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AFTERLIFE

Deliverable reference number and title:

D8.6 – Dissemination and exploitation activities

Due date of deliverable: 28/02/2022
Actual submission date: 02/03/2022

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Type

R	Document, report	☒
DEM	Demonstrator, pilot, prototype	☐
DEC	Websites, patent fillings, videos, etc.	☐
OTHER		☐

Dissemination Level

PU	Public	☒
CO	Confidential, only for members of the consortium (including the Commission Services)	☐

This project receives funding from the Bio-based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.

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1 Abbreviations

D	Deliverable
EC	European Commission
MS	Milestone
TRL	Technology Readiness Level
WP	Work Package

2 Publishable executive summary

AFTERLIFE proposes a flexible, cost- and resource-efficient process framed in the zero-waste and circular economy approach for the recovery and valorisation of the relevant fractions from wastewater. The first step of such process is an initial step consisting of a cascade of membrane filtration units for the separation of the totally of solids in wastewater. Then, the concentrates recovered in each unit will be treated to obtain high-pure extracts and metabolites or, alternatively, to be converted into value-added biopolymers (polyhydroxyalkanoates). Moreover, the outflow of the process is an ultra-pure water stream that can be directly reused.

The outcomes of the project are focused on:

- Demonstration of an integrated pilot using real wastewater from three water intensive food processing industries (fruit processing, cheese and sweets manufacturing)
- Demonstration of the applicability of the recovered compounds and the value-added bio products in manufacturing environments

The design and optimisation of the AFTERLIFE process following a holistic approach will contribute to improve performance and reduce the costs associated to wastewater treatment by maximising the value recovery.

The overall goal of the project AFTERLIFE was to demonstrate at TRL (Technology Readiness Level) 5 a promising innovative wastewater treatment with the simultaneous recovery of compounds of interest and the conversion of the rest of the organic matter into a high-volume added value biopolymer. Specific objectives have been defined and pursued in each WP (Work Package) to reach this goal:

- WP1 - Objective A. To develop the filtration system through the use of membrane filtration unit for the recovery of suspended and soluble solids in wastewater.
- WP2 - Objective B. To develop the process for the recovery and purification of valuable compounds in the concentrates from filtration step
- WP3 - Objective C. To develop the conversion of the low value-added organic matter into PHA by an anaerobic/aerobic process
- WP4 – Objective D. To optimise the resources in the process following a circular economy approach
- WP5 – Objective E. To design and optimise the overall AFTERLIFE process from a holistic point of view following a Multidisciplinary Design Optimisation (MDO) approach
- WP6 – Objective F. To conduct a demonstration at BBE Pilot Plant using real industrial wastewater and to generate the end products
- WP7 – Objective G. To provide proof of economic and industrial feasibility for AFTERLIFE process and comprehensive LCA and cost assessment

- WP8 – Objective H. To promote the exploitation of the project’s results and expand the impact of the process

The overall objective to demonstrate the innovative wastewater treatment with the simultaneous recovery of compounds of interest and the conversion of the rest of the organic matter into a high-volume added value biopolymer at TRL-5 was pursued. All of the planned steps were carried out and results can be presented in each WP. The water purification could be demonstrated and also the extraction of value-added components and the application thereof in food products. The production of bio-based plastics products was demonstrated as well. Some difficulties were encountered when conducting the fermentation processes and the production of bio-based plastics products. As a result, these difficulties lead to new insights and a better starting point for further research.

Under the project website URL www.afterlife-project.eu, more information on the results, dissemination material and news items can be found.

3 Introduction

This document shall give an overview of the dissemination and exploitation activities conducted during the project period of the AFTERLIFE project. Moreover, it shall verify that all planned activities were carried out and, as far as possible, it should also show the effects of the dissemination activities. The effects are mainly measured in "persons reached", "visits" or "clicks". Newly established collaborations and contacts are also very important, but most often not well measurable, especially when it comes to contacts of individuals involved in the project.

3.1 Dissemination strategy

Work Package 8 provided a dissemination strategy described in the communication and dissemination plan. It served to support and enhance the key project objectives related to the effective exploitation of the results. Work package 8 was led by NOVA and involved all other partners.

3.2 Exploitation strategy

The exploitation strategy of the key results in AFTERLIFE has been defined accounting on the support of the Horizon Results Booster services of the European Commission. Specifically, following the developed internal exploitation discussion, several workshops guided by LC Innoconsult have been organised to discuss the definition of the key exploitable results and the exploitation roadmap for each of them. The characterisation, use options and exploitation roadmap have been defined for the KERs. Then, a business plan has been discussed and drafted considering the value proposition identified to the activities in the project (Figure 1).

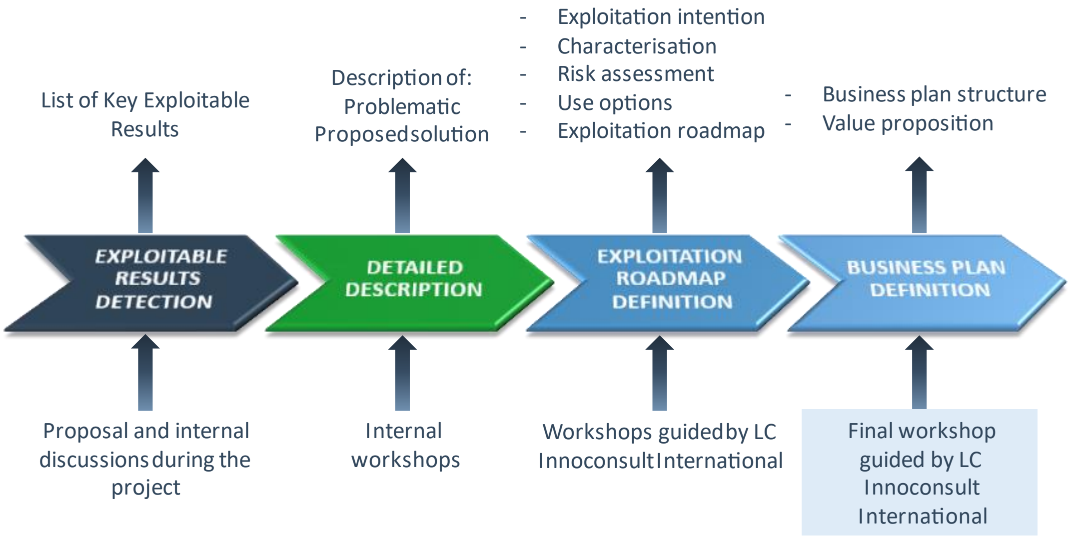


Figure 1: Roadmap for exploitation strategy definition

4 Dissemination activities

4.1 Overview of planned and actual activities

Table 1: Deliverables

Number	Title	Lead	Level	Due in month	Status
D8.1	Dissemination and exploitation plan	nova	Confidential	6	Completed
D8.2	Website	nova	Public	6	Completed
D8.3	Leaflet	nova	Public	9	Completed
D8.4	Video	idener	Public	24	Completed
D8.5	Stakeholder workshop	nova	Public	38	Completed
D8.6	Dissemination & exploitation activities report	nova	Public	48	Completed
D8.7	Replication for other industries	idener	Confidential	48	Completed

Table 2 shows the planned deliverables for WP 8 and their completion status. Table 3 shows the planned and accomplished milestones in WP 8:

Table 2: Milestones

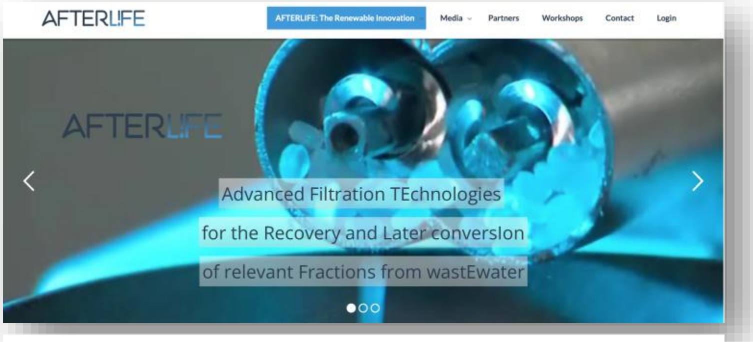
Number	Title	Lead	Due in month	Status
MS1	Website online	nova	4	Completed
MS8	BBI JU event	nova	42	Completed

More information about the individual deliverables and milestones is included within this report on the following pages. The table on the next page is showing the total numbers of dissemination activities conducted during the project period. It also shows the approximate number of persons reached and the number of scientific publications.

