrial symbiosis. Exploitation will incur publications and presentations at conferences. The results will be managed by the technology transfer office in support of the creation of start-ups.

4.1.8. KALUNDBORG

Table 14: Exploitation strategy for Kalundborg

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: KALUNBDORG Kalundborg Utility is a company that handles both water supply & distribution (groundwater & surface water), wastewater treatment from municipality/industry and heat recovery to support district heating.	
Exploitable result	**1 Data driven Joint Control system for WWTP operations.** **2 Fit-for-purpose-water** **3 Energy** **4 Material recovery**
Category	Marketable
Owner/Co-owners	EUT, AITASA
IPR	**Patenting, Copyright**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	• **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial Park operators;**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **consulting service,** • **equipment sale**
Benefits/competitive advantages	Lack of water resources is a hot issue both for our food, biotech, pharma industries, but also for the public which has a significant concern regarding those resources and the nature. Increasing WWTP energy efficiency in both Novozymes (NZ) and Kalundborg Utility (KCR) Increasing energy efficiency on heat pump at KCR as a conceptual study Physical trials, investigate potentials among stakeholders. Discover potentials in recovery of valuable nutrients, materials as a conceptual study
R&D	N/A
Exploitation Strategy	KALUND aim to invest in water-reuse from wastewater directed at the specific needs for water quality the present freshwater production is not sustainable, wetland biotopes around Lake Tisso are at risk and further growth of the local industry as well. Therefore, KALUND aims to reuse a minimum of 300,000 m^3 by 2021 and 600,000 m^3 by 2023 which would replace the current usage of untreated lake water by 100%.

4.1.9. X-FLOW

Table 15: Exploitation strategy for XFLOW

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: X-FLOW Production company Developer of membrane-based filtration technologies and one of the world's most renowned pioneers of membrane technology.	
Exploitable result	1 **Treatment of biotech WW based on novel membranes in combination with pre-treatment**
Category	Marketable
Owner/Co-owners	N/A
IPR	**Patenting, Trademark**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **Follow-up research** • **Feasibility / Design studies** • **Demonstrators and prototypes** • **consulting service** • **equipment sale**
Benefits/competitive advantages	The KER will extend the business options both for field of application and the exploitation of a new type of membrane. The knowledge and experience of this KER will be used in other projects. It can be employed in numerous other industries, such as chemical and petrochemical.
R&D	the KER fits perfect in X-Flow' s strategy being one of the world's most renowned pioneers of membrane technology
Exploitability Level	Medium to High (2-3)
Exploitation Strategy	X-Flow will always try to exploit for options to test and exploit new membranes, also for this specific application of reuse of biotech wastewater

4.1.10. GAL/AGROBICS

Table 16: Exploitation strategy for GAL/Agrobics

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: GAL/AGB The Institute of Applied Research, the Galilee Society is the scientific-strategic arm of the GS, is supported by the Ministry of Science and Technology. Researchers at the Institute conduct basic and applied research on community-centered projects that address the environmental and health needs of the Arab population in Israel.	
Exploitable result	**1 Biogas production in anaerobic bioreactors**
Category	Marketable, Knowledge, Policy makers
Owner/Co-owners	GAL/AGROBICS
IPR	**Patenting, Trademark**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **equipment sale** • **patent licensing / transfer agreement.**
Benefits/competitive advantages	
R&D	Empower the staff and the infrastructure of the Institute.
Exploitability level	High interest (3)
Exploitation Strategy	**AGB/GAL** will sell its highly stable anaerobic treatment (either immobilized-based and/or combined with AnMBR) to improve the tolerance for agro-industrial effluent (mainly olive mill wastewater) in medium to large WWTP, with ROI of 2-4 years, 20-30% more biogas, less sludge production and energy consumption.

4.1.11. STRANE

Table 17: Exploitation strategy for STRANE

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: STRANE Strane is a startup studio, which create startups out of innovation from European projects. Strane has its expertise in exploitation and business creation. Seitiss, which is also subsidiary of strane innovation and has an expertise in industrial symbiosis and Circular economy. Implementing circular economy solution in Europe.	
Exploitable result	**1 Synergy identification Tool**
Category	Marketable
Owner/Co-owners	N/A
IPR	**Patenting, Copyright**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are:

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	• **Water utilities** • **Public authorities** • **Industry (agro-food, chemical, manufacturing, biotech)** • **Industrial park operators** • **Energy utilities**
Exploitation Form	• **new spinoff/Start-up/Joint venture**
Benefits/competitive advantages	Matchmaking software that allows for an efficent automated identification of IS pairing for European industrial sites based on location, industrial flows, industrial processes, etc.
R&D	N/A
Exploitability level	High interest (3)
Exploitation Strategy	STRANE and its start-up Seitiss will develop their matching system with new models on water-based synergies. STRANE will expand its network to prominent industrial sites in the world to sell Seitiss's services on other synergies. STRANE will advance its research on IS sustainable business models. STRANE aims also to create 2+ start-ups to exploit project results.

4.1.12. NTNU

Table 18: Exploitation strategy for NTNU

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: NTNU NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU, the Norwegian University of Science and Technology (NTNU) is the largest university in Norway. NTNU is headquartered in Trondheim, with campuses in Gjøvik and Ålesund.	
Exploitable result	**1 Multi use play spaces playbooks** **2 Immersive media experiences**
Category	Marketable
Owner/Co-owners	KWR, Water Europe
IPR	**Copyright, Trademark**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	• **Energy utilities;**
Exploitation Form	• **Feasibility/Design studies** • **new spinoff/Start-up/Joint venture** • **consulting service,**
Benefits/competitive advantages	A unique tool for novel citizen engagement and Artistic interventions for citizen engagement
R&D	N/A
Exploitability Level	2 - 0
Exploitation strategy	NTNU will further develop its Digital storytelling tools and Immersive media technology and enhance the capacities of the University's Artificial Intelligence Lab and NTNU ARTEC (the Art and Technology task force) to provide services to the Industry and to enhance the curriculum of the Engineering and Media Schools with novel forms of science education.