Table 3: Total number of dissemination activities

	Activities	Total No. of Activities
Number of Dissemination and Communication activities linked to AFTERLIFE	Organisation of a Conference	12
	Organisation of a Workshop	6
	Press Release	2
	Non-scientific and Non-Peer-Reviewed Publication (popularised publication)	5
	Exhibition	4
	Flyer	1
	Training	0
	Social Media	12
	Website	17
	Communication Campaign (e.g. Radio, TV)	1
	Participation in a Conference	18
	Participation in a Workshop	6
	Participation in an Event other than a Conference or a Workshop	6
	Video/Film	1
	Brokerage Event	0
	Pitch Event	0
	Trade Fair	0
	Participation in Activities Organized Jointly with other H2020 Projects	2
	Other (dissemination/communication activity)	2
Number of persons reached, in the context of all dissemination and communication activities	Scientific Community (Higher Education, Research)	99512,5
	Industry	123152,6
	Civil Society	45693
	General Public	511568,9
	Policy Makers	17
	Media	30
	Investors	20
	Customers	10
	Other	28
Scientific Publications	Article in Journal	3
	Publication in Conference Proceedings/Workshop	0
	Books/Monographs	0
	Chapters in Books	0
	Thesis/Dissertation	1
	Other (publication)	0

4.2 D8.2 – Project website



Advanced Filtration TEchnologies
for the Recovery and Later conversIon
of relevant Fractions from wastEwater

Figure 2: Website title page

4.2.1 Website statistics

The following graphs and images all show data for the project period from 28 February 2018 until 31 January 2022. The total number of visits over these four years is 584,768, as shown in the following figure.

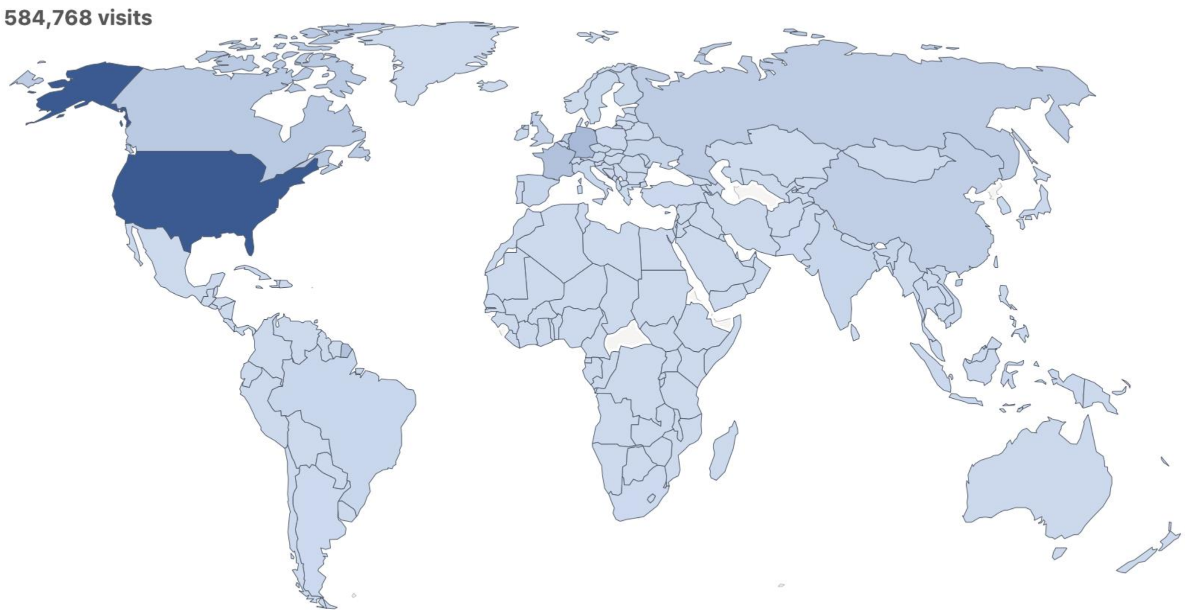


Figure 3: World map – Total visits over the project duration

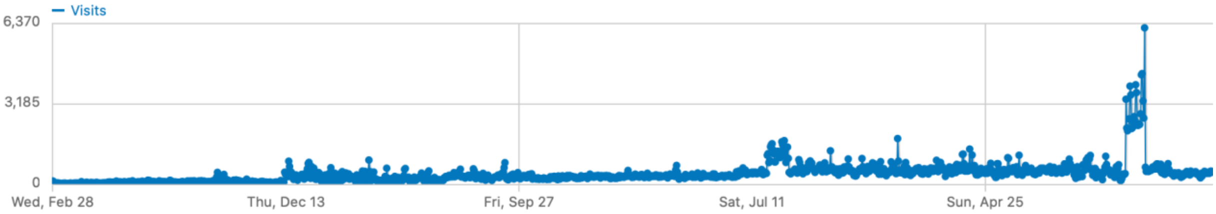


Figure 4: Total visits over the project duration

Figure 4 shows that the number of visits rose gently during the project duration. The peaks are very likely to be attempted hacker attacks as they are too high to be induced by a dissemination activity. Figure 5 shows the total pageviews and the unique pageviews over the project duration. Pageviews are the number of views of any of the sub pages of the AFTERLIFE project website. Unique pageviews are the number of pageviews that according to the information that the analytics application is gathering (like IP addresses and location of the users) can be assigned to one specific user.

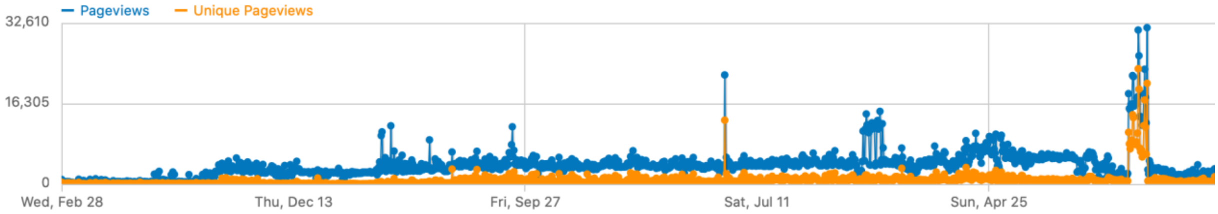


Figure 5: Total pageviews over the project duration

Most visits came from north America, Europe and Asia and more specifically from the United States of America, Germany, France, Canada and Russia.

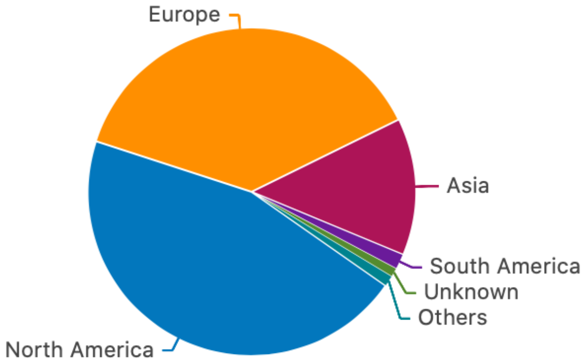


Figure 7: Total visits per continent

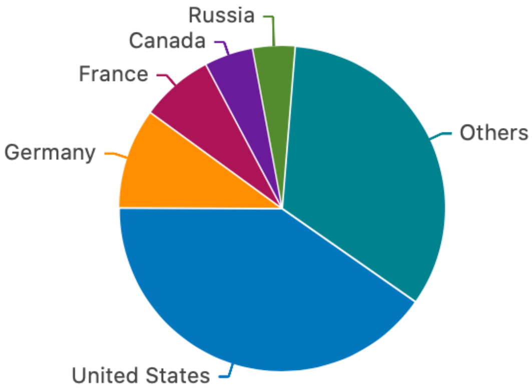


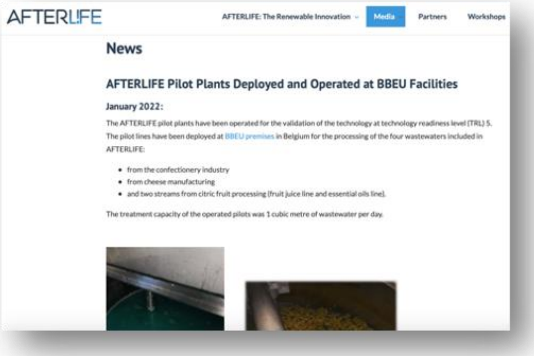
Figure 6: Total visits per country

Most visited pages were:

1. Partners (Figure 8)
2. News (Figure 9)
3. Media (Figure 10)

The AFTERLIFE project consortium consists of 14 companies from 7 countries

Figure 8: Screenshot oft he AFTERLIFE website – Partners



News

AFTERLIFE Pilot Plants Deployed and Operated at BBEU Facilities

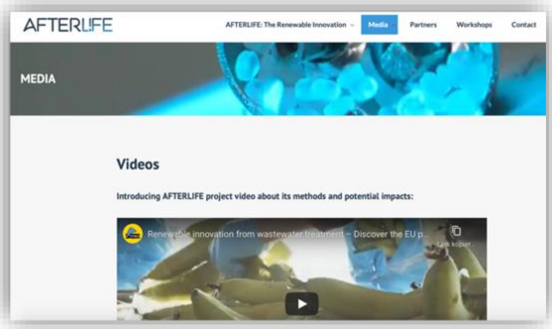
January 2022:

The AFTERLIFE pilot plants have been operated for the validation of the technology at technology readiness level (TRL) 5. The pilot lines have been deployed at BBEU premises in Belgium for the processing of the four wastewaters included in AFTERLIFE:

- from the confectionery industry
- from cheese manufacturing
- and two streams from citric fruit processing (fruit juice line and essential oils line).

The treatment capacity of the operated pilots was 1 cubic metre of wastewater per day.

Figure 9: Screenshot of AFTERLIFE website – News

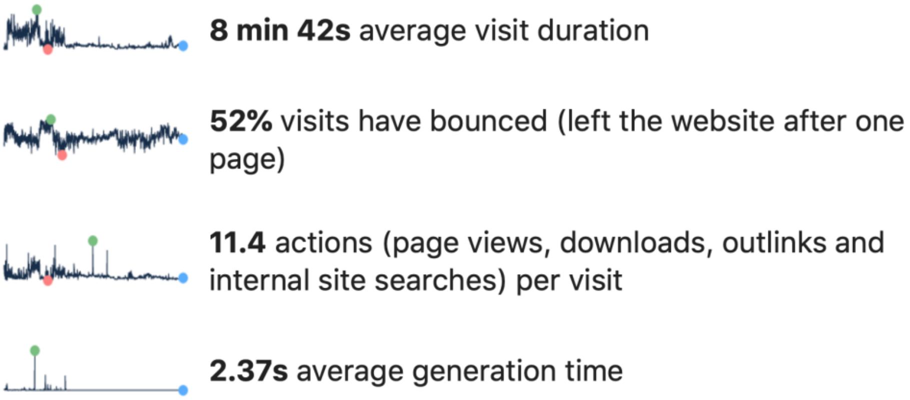


Videos

Introducing AFTERLIFE project video about its methods and potential impacts:

Figure 10: Screenshot of AFTERLIFE website – Media

The following figure shows an overview of the average duration of a website visit, the percentage of bounced visits (visitor left website after viewing just one page), the average number of actions per visit and the average generation time of the website over the AFTERLIFE project duration.



8 min 42s average visit duration

52% visits have bounced (left the website after one page)

11.4 actions (page views, downloads, outlinks and internal site searches) per visit

2.37s average generation time

Figure 11: Average visit duration, bounces, actions and generation time of the AFTERLIFE website

The following figure shows the total number of AFTERLIFE website visits from Europe. The graph can be described as similar to the total number of worldwide visits.

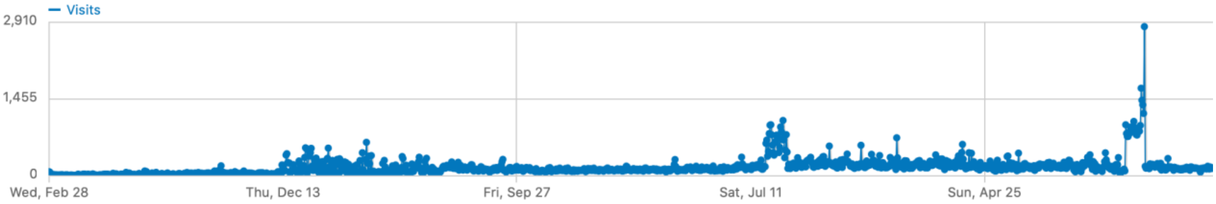


Figure 12: Website visits from Europe

The following figure shows the average time spent on the website during a visit from Europe. It is also gently rising during the project period which could be explained by growing and mor interesting content as publications and results were included.

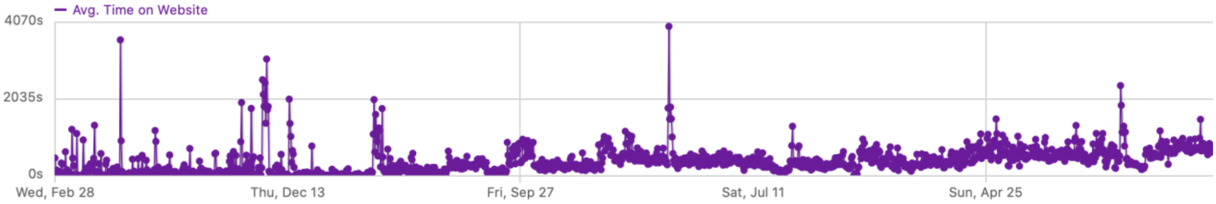
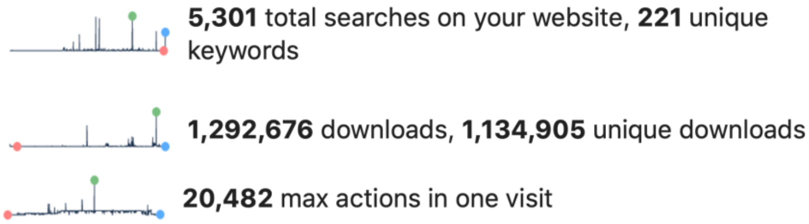


Figure 13: Average time spent on website in Europe

Below, the number of searches, downloads and maximum actions in one visit are shown for the project website. The peaks may refer to attempted hacker attacks.



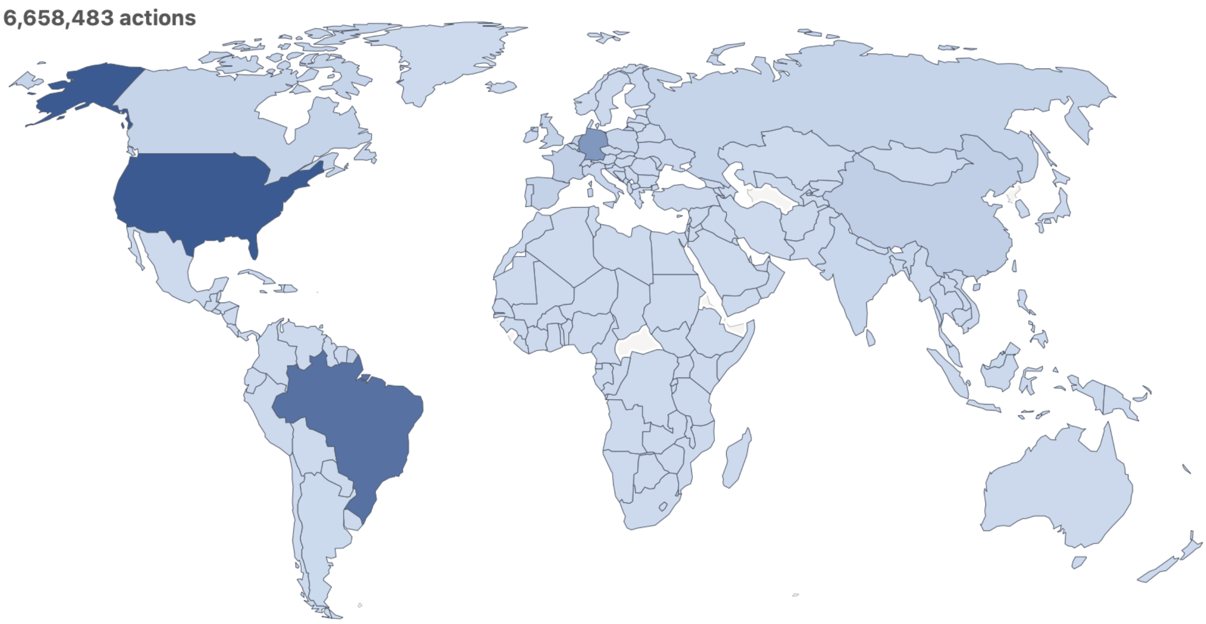
5,301 total searches on your website, **221** unique keywords

1,292,676 downloads, **1,134,905** unique downloads

20,482 max actions in one visit

Figure 14: Searches, downloads and maximum actions on AFTERLIFE website

The following map shows the total number of 6,658,483 actions on the AFTERLIFE website and their distribution over the world. It can be assumed that the project was noticed also outside of Europe.