4.1.13. NTUA

Table 19: Exploitation strategy for NTUA

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: NTUA National Technical University of Athens is an academic partner and in Ultimate participates with the Laboratory of Hydrology and Water Resources Management. The expertise of the Laboratory focuses on water and wastewater engineering, urban water systems design, optimisation and performance assessment.	
Exploitable result	**1 KPI Assessment Tool** **2 WSIS Digital Marketplace**
Category	Marketable
Owner/Co-owners	KWR, EUT, WE
IPR	**Patenting, Copyright, Open Access Solution**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Consultancies;** • **Standardization bodies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Exploitation Form	• **follow-up research** • **Feasibility/Design studies** • **Policy change / Standards /guidelines** • **new spinoff/Start-up/Joint venture** • **consulting service**
Benefits/competitive advantages	The MP will help NTUA to promote its own work in the field and collaborate with end users seamlessly. As a product the MP is also an artefact NTUA intends to support, possibly in collaboration with relevant start-ups and spinoffs.
R&D	**KPI Assessment Tool**: NTUA will develop methods and tools (e.g. Sherwood plot, KPI framework) to then use to extent its innovative research portfolio for Industrial Symbiosis, identifying and supporting business opportunities related to industrial symbiosis. **WSIS Digital Marketplace**: Around the MP, NTUA will also develop method and business concepts (water and chemical leasing approaches and links between performance and investment) to be used to both create additional research and innovation in water and environmental economics, and to provide services through spinoffs and early-stage start-ups.
Exploitability Level	High Exploitability Level 3
Exploitation strategy	The development of assessment methodologies and business concepts to support the design of environmentally sustainable and economically optimal industrial symbiotic schemes

4.1.14. UNEXE

Table 20: Exploitation strategy for UNEXE

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: UNEXE The Centre for Water Systems-UNEXE (CWS) is internationally renowned for its research into water systems engineering. Supporting, developing and operationalising sustainable water management is a key challenge for the future that is strongly addressed by the Centre's activities. This includes research into water supply and distribution systems, waste water and urban drainage systems, flood risk management, and smart water systems.	
Exploitable result	1 **HMS Simulation & Stress-Testing** 2 **Interactive Gamified Visualisation Tool**
Category	Marketable, Knowledge, Policy makers
Owner/Co-owners	EUT, AITASA
IPR	**Trademark**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **follow-up research,** • **new spinoff/Start-up/Joint venture** • **consulting service** • **equipment sale**
Exploitation Form	• **follow-up research** • **Demonstrators and prototypes** • **new spinoff/Start-up/Joint venture** • **consulting service**
Benefits/competitive advantages	Assess symbiosis paths under different conditions to enhance transferability; Improved collaborative decision-making.
R&D	N/A
Exploitability Level	Highly Exploitable
Exploitation strategy	UNEXE will build on its Centre for Resilience in Environment, Water and Wastes build with South West Water utility and seek opportunities for scaling up ULTIMATE applications via its ongoing business partnership facilitators (e.g. SETsquared, Impact Lab). It will also organise special sessions in International Conferences (e.g. HIC, WDSA, CCWI, IAHR, IWA specialised conferences) and special issues in journals (e.g. Hydroinformatics, Urban Water, ASCE journals and STOTEN).

4.1.15. KWB

Table 21: Exploitation strategy for KWB

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: KWB The Berlin Centre of Competence for Water (Kompetenzzentrum Wasser Berlin gGmbH, KWB) is an international non-profit research center on urban water systems. The execution of R&D projects, and the dissemination of project results together with the organization of conventions and symposia. The KWB has a staff of 30 full-time persons, who are active in projects mainly related to water resource management and innovative water and wastewater treatment technologies.	
Exploitable result	**1 Technology Evidence Base**
Category	Marketable
Owner/ Co-owners	KWB
IPR	**Patenting, Copyright**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Public authorities;** • **Consultancies;** • **Industry (Agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **follow-up research,** • **Feasibility/Design studies** • **Policy change / Standards /guidelines** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **consulting service,** • **equipment sale** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	Access to technology showcases and use as reference to exploit in the market.
R&D	N/A
Exploitability Level	Highly exploitability
Exploitation strategy	KWB will expand its capacities in LCA and risk assessment from municipal water system to industry-water utility symbiosis, to be offered for other research projects and consulting services especially to Berlin Water Company. The activities in Kalundborg will also expand the capacities of KWB on the strategic topics of WWTP modelling and water reuse.

4.1.16. SUEZ RR

Table 22: Exploitation strategy for SUEZ RR

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS
PARTNER: SUEZRR SUEZ is an industrial solutions and services group specialized in the reuse and safeguarding of resources, with extensive knowhow in water, water treatment, consulting, and the reuse and recycling of waste. For decades, the Group has been providing industrial customers and local authorities with the expertise and services of its remediation activity, specialized in the preservation of water resources and the reuse of contaminated sites. SUEZ's ROBIN plant produces local, green, sustainable and competitive energy from non-recyclable waste wood to

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

supply the 15 sites on the Roussillon chemical platform and to support them in their energy transition. SUEZ RR IWS CHEMICALS operate incinerators for hazardous and non-hazardous liquid waste (aqueous and organic) coming both from co-located industries and elsewhere (via tanker trucks). Water used to wash flue gas resulting from incineration is sent to a WWTP on-site.	
Exploitable result	1. **Method for recovery of sulphur from flue gas** 2. **Recovery of metals from the flue gas cleaning water**
Category	Marketable
Owner/ Co-owners	SUEZ RR
IPR	**Patenting, Trademark**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **follow-up research,** • **Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture** • **consulting service,** • **equipment sale** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	Decrease emissions and produce marketable products replacing primary raw materials
R&D	N/A
Exploitability Level	Highly Exploitability
Exploitation strategy	SUEZ-RR will significantly improve sulphur recovery by setting up an industrial pilot on site and conducting major experimental and modelling work, leading to an investment of several million euros for the equipment by 2026. The new unit should generate more than 1M€/y and lead to increased customer loyalty. Replication is foreseen to the 2 other incinerators managed by IWS in Europe and to new customers.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

4.1.17. WE

Table 23: Exploitation strategy for WE

SUMMARY OF INDIVIDUAL EXPLOITATION PLANS	
PARTNER: WE Water Europe is a multistakeholder association representing the whole water value-chain and is the recognised voice and promoter of water-related RTD and innovation in Europe.	
Exploitable result	**3. WSIS Living Labs**
Category	Marketable
Owner/ Co-owners	WE
IPR	**Open-Source Solution**
End user	Depending on the R&D process design structure within the industry the profiles that might get information from our results are: • **Water utilities;** • **Public authorities;** • **Consultancies;** • **Industry (agro-food, chemical, manufacturing, biotech);** • **Industrial park operators;** • **Energy utilities;**
Exploitation Form	• **Policy change, Demonstrators and prototypes,** • **new spinoff/Start-up/Joint venture,** • **consulting service,** • **equipment sale** • **Patent licensing / transfer agreement.**
Benefits/competitive advantages	To support members and non-members of WE to develop collaborations for the market up-take and scale up of innovative solutions.
R&D	By allowing different stakeholders to collaborate in the same context with a systemic approach
Exploitability Level	Depend on maturity
Exploitation strategy	WE will support the deployment of the Digital Marketplace as a new added-value service to its partners. WE will also connect to the ULTIMATE ecosystem and support its links to the wider water community it represents. Of interest to WE is the concept of LLs which will benefit from the project's work on WSIS oriented LLs

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5. Start-ups concepts

5.1. SEITISS Business Activities

5.1.1. Presentation

During the SCALER and EPOS project, STRANE generated key results, databases and knowledge to be transferred and exploited. In that sense, STRANE INNOVATION created Seitiss. Seitiss is a start-up providing an innovative IS toolbox to Industrial sites and local authorities. Seitiss was launched by STRANE team in mid-2018. The first offers were initially based on the methodology, databases, and matching algorithms. Seitiss offers IS services to public actors and industrial sites and aims to become a major industrial synergy creator and manager.