4.3 Events

4.3.1 AFTERLIFE Webinar on Advanced Filtration Technologies for the Recovery and Later Conversion of Relevant Fractions from Wastewater 2019

The AFTERLIFE Webinar on Advanced Filtration Technologies for the Recovery and Later Conversion of Relevant Fractions from Wastewater took place on 15 October 2019. The webinar addressed the following topics:

1. Filtration, solvent extraction and steam extraction, with an eye on the big numbers
2. Recovery and natural compounds of interest from agri-food wastes

More detailed information is available on www.afterlife-project.eu/webinar and the presentation slides are downloadable here via www.afterlife-project.eu/wp-content/uploads/2019/10/AFTERLIFE-webinar.pdf.

4.3.2 BBI JU Stakeholder Forum 2019

AFTERLIFE was present at the BBI JU stakeholder forum on 3–4 December 2019 in Brussels. This public event brought together the bio-based industries community and facilitated open discussions on the impact, achievements and strategic direction of the BBI JU projects. Dr. María López gave a presentation about the project and AFTERLIFE was presented at a booth:

Figure 15: Dr. María López (right) and Dr. Seena Koyadan presenting AFTERLIFE at the BBI JU Stakeholder Forum 2019 in Brussels

4.3.3 D8.5 – AFTERLIFE stakeholder workshop 2020

The AFTERLIFE stakeholder workshop took place online on 9 October 2020. Here, the project consortium discussed the challenges in the wastewater industry and the project results so far. Presentation topics were:

- Versatile End-of-Life options for AFTERLIFE products – Prof. MSc. Jan Ravenstijn (GO!PHA, The Netherlands)

- The Rheticus Project – Dr. Thomas Haas (Evonik, Germany)
- Advanced Filtration Technologies for the Recovery and Later Conversion of Relevant Fractions from Wastewater – Dr. Maria Lopez (Idener, Spain)
- Membrane Technology in Valuables and Water Recovery from Wastewaters of Food Industry – Dr. Antti Gronroos (VTT, Finland)
- PHA Production from Industrial Waste Streams as part of Sustainable Plastics Production towards a Circular Plastics Economy – Dr. Oliver Drzyzga (CIB-CSIS, Spain)
- Production of Bio-Based Volatile Fatty Acids from Organic Waste as Chemical Building Blocks – Dr. Nicola Frison (Innoven, Italy)
- Sustainable Extraction of Amino Acids from Agro-Industrial Wastewater Streams – Dr. Javier Ceras (Lurederra, Spain)

The presentation slides are available on the project website: www.afterlife-project.eu/workshop

4.3.4 MS8 – BBI Workshop on Bio-Based Polymers 2021

On 29 March 2021, Milestone 8 was reached with the organisation of a workshop on bio-based polymers together with six other projects under the BBI JU call from 2016.

The event was disseminated via an article on renewable carbon news (www.renewable-carbon.eu/news/bbi-workshop-on-bio-based-polymers-on-29-march-2021, Figure 16), LinkedIn (Figure 17), Twitter, the nova-Institutes monthly newsletter and the AFTERLIFE project website (Figure 18 and Figure 19 and www.afterlife-project.eu/bbi-workshop-2021).

1 March 2021

Bio-based polymers workshop on 29 March 2021: These 7 innovations bring us closer to a carbon-neutral economy

Atmospheric CO2 will keep on climbing higher and higher if we don't stop using fossil resources. How to make the switch to renewable carbon instead? The free online workshop on 29 March will present seven options.

Figure 16: MS8 Dissemination – Screenshot oft the article on Renewable Carbon News

nova-Institut GmbH
2.920 Follower:innen
1 Jahr •

+++SAVE THE DATE: 29 March 2021 13:00 CET+++ free webinar about #Biobased polymers! What are the challenges? How do bio-based polymers, #sustainability and the new single-use plastics directive fit together? What is already possible? Seven projects from the same BBI call will present their latest results. Please check out the programme and register here: https://lnkd.in/gKYVwPq

#AFTERLIFE
Bio-based Industries Joint Undertaking (BBI JU)
#biopolymers
#singleUsePlastics
#renewablecarbon

Übersetzung anzeigen

AFTERL!FE

BBI WORKSHOP ON BIO-BASED POLYMERS

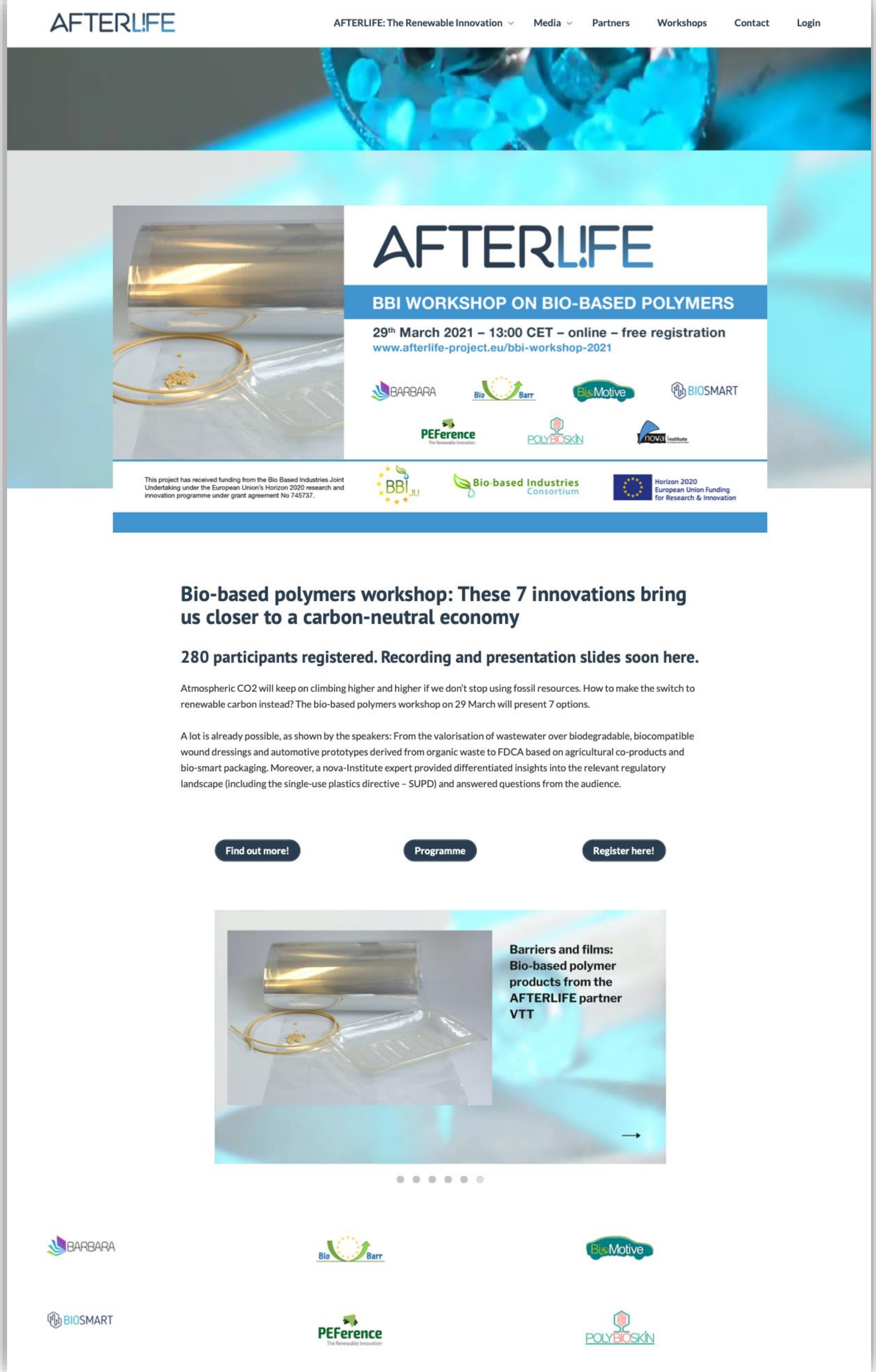
29th March 2021 – 13:00 CET – online – free registration
www.afterlife-project.eu/bbi-workshop-2021

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737.

Sie und 22 weitere Personen

Reaktionen

Figure 17: MS8 Dissemination – LinkedIn post



29th March 2021 – 13:00 CET – online – free registration
www.afterlife-project.eu/bbi-workshop-2021

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737.

Bio-based polymers workshop: These 7 innovations bring us closer to a carbon-neutral economy

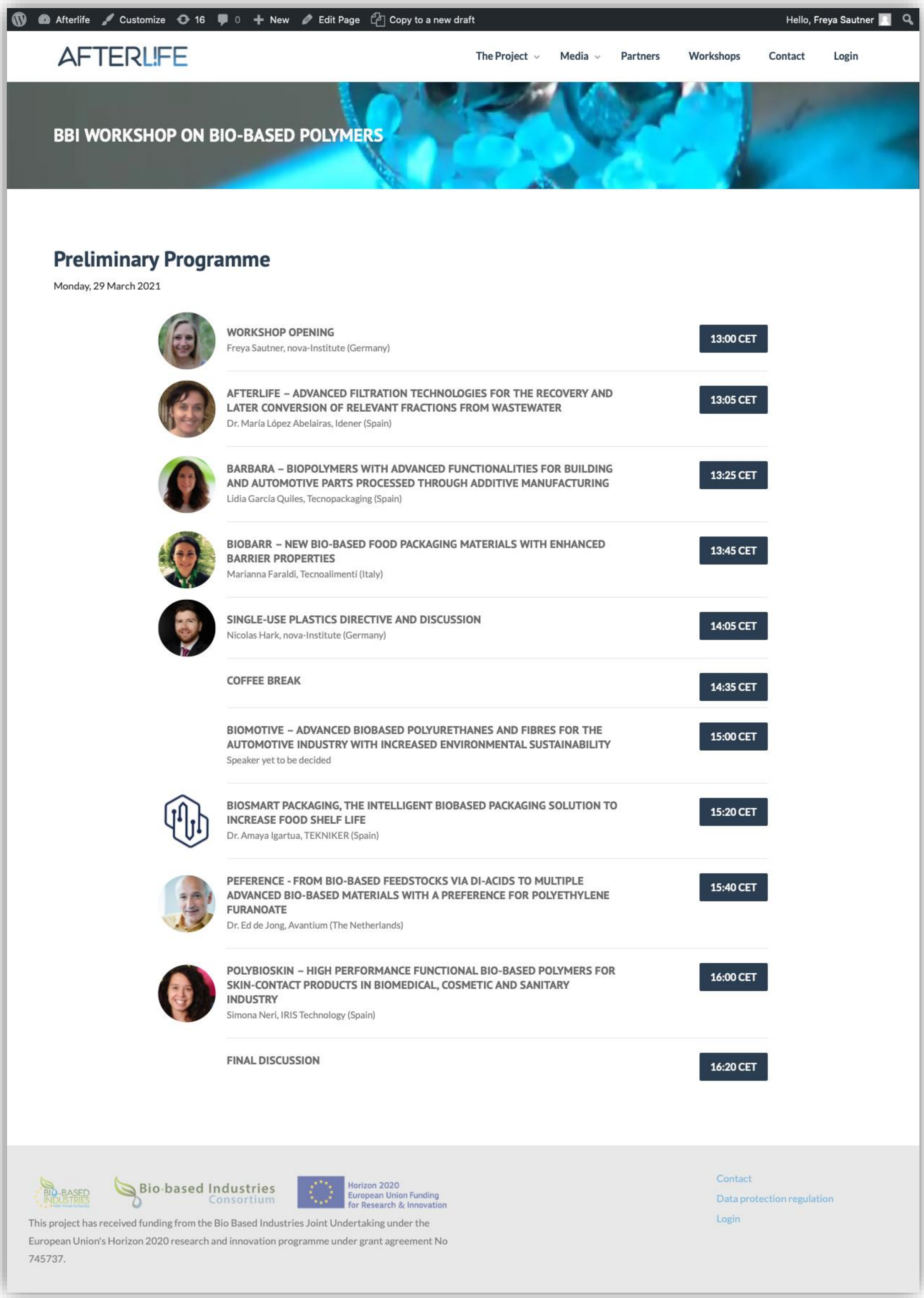
280 participants registered. Recording and presentation slides soon here.

Atmospheric CO2 will keep on climbing higher and higher if we don't stop using fossil resources. How to make the switch to renewable carbon instead? The bio-based polymers workshop on 29 March will present 7 options.

A lot is already possible, as shown by the speakers: From the valorisation of wastewater over biodegradable, biocompatible wound dressings and automotive prototypes derived from organic waste to FDCA based on agricultural co-products and bio-smart packaging. Moreover, a nova-Institute expert provided differentiated insights into the relevant regulatory landscape (including the single-use plastics directive – SUPD) and answered questions from the audience.

Barriers and films: Bio-based polymer products from the AFTERLIFE partner VTT

Figure 18: MS8 – Dissemination of the BBI JU Event on the AFTERLIFE website



BBI WORKSHOP ON BIO-BASED POLYMERS

Preliminary Programme

Monday, 29 March 2021

WORKSHOP OPENING
Freya Sautner, nova-Institute (Germany)
13:00 CET

AFTERLIFE – ADVANCED FILTRATION TECHNOLOGIES FOR THE RECOVERY AND LATER CONVERSION OF RELEVANT FRACTIONS FROM WASTEWATER
Dr. María López Abelairas, Idener (Spain)
13:05 CET

BARBARA – BIOPOLYMERS WITH ADVANCED FUNCTIONALITIES FOR BUILDING AND AUTOMOTIVE PARTS PROCESSED THROUGH ADDITIVE MANUFACTURING
Lidia García Quiles, Tecnopackaging (Spain)
13:25 CET

BIOBARR – NEW BIO-BASED FOOD PACKAGING MATERIALS WITH ENHANCED BARRIER PROPERTIES
Marianna Faraldi, Tecnoalimenti (Italy)
13:45 CET

SINGLE-USE PLASTICS DIRECTIVE AND DISCUSSION
Nicolas Hark, nova-Institute (Germany)
14:05 CET

COFFEE BREAK
14:35 CET

BIOMOTIVE – ADVANCED BIOBASED POLYURETHANES AND FIBRES FOR THE AUTOMOTIVE INDUSTRY WITH INCREASED ENVIRONMENTAL SUSTAINABILITY
Speaker yet to be decided
15:00 CET

BIOSMART PACKAGING, THE INTELLIGENT BIOBASED PACKAGING SOLUTION TO INCREASE FOOD SHELF LIFE
Dr. Amaya Igartua, TEKNIKER (Spain)
15:20 CET

PEFERENCE - FROM BIO-BASED FEEDSTOCKS VIA DI-ACIDS TO MULTIPLE ADVANCED BIO-BASED MATERIALS WITH A PREFERENCE FOR POLYETHYLENE FURANOATE
Dr. Ed de Jong, Avantium (The Netherlands)
15:40 CET

POLYBIOSKIN – HIGH PERFORMANCE FUNCTIONAL BIO-BASED POLYMERS FOR SKIN-CONTACT PRODUCTS IN BIOMEDICAL, COSMETIC AND SANITARY INDUSTRY
Simona Neri, IRIS Technology (Spain)
16:00 CET

FINAL DISCUSSION
16:20 CET

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737.

Figure 19: MS8 – Programm of the Workshop on Bio-Based Polymers

For dissemination purposes, an event banner was created by the nova-Institute's graphic department as can be seen in the following figure.