Seitiss made an assessment of the IS potential at a local authority scale and is currently studying numerous synergies for private companies and has already implemented and managed three synergies. The timeline in Figure 14 introduces the major development steps since 2018.

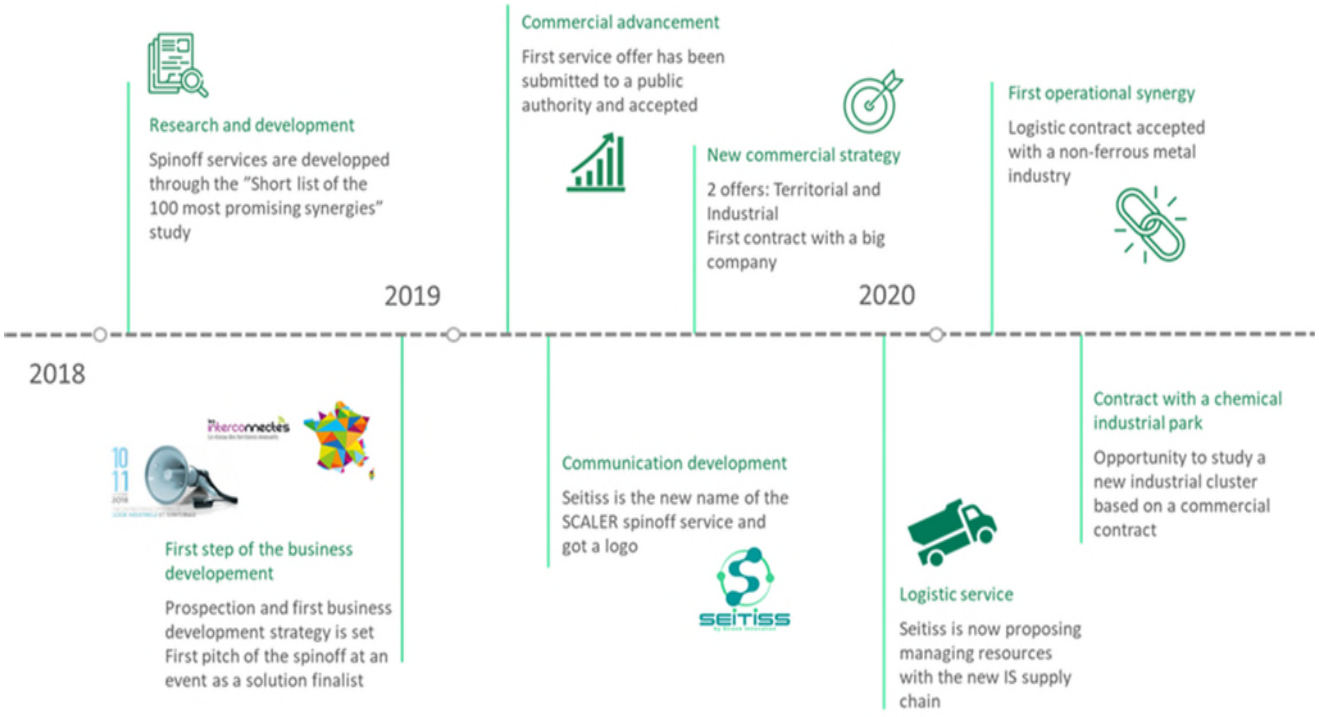


Figure 14: Seitiss development timeline

Seitiss operates in French industrial territorial areas but aims to deploy its offers across EU. It brings a real added value to actors wishing to develop circular economy initiatives.

Seitiss aims at becoming a leading actor to find and manage industrial synergies.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

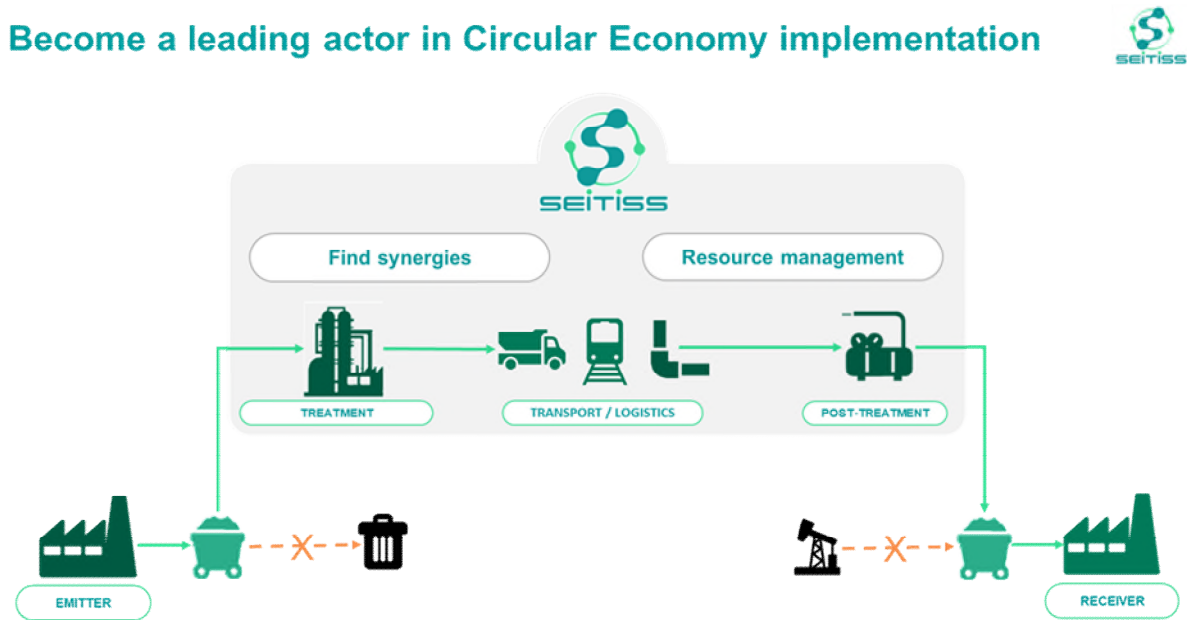


Figure 15: Synergy implementation

5.1.2. Technology

STRANE has developed a range of innovative tools for the creation of industrial synergies. Seitiss identifies alternative resources and waste valorisations through industrial synergies thanks to an unique automatic synergy identification system (models and algorithms), finds partners within an economically viable radius thanks to our database of geolocated sites, then sets-up/implements and manages the synergy. Tools are presented in the figure below.