Figure 20: MS8 – Event banner

The registration page for the Zoom webinar was also customised using the event banner and a matching background colour:

Webinar-Registrierung

Thema	BBI Workshop on Bio-Based Polymers on 29 March 2021
Beschreibung	Bio-based polymers are on the rise! What are the challenges? How do bio-based plastics, sustainability and the new single-use plastics directive fit together? What is already possible? Seven projects will present their latest results: From the valorisation of wastewater over biodegradable, biocompatible wound dressings and automotive prototypes derived from organic waste to FDCA based on agricultural co-products and bio-smart packaging.
Zeit	29.März.2021 13:00 in Amsterdam, Berlin, Rom, Stockholm, Wien

Figure 21: MS8 – Screenshot of customised registration page

279 participants registered for the event and at least 200 participated. A discussion developed at the after the last presentation. The participants were interested in receiving the video recording of the event and the presentation slides. All registrants were informed as soon as the material was uploaded to the AFTERLIFE website where it is still available (www.afterlife-project.eu/bbi-workshop-2021).

4.3.5 Visits of conferences, workshops and other events

Table 4: Visited events during the project period

Partner	Title	Date	Place
CTC Spain	Poster in VIII International Symposium on Food Technologies. AFTERLIFE project: an integrated solution for the recovery and conversion of relevant fractions from wastewater	09.05. 2017	Auditorio Victor Villegas Murcia, ES
CSIC	Oral presentation by A. Prieto “Convirtiendo la basura en bioplástico, una apuesta sostenible” (in English: Converting waste into bioplastics, a sustainable bet)'' at http://jointcongress2017.com/ (spanish satellite event)	24.10. 2017	Gijon, ES
EggPlant	Talk at Ecomondo (Green Technologies Expo), AFTERLIFE project: a zero-waste and circular economy approach for the recovery and valorisation of the relevant fractions from wastewater	08.11. 2017	Rimini, IT
EggPlant	AFTERLIFE booth at the 2107 BBI Stakeholder Forum	06.12. 2017	Brussels, BE
Eggplant/nova	BBI Stakeholder forum	07.12. 2017	Brussels, BE
nova	Biocomposites conference Cologne	07.12. 2017	Cologne, DE
Hendrik Waegeman, BBEPP	European Bioplastics Conference	28.12. 2017	Berlin, DE
CSIC	Wastes as feed-stocks for bio-based polymer production	12.03. 2018	Havana, CU
nova	Project flyer introduced in 6th CO2 conference	15.03. 2018	Cologne, DE
nova	Project flyer introduced in 11th Bio-based material conference	15.04. 2018	Cologne, DE
nova	Project flyer introduced in 15th International Conference of the European Industrial Hemp Association	12.06. 2018	Cologne, DE
CSIC	“Una visión actualizada de la producción de bioplásticos de origen bacteriano” (in English:	25.06. 2018	Oviedo, ES

	An actual overview on the production of bioplastics from bacterial origin)		
nova	Project flyer distributed in the fair 'Composites Europe'	10.09. 2018	Stuttgart, DE
Innoven	World Water Congress	16.09. 2018	Tokyo,JP
nova	Project flyer introduced in 1st Revolution in Food and Biomass Production (REFAB) conference	01.10. 2018	Cologne, DE
CSIC	Puzzling out the PHA machinery in the model bacterium Pseudomonas putida KT2440	21.10. 2018	Beijing, CN
CSIC	“Convirtiendo la basura en bioplástico, una apuesta sostenible” (in English: Converting waste into bioplastics, a sustainable bet).	24.10. 2018	Gijon, ES
CSIC	Project flyer introduced at the 3rd European Nutrient event	08.11. 2018	Rimini, IT
NOVA	7th Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers	19.03. 2019	Cologne, Germany
CSIC	Chemplast Congress	01.05. 2019	Spain
Lurederra	Talk at University of Konstanz	01.05. 2019	Konstanz, Germany
CELABOR	International Conferences on ULB Centre Point in Gosselies	01.05. 2019	Gosselies, Belgium
CSIC	Frontiers in Biomedical Polymers; 13th International Symposium.	01.05. 2019	Spain
NOVA	12th International conference on Bio- based Materials	15.05. 2019	Cologne, Germany
CSIC	XIII Congreso Anual de Biotecnología Universidad CEU	01.06. 2019	Spain
CSIC	2nd Minisymposium of the GRK1708- Bacterial Storage Compounds	01.06. 2019	Germany
CSIC	Expoquimica BIO	01.06. 2019	Spain
Innoven	7th International Conference on Sustainable Solid Waste Management (HERAKLION20199	01.07. 2019	Greece
CSIC	10th European Symposium on Biopolymers 2019 (ESBP-2019)	01.09. 2019	Straubing, Germany
NOVAID	Noite Europeia dos Investigadores 2018- 2019 / European Researchers Night [EN]	01.09. 2019	Portugal

NOVAID	IWARR2019 - 3RD IWA Resource Revocery Conference	01.09. 2019	Italy
CSIC	4th International Symposium on Bacterial Nanocellulose (ISBNC-2019)	01.10. 2019	Portugal
NOVAID	Caminho da Inovação	01.10. 2019	Portugal
nova	8th Biocomposites Conference	01.11. 2019	Cologne, DE
CSIC	Moe Jam Science	01.11. 2019	Spain
IDENER	Conference: IWA Resources Recovery	01.11. 2019	Italy
IDENER	BBI JU Stakeholder Forum	01.12. 2019	Belgium
CSIC	Producción de bioplásticosde origen bacteriano	01.01. 2020	Madrid, Spain
CSIC	Conference "Productos Biotecnológicos Colombia útiles para el humano y la Industria"	01.05. 2020	Columbia
CSIC	From plastics to policy: How can we improve the performance of food packaging? Part 2: The technology behind bio-plastics (with Auxi Prieto; CIB)	07.05. 2020	internet webinar hosted by the RefuCoat H2020 BBI-JU project
CSIC	Desarrollo biotecnológico de polímeros (by Auxi Prieto, CIB)	13.05. 2020	online workshop of Universidad Colegio Mayor de Cundinamarca (Colombia), Facultad Ciencias de la Salud, Programa Bacteriología y Laboratorio Clínico
CSIC	PHA production from industrial waste streams as part of sustainable plastics production towards a circular plastics economy (by Oliver Drzyzga, CIB)	09.10. 2020	AFTERLIFE project Stakeholder workshop; https://afterlife-project.eu/stakeholder/home
CSIC	La sostenibilidad de plásticos (by A. Prieto, CIB)	12.11. 2020	Madrids Week of Science with CSIC; 18:00-19:30; https://www.cib.csic.es/news/outreach/cib-participates-new-edition-science-week-2020
CSIC	Member discussion of the Plastics Circularity Multiplier initiative (with A. Prieto presenting	13.11. 2020	videoconference of PCM members and guests

	the SusPlast platform and various EU projects including AFTERLIFE)		
CSIC	Revalorización de aguas residuales para la producción de bioplásticos (by A. Prieto, CIB)	01.12. 2020	Workshop at final meeting of BactiWater EU project
CSIC	A holistic view of the bio-based plastic production (by A. Prieto, CIB)	11.12. 2020	CICbioGUNE Seminar Series (online event); https://www.cicbiogune.es/activities
nova	BBI Workshop on Bio-Based Polymers	29.03. 2021	Zoom
CSIC	Strategies for improving the production of polyhydroxyalkanoates from industrial wastewater by Cupriavidus necator H16 (by Natalia Hernández, CIB-CSIC)	26.04. 2021	online Symposium on Biomaterials, Fuels and Chemicals (SBFC-2021); https://www.simbhq.org/sbfc/
nova	Renewable Materials Conference 2021, presented AFTERLIFE in the conference manual	18.05. 2021	Online
NOVAID	IWA EcoSTP 2021: PHA Production Using Fermented Wastewater From A Sweets Manufacturing Industry Rich In Lactate And Ethanol	21.06. 2021	Online Oral Presentation
NOVAID	IWA EcoSTP 2021: Effect of a Substrate Shift in the Accumulation Reactor of a Three-Stage PHA Production Process by a Mixed Microbial Culture	21.06. 2021	Online Poster Presentation
CSIC	Oral presentation Auxi Prieto at Summer School: "Redes de colaboración público-privada para investigación estratégica en problemas globales (engl.: Public-private collaboration networks for strategic research on global problems)	06.07. 2021	San Lorenzo de El Escorial, Spain
CTNC	Collaboration between CTAgua Uruguay and CTNC Spain	08.10. 2021	online
CSIC	Science and Technology Week of CSIC 2021: "Bacterial polymers: let's give our planet a break!" (with Auxi Prieto)	02.11. 2021	CIB-CSIC, Madrid, Spain

4.3.6 Other special events

- AFTERLIFE was exhibited during the BBI JU Stakeholder Forum 2017 and 2019 and at the European Bioplastics Conference 2019.
- The third general assembly and first exploitation workshop was hosted by CSIC in their building located in Madrid in November 2019.
- A whole page ad was published in the conference journal of the Renewable Materials Conference organised by the nova-Institute in 2021. The ad is shown in the following figure.