I. **The synergy identification is supported by the matchmaking tool. Other resources are used (synergies databases and knowledge repositories) to complete the matchmaking tool potential.**
II. **The research of potential partners within a viable radius is supported by all geolocated industrial sites database.**
III. **Business cases are provided to each individual stakeholder and are based on the framework developed within EPOS and SCALER. This method provides a comprehensive business models to aid in decision making and implementation. It will be further studied within ULTIMATE in the T5.1.**

Creating an industrial synergy is a complex and iterative process starting with the identification of opportunities on-site and ending with a successful setup and operation. A synergy finds value by increasing the waste stream intrinsic value and diverting it from landfill, incineration or realising in the nature. To reach a maximum impact and quick synergies implementation, Seitiss proposes two business offers.

1 **Research of valorisation routes or alternative raw materials deposits and synergy technical feasibility assessment: This service is mainly dedicated to industries and focus on a certain resource. It includes 1) a deep analysis of the resource of interest characteristics, 2) a synergy study step with the**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

identification of valorisation routes and the research of nearby potential partners to implement the synergy confirmed by an on-field survey, 3) a setting-up of the value chain by selecting the most adapted synergy, providers, and intermediates.

2 **Synergy implementation and resource management turnkey package: this offers build on the first one and corresponds to a full resource management package. Seitiss is the unique contact point for the industry and manage all aspects of the resource valorisation: logistics, providers and subcontractor's management, legal and administrative documentation, chartering, quality guarantee.**

These two services are presented in the figure below.

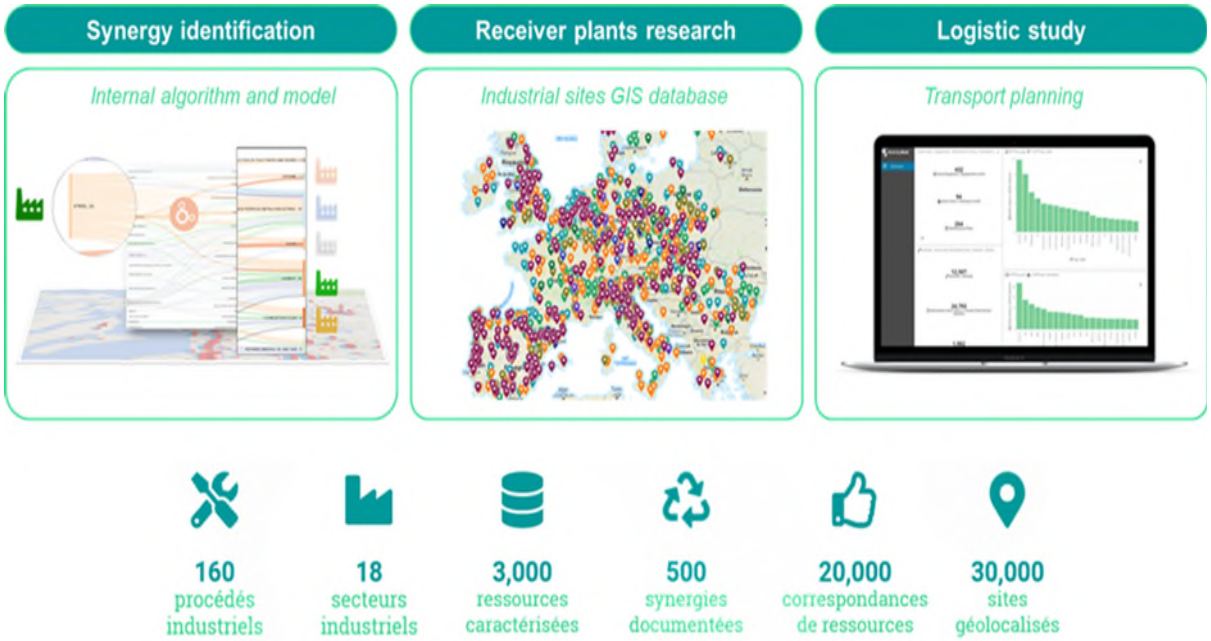


Figure 16: Tools and skills (Source: STRANE)

5.1.3. Use Cases

STRANE has designed several offers according to the needs of each actor. These offers are presented through the following kind of stakeholder.

i. For territorial actors

Territorial actors need to identify the strategic resources and potential synergies within their geographical area in order to wisely foster IS initiatives and increase their attractiveness. Seitiss proposes an identification of industrial plants that generate a certain amount of waste, lists and quantifies these resources and identifies all potential synergies that could be implemented:

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **Identification of all actors within the territory**
- **Characterisation of all inputs/output flows, equipment, services, etc. available or under exploited at the territory level.**
- **Research of synergies related to the potential resource in the area and with neighbouring regions.**
- **Facilitation of the initiative through workshop and a collective intelligence platform to generate complementary synergies ideas, identify cross-interest and prioritise/select projects to implement.**
- **Report and summarise strategic synergy implementation with an associated action plan.**

Seitiss can also stimulate the implementation process. These projects can often lead to feasibility study with industrial sites that have attended the workshops.

ii. Offers for industrial sites

IS approach is an alternative solution for companies that pay taxes or which have the willingness to be more sustainable. Seitiss solution can be applied in many situations, in particular:

- **Alternative raw materials research: the study proposed by Seitiss aims to find alternative raw materials compliant with the process and comparable in term of costs compared to the original raw materials.**
- **Alternative end of use for "waste resource": wastes that can be considered as resources become costly for companies to manage. Most of the time, Seitiss can find a solution to reuse it in another sector thanks to its database of resources and synergies.**

These needs have frequently been met during events and meetings with industrial companies and managers. Offers have been made accordingly with the following common basis phases:

- **Study of resource specifications (raw materials usually used or the waste resource characteristics)**
- **Research for synergies and relevant sectors to reuse/valorise it**
- **Prioritise the industrial sector interested in the resource**
- **Map and identify the corresponding installations at the regional scale**
- **Make a field survey and interview with technical expert**
- **Test the synergy by supplying samples to confirm the technical feasibility**
- **Find an intermediate actor that could treat the resource to make the synergy feasible (if needed) and find adapted conditioning and transport solutions**

This service gives all keys to the industrial site for testing and implementing the synergy with its new partner. Nevertheless, the implementation remains difficult for those actors. Often this Is not the company's core business and the team lack the skills and time to move to the implementation step. Therefore, the Seitiss team developed a new service to implement and operate the synergy value chain. Seitiss team selects the most adapted intermediaries, the best packaging for the resource and the type of transport.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

iii. For industrial parks

Seitiss developed an offer for industrial platforms/parks, also applicable to clusters and ports. It aims to identify and characterise all wastes streams generated at the platform level. An exhaustive review of wastes resources and characteristics is performed. Interviews are also planned with the industrial companies. Current valorisation routes are described (valorisation rate, final eliminator, final treatment mode, etc.) and improvements are discussed. At the end of the first phase, the platform and the decision-makers obtain a comprehensive view of circulating flows. The second phase of the project aims to search and define the best valorisation routes (at a local and regional level). Synergies between the platform's members but also with external solution providers are proposed and an action plan to reach the implementation is suggested. This action plan concerns quick wins options but also medium to long term structuring projects.