Figure 22: Renewable Materials Conference journal ad 2021

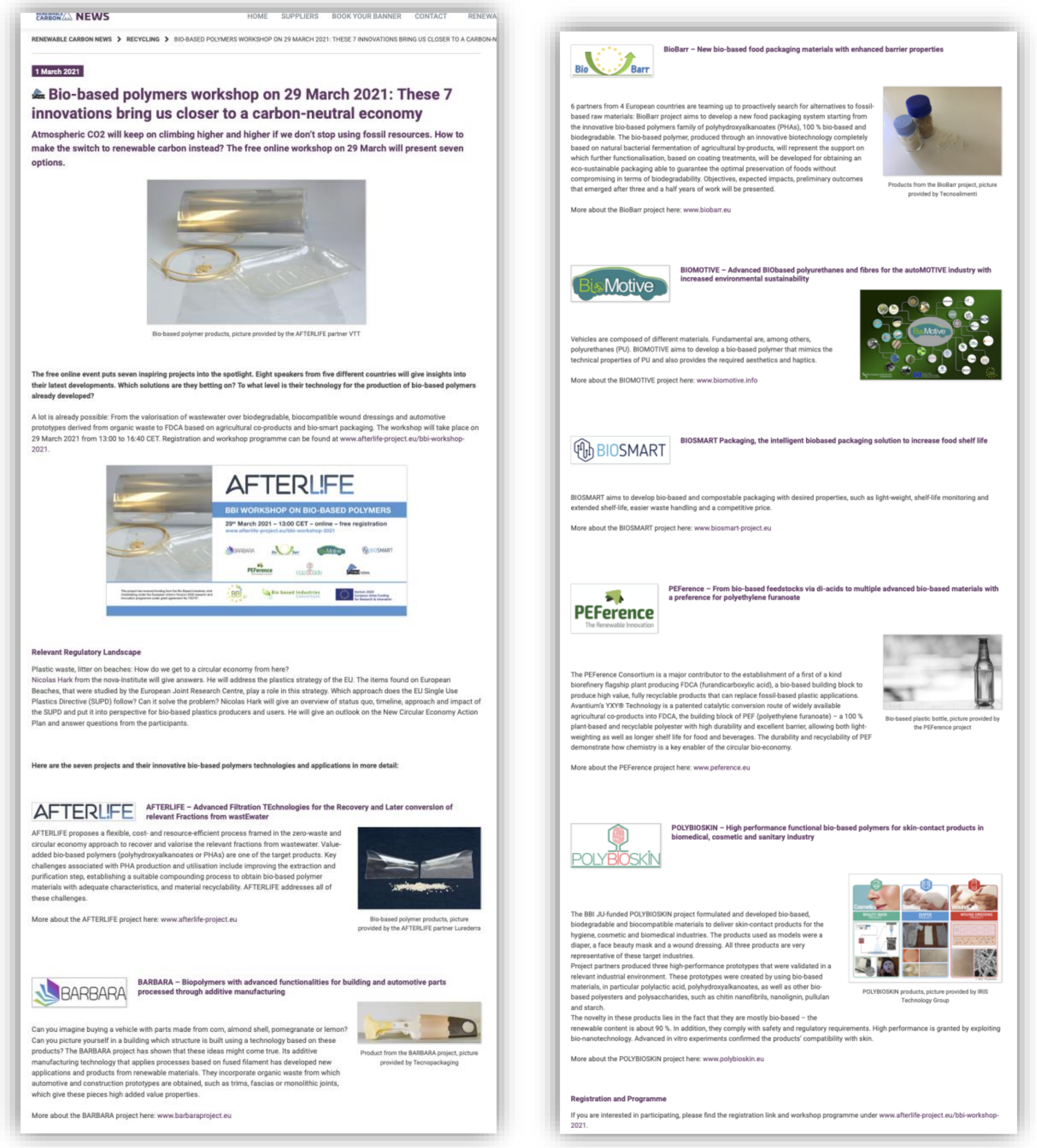
4.4 Publications

Table 5: Scientific publications

Num-ber	Title	Authors	Publication	Journal	DOI
1	About how to capture and exploit the CO_2 surplus that nature, per se, is not capable of fixing	Manuel S. Godoy; Beatrice Mongili; Debora Fino; M. Auxiliadora Prieto	2017	Microbial biotechnology	10.1111/1751-7915.12805
2	Improvement and Development of Innovative Purification Techniques of Biopolymers Recovered from Fermentative Broth	Anja Lauder	2019	Master's Thesis	
3	Membrane-based conceptual design of reuse water production from candy factory wastewater	Kyllönen, Hanna; Heikkinen, Juha; Ceras, Javier; Fernandez, Claudio; Porc, Olaf; Grönroos, Antti	2021	Water Science & Technology	10.2166/wst.2021.326
4	When microbial biotechnology meets material engineering	Ana M. Hernández-Arriaga; Cristina Campano; Virginia Rivero-Buceta; M. Auxiliadora Prieto	2021	Microbial biotechnology	10.1111/1751-7915.13975

4.5 Press releases and articles

- On 24 November, 2017, the first press release about AFTERLIFE was published on www.cib.csic.es/news/research/kick-meeting-afterlife-bio-based-industries-project.
- On 30 November 2017, the an article and press release about AFTERLIFE were published on *Renewable Carbon News*: www.renewable-carbon.eu/news/four-year-project-to-develop-an-integrated-solution-for-the-recovery-and-conversion-of-relevant-fractions-from-wastewater-to-make-natural-additives-and-bioplastics
- In December 2017, an article about AFTERLIFE was published in *CTC ALIMENTACIÓN* (www.afterlife-project.eu/wp-content/uploads/2019/02/Afterlife-CTC-magazine-December-2017.pdf)
- On 27 July 2018, an article called "Recovery and Valorisation of Wastewater Fractions for a Circular Economy – AFTERLIFE" was published in *BEsustainable* www.besustainablemagazine.com/cms2/afterlife-recovery-and-valorisation-of-wastewater-fractions-in-the-name-of-circular-economy
- On 29 April 2019, an article called "Solution for waste water in bioplastics and food additives" about the AFTERLIFE project was published by the EC: www.ec.europa.eu/research-and-innovation/en/projects/success-stories/all/solution-waste-water-bioplastics-and-food-additives
- In July 2019, a comprehensive article about the AFTERLIFE project called "Caracterización de las aguas residuales de las empresas españolas socias del proyecto AFTERLIFE" was published in *CTC ALIMENTACIÓN (www.afterlife-project.eu/wp-content/uploads/2019/09/CTC-Alimentación-70_18-20.pdf)*
- On 24 February 2021, an article and press release were published on *Renewable Carbon News* to promote the expert survey on the socio-economic impact of the biotechnological AFTERLIFE process (www.renewable-carbon.eu/news/join-our-expert-survey-and-evaluate-the-newly-developed-afterlife-process-for-the-extraction-of-value-added-products-from-waste-water).
- On 1 March 2021, another article and press release were published on *Renewable Carbon News* (www.renewable-carbon.eu/news/bbi-workshop-on-bio-based-polymers-on-29-march-2021). Their purpose was the dissemination of the MS8 BBI Workshop on Bio-Based Polymers. It includes an illustrated description for all of the seven BBI JU projects and features the URLs of the seven project websites (Figure 23).
- The final press release will be published in March 2022 and will include details about the project results. It will cover:
  - The AFTERLIFE Pilot Plants deployed and operated at BBEU facilities in Belgium
  - AFTERLIFE end products (foods and plastic goods)
  - The results of the socio-economic assessment



RENEWABLE CARBON NEWS HOME SUPPLIERS BOOK YOUR BANNER CONTACT RENEWA

RENEWABLE CARBON NEWS › RECYCLING › BIO-BASED POLYMERS WORKSHOP ON 29 MARCH 2021: THESE 7 INNOVATIONS BRING US CLOSER TO A CARBON-N

1 March 2021

Bio-based polymers workshop on 29 March 2021: These 7 innovations bring us closer to a carbon-neutral economy

Atmospheric CO2 will keep on climbing higher and higher if we don't stop using fossil resources. How to make the switch to renewable carbon instead? The free online workshop on 29 March will present seven options.