5.1.4. Background

Seitiss was developed within European projects related to Industrial Symbiosis. EPOS and SCALER enable to launch the activities and services. New projects granted to Strane as Ultimate will foster the fast deployment of the company.
Seitiss has already numerous clients (12) and is supported by many innovative organisations.

Figure 17: Partners company's

5.1.5. Exploitation during the project lifetime

5.1.5.1. Targeted market

Since the beginning of its launch, Seitiss targets the following industrial sectors: chemical, ferrous and non-ferrous metals, cement and construction, water treatment, agro-food industries, paper, glass, foundries and some manufacturing activities.

Seitiss is also targeting local and regional authorities, to assess the IS potential within their administrative area and deploy a facilitation process with the local industrial sites. Deploying IS enables them to become more attractive for new activities and plants.

Industrial platforms are very promising for the business develoment. Seitiss targets industrial areas (manufacturing, chemical Industries, cement Industries, steel Industries and petrochemical Industries) and chemical clusters.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

5.1.5.2. Research and development activities.

Seitiss will take the opportunity of Ultimate to develop its databases and tools dedicated to the identification of synergies. The tool will be tested on the 9 Case Studies of the project in order to identify input and output streams and search for synergies / potential partners to implement it.

In the task 5.1, the team extended its skills on technical enquiries with sites experts, on resources analysis and synergies identification. The preliminary result provided in this deliverable give an overview of resources synergies that could be developed with the consortium partners. The objective is then to further study these synergies and implement them according to the partner's willingness. The deployment of the synergies can potentially be planned later in the project.

Ultimate will enable to study a wide variety of synergies related to water management activities and that could be replicate in other locations in EU. Specific cases of bentonite, hydrogen peroxide, wastewater for agricultural use and other targeted resources will be deeply studied to be replicated.

5.1.5.3. Business Exploitation

Seitiss will carry out specific business exploration to accelerate its development. New relationships with major European industrial clusters within Ultimate will enable to get new business opportunities. Seitiss targets to reach 5 replications of its offer for industrial parks. Such a result could lead to around 300 k€ of new revenues.

Depending of the results provided in the D5.1, several partners could be interested to deep analyse their resource and implement specific synergies. It mainly concerns some CS with targeted resources:

- **Hydrogen peroxide residues**
- **Bentonite**
- **Sodium bisulphite for the Suez IWS Case**
- **Wastewater**

This list will be updated regularly all along the project. Depending on the technical feasibility confirmation, additional efforts will be engaged to identify potential replication locations in EU, adapted to the deployment of these synergies.

5.2. Greener than green

During the exploration and screening of technologies inside the ULTIMATE project, STRANE has identified some promising technologies for exploitation and advancement. These technologies are associated with Greener than green and Agrobics.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The ambition of these technologies is to extract value-added compounds from some industrial wastewater streams (food and processing industry and agro-industry).
Two demo cases have thus aroused our interest - case study 4 and case study 6- for a potential spinoff that would exploit its technology out of GtG's and AGB's home country.

5.2.1. Presentation of GTG's project

Greener than Green Technologies S.A. (GtG Technologies) is a clean tech start-up business that sprung out of university pioneered research on water treatment technologies and private funding. Its primary targets are the following:

- To scale up and commercialize already developed laboratory-based techniques for water treatment as a standalone process or coupled to existing processes,
- the identification, extraction, isolation and commercialization of value added/high interest compounds from organisms (e.g., plant, animal, microbial) or from industrial, agricultural or residential waste.

Greener than Green Technologies SA (GtG) is active in R&D and marketing of disruptive water and wastewater remediation technologies and methodologies for the circular usage of water, providing tools and advice to industries and communities assisting the transition towards circular economy models.

5.2.2. Background

The fruit and vegetable processing industry are inarguably a water demanding sector. Furthermore, to meet the effluent criteria as well as to reduce the cost of disposing wastewater to the municipal WWTP, all sizeable fruit processing plants have their own primary biological wastewater treatment unit. However, due to seasonality of this industry the biological treatment unit is stopped when not used and must be restarted when needed, driving the operational cost upwards and seasonality that most often coincides with the dry season puts a lot of strain on local freshwater resources, especially in southern European and Mediterranean countries.
Additionally, as part of the industrial processes, these processes are associated with use of water and produce wastewater that needs to be disposed of, in accordance with the local and international legislations. Given the high volumes and high concentration of pollutants, nutrients, etc. present in this wastewater the cost of the disposal of such water is continuously increasing. Fruit and vegetable industry wastewater are very rich in value-added compounds, without this technology they will be sent to the sewage plant to be eliminated, which represents a big economic loss for the industry.

5.2.3. ULTIMATE demo case (case study 4)

5.2.3.1. Goals

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

The Ultimate goal is to produce a prototype unit, either mobile e.g. containerized, or easily deployable, so it can treat wastewater at different sites, depending on the seasonality of the fruit and vegetable, in addition to valorising value-added products present in the wastewater such as polyphenols, anthocyanins, flavonoids, tocopherols. Finally, wastewater may be rendered suitable for reuse in irrigation and certain or possibly all parts of the industrial process or secondary uses, reducing the demand for fresh water, and the improved quality of the wastewater reduces the cost of running.
Extracted value added compounds can be used either by the industry itself to increase the value of exiting products (e.g. natural juice fortified with antioxidants) or sold to pharmaceutical, nutraceutical, and natural products sectors.

The ULTIMATE demo will take place in the Argolida area, where there is an increasing water demand for irrigation purposes that along with the high-water consumption of the fruit processing industry is putting the regional aquifer under a great pressure. This is due to the fact that most water comes from irrigation wells.
This water quality is rather poor, with high conductivity (around 3000 μS/cm) and needs treatment before it can be used in the industry. The most common treatment method is reverse osmosis, which requires high energy consumption and maintenance costs. In addition to this, it must be said that the wastewater treatment rises the overall water usage cost, as all industrial waste is collected by the municipal treatment plant.

In order for the local industries to meet the effluent criteria as well as to reduce the cost of disposing wastewater to the municipal treatment plant all factories of a reasonable size have their own primary biological treatment unit. However, due to the seasonality of the fruit processing industry the primary treatment unit is stopped when not used and has to be restarted when needed, driving the operational costs upwards.

This region therefore has characteristics that are particularly suitable for the GtG project, namely, the high cost of water and its treatment, and the seasonality of the activity, which forces industrialists to stop their biological treatment during the off-peak season and restart it when the activity picks up, which is constraining in operational and economic terms.

Greener Than Green Technologies S.A. in collaboration with Alberta S.A. (food industry) will design and implement a wastewater treatment process that will involve a first step of capturing value-added compounds and a secondary step of treatment rendering effluents suitable either for reuse - used within the processing plant or to irrigate local farms and orchards - or for disposal to the local wastewater treatment plant. The use of some of the extracted value-added compounds in an existing juice product will be assessed, aiming to create a new, functional juice with added properties, health benefits and value. The rest of the extracted value-added compounds will be sold to other industries.

The following tasks will be carried out by GtG during the Ultimate project:

- Determination of pollutants and added-value compounds in the wastewater (presence and quantitation).
- Determination of the most efficient and suitable adsorption materials for the treated wastewater.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- Determination of the most suitable remediation technology and the form of hybrid setup, most suitable for this case.
- Determination of the extraction process.
- Pilot plant construction, operation, and optimization.

5.2.3.2. Technology

5.2.3.2.1.Process description

The technology studied in this demo case is made of the following steps: Filtration - Adsorption/Extraction - Advanced Oxidation Process (AOP). During the filtration stage, particles of organic matter that are too large (i.e., not suitable to be disposed of in the biological treatment) are removed. Adsorption/Extraction technologies can selectively remove value-added compounds for further purification and isolation.
Finally, a suitable AOP will significantly reduce the remaining organic load or effectively turn non-biodegradable organic compounds into their more biodegradable forms. If deemed necessary, a suitable Small Bioreactor Platform (SBP) may be employed simultaneously, in parallel or in series with the AOP step to further reduce the organic content.

5.2.3.2.2.Differentiating aspects

The extraction process of added-value compounds developed by GtG uses subcritical water. Other extraction ways that can be found in literature are based on the use of organic solvents which are often toxic. This is an advantage of GtG's technology.

5.2.3.2.3.Maturity

The final hybrid process has already been tested at laboratory scale in GtG' s labs and is currently considered at TRL4. It is intended to be upgraded to TRL 7 with the Ultimate project in which the prototype will be demonstrated in a real operational environment of a production plant.

5.2.3.2.4.Outputs

Two outputs are to be considered: treated water and extracted value-added compounds. Treated water will be suitable for reuse in irrigation and/or in possibly all parts of the industrial process or in secondary industrial uses, thus reducing the demand for fresh water, and the cost of the final wastewater treatment plant thanks to the improved quality of the wastewater.
Targeted added-value compounds are mainly antioxidants, e.g., polyphenols, flavonoids, anthocyanins, tocopherols, carotenoids, lycopene, chlorogenic acid, procyanidins/catechin compounds, phlorizin, naringenin.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Fruit	Compound	Class	Properties & Uses	Price/g*
Orange	Hesperetin	Flavonone	Lowers cholesterols, Anticancer, Favourably favours lipids	€13
	Naringenin	Flavonone	Antioxidant	€1
	Kaempferol	Lignan	Reducing the risk of chronic diseases, especially cancer.	€5.900
Redcurrant	Cyanidin 3-O-glucoside	Anthocyanin	Food colourant	€29
Beetroot	Luteolin	Flavone	Potentials for cancer prevention and therapy	€18.100
			Used in green tea extracts	€22.499
Blsck Chokeberries	Cyanidin 3-O-arabinoside	Anthocyanin	Used as natural colorant	€84.000
Pomegranate	(+)-Catechin	Flavonol	Used in green tea extracts	€22.499
	(+)-Gallocatechin	Flavonol	Antibacterial, Antifungal, Antimalarial, Diuretic, Antiulcer, Xanthine oxidase inhibitor, Antiplasmodic...	€150.000
Carot	3,4-Dicaffeoylquinic acid	Phenolic acid	Antioxidative, DNA protective, Neuroprotective, Hepatoprotective, Anti-influenza viral activity	€374.000

*Price of analytics standards normalised to 1g

Figure 18: Fruit compounds with respective estimated price (Source: Greenerthangreen)

As it's mentioned in the above Figure 18, the cost of different value-added compounds, the most expensive one being the 3,4-dicaffecylquinic acid (Phenolic acid) and can be extracted from carrot products, and the second most expensive value-added is (+) Gallocatechin, which cost estimated around € 374.000 and € 150.000 respectively.

Prices needed to be updated for each European country but GtG tables emphasizes the financial interest of extracting these compounds from wastewater to target the promising industrial clients for them. The most promising markets are mainly the carrot and pomegranate ones.

5.2.4. Exploitation during the project lifetime

5.2.4.1. Market exploration

Strane is about to make a roadmap for its exploitation work regarding Greener Than Green technology during the project lifetime: explore the market to make an assessment of the size of the market and identify the footprints of the potential industrial sites and customers. This task will prioritize the market analysis and collect feedback from industries about the specifications value-added compounds should meet to find long-term customers offering good prices.

Strane will make identification of the food industries that could be eligible to GtG's process: fruit/vegetable processing industries. Expected results are:

- A list of the targeted sectors: clarification on the type of industries and/or activities to be focused on
- A list of the region to be targeted for GtG's process sales: which European countries and within them which regions gather potential customers.
- A mapping of the potential customers will then be produced.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- Based on the above information, market will be segmented, and interviews will be conducted to validate the interest of potential customers.

The same process will be followed for the potential customers of the extracted value-added compounds. The two sets of data will need to be compared to determine whether the project has real viability.

As it's showing in below figure 16, the potential market of fruit and vegetable industries with density of installation. Biggest actors have been identified by Strane within European region.

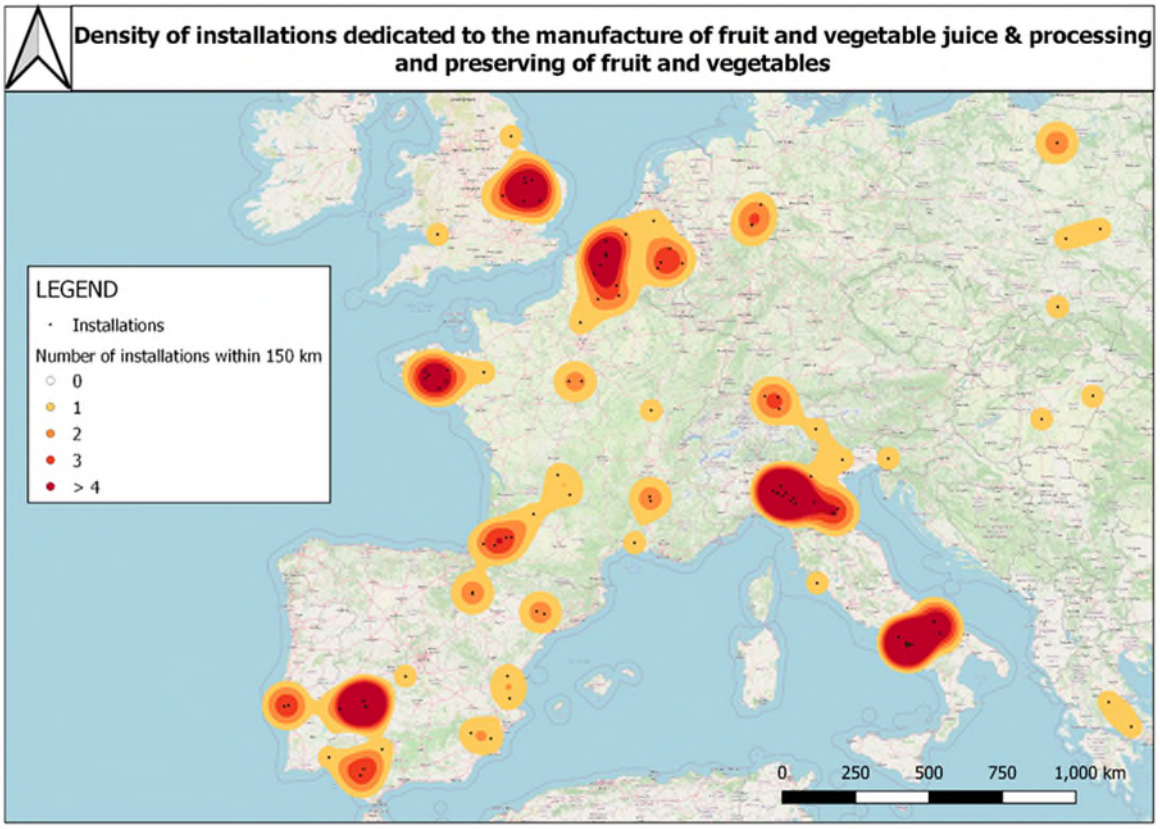


Figure 19: Density of installations dedicated to the manufacture of fruits and vegetable juice & processing.

From this map we notice that areas with a big fruit and vegetable industry are located in the eastern part of England, in the northern and western parts of France, in the northern and southern parts of Italy, and in the south west of Spain, with a number of installations higher than 4 within a 150 km radius.

- Get some feedback about the specifications value-added compounds should meet to find long-term customers offering good prices

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Interviews of the potential customers of these products will be conducted so that we get as much information as possible on how the extracted compounds should be prepared so they find most valuable applications.

5.2.4.2. Business model

Exploiting the full potential of GtG's solution will require different kind of activities:

i. Find the most suitable customer(s) for each specific case.

A "suitable customer" should meet the following criteria:

- Be interested by the extracted compounds.
- Validate both technical and economic feasibilities.

Technical feasibility will be validated, if the potential customer is willing to buy products that can be extracted from the industrial wastewater at stake; economic feasibility will be validated, if the whole process (from wastewater treatment and compounds extraction to compounds post-treatment and selling) brings benefits to the industrial in terms of cost-effective.

ii. Water treatment

Wastewater treatment units will have to be designed (and fit to the special needs of each customer), constructed, installed, and operated. In addition, for the cases where it makes sense and if regulations enable it, a whole reuse process will possibly also have to be designed and installed.

- Industrial synergies management
- The following steps will have to be managed:
- Preparation of the extracted value compounds so they meet the specifications of the final customers.
- Management of all the logistics activity dedicated to the value-added compounds: from the water treatment place to the compound post-treatment and preparation place and from this latest to the final customers**.**

Strane understood that Greener Than Green aims at managing all these activities by itself, at least for the Greek market. Strane Innovation is willing to work along with Greener Than Green to extend these activities out of Greece, within other European countries and to begin with in France, home country of Strane. A new company shall be created by Strane to manage the activities. Let's call it "Green Fruits" for the purposes of this deliverable.

Potential partners for Green Fruits could be in relation with other projects and start-ups developing by Strane Innovation currently:-

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

A. Newater Source

Strane Innovation is involved in several European projects dealing with circular economy in the field of water: Ultimate and NextGen.

As part of its missions in NextGen project, Strane explores the potential of the creation of a start-up which would be named Newater Source.

Newater Source intends to be a facilitator for the sewer mining technology (NextGen demo case of NTUA process) development in Europe starting with France. Newater Source ambition is to become a key player in the field of domestic wastewater reuse. As a spinoff of NextGen project Newater Source is for now focused on domestic wastewater reuse but Strane Innovation is currently working on its business model and exploring other paths which could lead Newater Source to be a company proposing reuse feasibility studies, design and construction activities and operation services of wastewater treatment units.

The food processing industry could be a targeted customer and GtG' s project offers new perspectives for the reflection on the creation of this start-up.

B. Seitiss

The part has been already briefed in above section 4.1. Please read section for detailed explanation.

Purpose	Responsible	Activities	Responsible	Relationships with Green Fruits
Create circular economy loops from the fruit/vegetable processing industries out of Greece (home country of GtG) beginning with France	Strane/Seitiss	Circular economy loops identification	Strane	N.A.
		Water treatment	Newater Source	Subcontractor
		Industrial synergies management	Seitiss	Subcontractor

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

6. Key performance indicators and achieving impact

This section outlines the plan for harnessing the impact potential of the exploitable results and for measuring the success of the exploitation efforts.

6.1. Exploitation KPIs

ULTIMATE's success at reaching targets related to the exploitation objectives will be evaluated using exploitation key performance indicators (KPIs). The main objectives include the successful adoption of results and benefits within emergency services, research communities and policy advisers and ensuring the longevity of the project's results through either policy uptake, further research, or commercial applications.

KPIs will be set at multiple levels to ensure that the exploitation potential is considered thoroughly. At this stage it is, however, too early to formulate specific KPIs as the project partners are only starting to think about the exploitation dimension. The KPIs will be defined and developed as the exploitation targets become clearer over the course of the final year of the project. They will be presented in D5.8, the final plan for business and the exploitation of results.

Exploitation KPIs that will be included and formulated as measurable targets include:

- Share of participating SMEs introducing innovations new to the company or the market;
- Growth and job creation in participating SMEs;
- Number of publications in peer-reviewed high impact journals and number of joint public-private publications, opening doors to further and broader research activities;
- Number of patent applications and patents awarded;
- Number of prototypes and testing activities;
- Share of publications from EU funded projects which are among the top X% highly cited;
- Number of new products, processes, and methods launched into the market;
- Number of institutional change actions promoted by the project;
- Number of fully scaled-up solution; -
- Number of long-term binding agreement to deliver water-smart industrial symbiosis;
- Number of institutions or entities adopting the guidelines;
- Number of business ideas incubated;
- Number of start-ups or spin-offs created.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

6.2. Exploitation impact

The online and governmental community will be crucial in terms of harnessing the impact potential. The social media platforms where ULTIMATE has a strong presence, i.e. Twitter, YouTube and LinkedIn, will be utilised to strengthen the online and offline community of active participants in ULTIMATE. This will create momentum for the exploitation of project results. The social media network and the project web site will keep expanding and continue beyond the life of the project. They will be maintained and developed by end users and members of the CoP. This will have a ripple effect and extend the network both horizontally and vertically to include all crucial groups of stakeholders at regional, national and EU-level. Partners will support this activity through new water technology related projects and linking ULTIMATE to the water technology Association.

The impact of the CoP forum, which brings together infrastructure operators, policy makers and other relevant stakeholders, is set out to be significant. The forum will have a lifetime that will extend well beyond the end of the project. As the CoP will act as a widely accepted "authority" on water technology, the impact potential created through the forum is remarkable. The forum will act as a hub leading the evolution of the guidelines and initiating resilience innovations and other exploitation activities.

The efforts to achieve impact are emphasised on the fronts where the project carries out external collaborations, including the research community, key stakeholders, ongoing European and national projects on topics related to emergency and disaster management and resilience and regulatory and legislative authorities. The expansion of these fronts will naturally have a knock-on effect on the activities related to gaining impact.

A precise impact plan will be included in D5.8. It will define a strategy for further development and exploitation of the research and the project results. It will demonstrate how the expected impact of the project will be realised and how the societal, environmental and economic benefit of crisis response will be strengthened across the EU.

6.3. Exploitation Barriers

The deployment and uptake of WSIS depends also on potential barriers that could be encountered. For example, market barriers could be related to "absence of awareness about the need of such a product/service", "potential users not accepting it", "high costs of commercialisation" but also to the "high level of novelty of the product" in case of research breakthroughs or radical innovations. The identification of possible market barriers implies the need for the partner to study the market, identify suitable mitigation paths to overcome the barriers and check the efficacy of the actions undertaken,

An initial list of potential type of barrier that could affect Ultimate WSIS solutions adoption is presented below:

- **Technical**
- **Legal and regulatory: Regulatory Issues.**
- **Encountered problems to achieve the TRL level.**
- **Market size and implementing these technologies on ground level.**
- **Economics: Economically not feasible for very small-scale enterprises**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

- **Need for an innovative or non-conventional business arrangement or partnerships to make the technology exploitable.**
- **KER are more related to the actual will of private and public industries and organizations to change their procedures to integrate the ULTIMATE technologies rather than to competitors already in the market. There would be the need to clearly state and demonstrate the benefits of such technologies to convince such potential clients to change their procedure.**
- **Costs and organization of the implementation.**

The following Table 24 presents type pf barriers that could encountered technologies developers and could impact the adoption of WSIS.

Table 24: Type of barriers

Type of barrier	Examples
Technical	▪ **Encounter problems to reach expected TRL** ▪ **Adequacy of the technical response to the needs of the water sector and water intensive industries** ▪ **Possibility to the potential adopters to adapt their process for WSIS solutions implementation** ▪ **Proof of the technical benefit** ▪ **Technology integration problems**
Market	▪ **Reluctance to change existing practices for firms with a long history and stable contexts** ▪ **Restrictive market: not enough final users** ▪ **No replicable solution** ▪ **Too low margin** ▪ **Instability in demand factors (i.e. need)** ▪ **Market immaturity**
Legal & regulatory	▪ **Lack of regulation about water and waste reuse** ▪ **Broker with regulatory authorities do not lead to an exploitation position for water / energy / nutrients reuse** ▪ **Water treated by WSIS solutions do not reach the adapted threshold for irrigation or other use**
Policy to incentivise	▪ **No tax fostering the adoption of Ultimate technologies** ▪ **Uncertainty in the approach of future policies**
Model	▪ **Need for an innovative or non-conventional business arrangement or partnerships to make the technology exploitable**
Economic and operational	▪ **Technologies requiring massive investments and financial support** ▪ **Adequation costs /effort to implement / benefits expected** ▪ **Solution economically not acceptable for small-scale enterprises** ▪ **Lower, unclear or inexistent economic benefits**

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

	▪ **Lack of funding**
Overloading	▪ **In the case of the adoption of a WSIS solution require time consuming operation compared to the current situation**

7. Conclusion

This deliverable has described the preliminary plan for exploitation and partner' individual strategy of results for ULTIMATE. It has presented the project's key exploitation objectives and methodology and described the current exploitation landscape surrounding ULTIMATE.

It has introduced the basic analysis exercise that involved all partners, and that was carried out in M1-M12. It has briefly outlined the results of the analysis views of the partners on ULTIMATE's results. It has presented the ULTIMATE exploitation strategy, including key exploitable results, exploitation potential, partners' interest, and role in exploitation as well as relevant target sectors, audiences, stakeholders, and markets.

It has outlined the impact that the project is set out to have and listed the types of exploitation KPIs to be formulated. Finally, it has presented the timeline for the implementation of the exploitation activities.

The next steps start with involving all partners in the joint effort of developing the final exploitation strategy to ensure successful exploitation of the results of the project. As mentioned earlier, all partners have committed to contributing to and engaging in exploitation activities to achieve this objective.

The current version of the exploitation strategy contains gaps that need to be filled in the coming months.

The deliverable pointed out that the partners have not developed a clear view of the exploitation landscape surrounding the project yet. Most partners feel that they will be more prepared to contribute to developing the exploitation strategy and plan towards the end of the project, when the concepts and technology will be more mature. The next steps will encourage the partners to start thinking about exploitation in a strategic way to be able to formulate their answers to key questions related to exploitation. These questions will focus on possible competitors, expected added value, possible market barriers, remaining time before exploitation, impact on the portfolio and IPR measures.
In terms of concrete actions, an exploitation workshop (online), the second round of exploitation grid and technology characterisation analysis exercises will be organised. These will create the opportunity for partners to reflect on their previous inputs and on

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

other partner's inputs, to develop more mature and in-depth approaches to all aspects related to exploitation. Partners will be supported in the exercise where the aim is to facilitate the development of a better understanding of the players in the field and the marketplace.

One of the lessons learned is that it is crucial to open up the discussion on exploitation with partners early in the project. It takes time to develop a profound understanding of the full spectrum of exploitation and to formulate a take on it. It is, therefore, important to encourage partners to start thinking about their stance as early as possible.

The next steps also include sustained and expanded collaboration with the UCoP, whose significant experience and expertise are set out to contribute to innovations and other exploitation activities. The involvement of UCoP members and the work on the integrated UCoP forum, Social media and website will continue, and it will facilitate communication and sharing of best practices, which is essential for successful exploitation. Through the active involvement of stakeholders and end-users through the UCoP, ULTIMATE will ensure that the process and methodologies are relevant and accepted within water treatment domains and sectors. This, in turn, will foster uptake and exploitation of the project results, both in the final year and after the project, at local, national, the European level and international level.

The steps to be taken after the lifetime of the project and the final exploitation strategy, which will be flexible and scalable, will be presented in D5.8 and D5.9 final Plan for business and exploitation of results [final]. It will incorporate a tailored set of messages targeted at a specified sector in the oil and refining and research community and other key stakeholders, taking into account their needs and concerns.
The ULTIMATE consortium has the required skills, knowledge and experience to ensure maximum impact is achieved. With the commitment and contribution of all partners, successful exploitation, and the significant impact of the guidelines can be ensured.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318