Bio-based polymer products, picture provided by the AFTERLIFE partner VTT

The free online event puts seven inspiring projects into the spotlight. Eight speakers from five different countries will give insights into their latest developments. Which solutions are they betting on? To what level is their technology for the production of bio-based polymers already developed?

A lot is already possible: From the valorisation of wastewater over biodegradable, biocompatible wound dressings and automotive prototypes derived from organic waste to FDCA based on agricultural co-products and bio-smart packaging. The workshop will take place on 29 March 2021 from 13:00 to 16:40 CET. Registration and workshop programme can be found at www.afterlife-project.eu/bbi-workshop-2021.

AFTERL!FE
BBI WORKSHOP ON BIO-BASED POLYMERS
29th March 2021 – 13:00 CET – online – free registration
www.afterlife-project.eu/bbi-workshop-2021

Relevant Regulatory Landscape

Plastic waste, litter on beaches: How do we get to a circular economy from here?
Nicolas Hark from the nova-Institute will give answers. He will address the plastics strategy of the EU. The items found on European Beaches, that were studied by the European Joint Research Centre, play a role in this strategy. Which approach does the EU Single Use Plastics Directive (SUPD) follow? Can it solve the problem? Nicolas Hark will give an overview of status quo, timeline, approach and impact of the SUPD and put it into perspective for bio-based plastics producers and users. He will give an outlook on the New Circular Economy Action Plan and answer questions from the participants.

Here are the seven projects and their innovative bio-based polymers technologies and applications in more detail:

AFTERLIFE – Advanced Filtration TEchnologies for the Recovery and Later conversion of relevant Fractions from wastEwater

AFTERLIFE proposes a flexible, cost- and resource-efficient process framed in the zero-waste and circular economy approach to recover and valorise the relevant fractions from wastewater. Value-added bio-based polymers (polyhydroxyalkanoates or PHAs) are one of the target products. Key challenges associated with PHA production and utilisation include improving the extraction and purification step, establishing a suitable compounding process to obtain bio-based polymer materials with adequate characteristics, and material recyclability. AFTERLIFE addresses all of these challenges.

More about the AFTERLIFE project here: www.afterlife-project.eu

Bio-based polymer products, picture provided by the AFTERLIFE partner Lurederra

BARBARA – Biopolymers with advanced functionalities for building and automotive parts processed through additive manufacturing

Can you imagine buying a vehicle with parts made from corn, almond shell, pomegranate or lemon? Can you picture yourself in a building which structure is built using a technology based on these products? The BARBARA project has shown that these ideas might come true. Its additive manufacturing technology that applies processes based on fused filament has developed new applications and products from renewable materials. They incorporate organic waste from which automotive and construction prototypes are obtained, such as trims, fascias or monolithic joints, which give these pieces high added value properties.

More about the BARBARA project here: www.barbaraproject.eu

Product from the BARBARA project, picture provided by Tecnopackaging

BioBarr – New bio-based food packaging materials with enhanced barrier properties

6 partners from 4 European countries are teaming up to proactively search for alternatives to fossil-based raw materials: BioBarr project aims to develop a new food packaging system starting from the innovative bio-based polymers family of polyhydroxyalkanoates (PHAs), 100 % bio-based and biodegradable. The bio-based polymer, produced through an innovative biotechnology completely based on natural bacterial fermentation of agricultural by-products, will represent the support on which further functionalisation, based on coating treatments, will be developed for obtaining an eco-sustainable packaging able to guarantee the optimal preservation of foods without compromising in terms of biodegradability. Objectives, expected impacts, preliminary outcomes that emerged after three and a half years of work will be presented.

More about the BioBarr project here: www.biobarr.eu

Products from the BioBarr project, picture provided by Tecnoalimenti

BIOMOTIVE – Advanced BIObased polyurethanes and fibres for the autoMOTIVE industry with increased environmental sustainability

Vehicles are composed of different materials. Fundamental are, among others, polyurethanes (PU). BIOMOTIVE aims to develop a bio-based polymer that mimics the technical properties of PU and also provides the required aesthetics and haptics.

More about the BIOMOTIVE project here: www.biomotive.info

BIOSMART Packaging, the intelligent biobased packaging solution to increase food shelf life

BIOSMART aims to develop bio-based and compostable packaging with desired properties, such as light-weight, shelf-life monitoring and extended shelf-life, easier waste handling and a competitive price.

More about the BIOSMART project here: www.biosmart-project.eu

PEFerence – From bio-based feedstocks via di-acids to multiple advanced bio-based materials with a preference for polyethylene furanoate

The PEFerence Consortium is a major contributor to the establishment of a first of a kind biorefinery flagship plant producing FDCA (furandicarboxylic acid), a bio-based building block to produce high value, fully recyclable products that can replace fossil-based plastic applications. Avantium's YXY® Technology is a patented catalytic conversion route of widely available agricultural co-products into FDCA, the building block of PEF (polyethylene furanoate) – a 100 % plant-based and recyclable polyester with high durability and excellent barrier, allowing both light-weighting as well as longer shelf life for food and beverages. The durability and recyclability of PEF demonstrate how chemistry is a key enabler of the circular bio-economy.

More about the PEFerence project here: www.peference.eu

Bio-based plastic bottle, picture provided by the PEFerence project

POLYBIOSKIN – High performance functional bio-based polymers for skin-contact products in biomedical, cosmetic and sanitary industry

The BBI JU-funded POLYBIOSKIN project formulated and developed bio-based, biodegradable and biocompatible materials to deliver skin-contact products for the hygiene, cosmetic and biomedical industries. The products used as models were a diaper, a face beauty mask and a wound dressing. All three products are very representative of these target industries.
Project partners produced three high-performance prototypes that were validated in a relevant industrial environment. These prototypes were created by using bio-based materials, in particular polylactic acid, polyhydroxyalkanoates, as well as other bio-based polyesters and polysaccharides, such as chitin nanofibrils, nanolignin, pullulan and starch.
The novelty in these products lies in the fact that they are mostly bio-based – the renewable content is about 90 %. In addition, they comply with safety and regulatory requirements. High performance is granted by exploiting bio-nanotechnology. Advanced in vitro experiments confirmed the products' compatibility with skin.

More about the POLYBIOSKIN project here: www.polybioskin.eu

POLYBIOSKIN products, picture provided by IRIS Technology Group

Registration and Programme

If you are interested in participating, please find the registration link and workshop programme under www.afterlife-project.eu/bbi-workshop-2021.

Figure 23: Article on MS8 event

4.6 Social media

Social media was used to disseminate project details, results and events. With every press release or article, a LinkedIn and Twitter posting was created. All known project partners, the funding organisations and stakeholders with social media accounts were tagged to increase the range of the postings.

4.7 Dissemination material

The following dissemination material was developed in the beginning of the project and updated according to changes in the consortium and the sponsors guidelines.

4.7.1 Project identity

The following figure shows the AFTERLIFE project logo:

Figure 24: AFTERLIFE project logo

The following figure is showing the colours chosen for the AFTERLIFE projects identity.

Figure 25: AFTERLIFE colours

4.7.2 D8.3 – Leaflet

The AFTERLIFE Leaflets are attached as Annex I and II.

4.7.3 Roll-up

The AFTERLIFE Roll-up is attached as Annex III.

4.7.4 D8.4 – Videos

- 22 July 2019, “Renewable innovation from wastewater treatment – Discover the EU project AFTERLIFE”: www.youtube.com/watch?v=egIUtwdFQMA&feature=emb_imp_woyt

  - ⇒ 1,013 views
- 5 August 2019, "European SMEs finding a new way to valorise industrial wastewater – AFTERLIFE": www.youtube.com/watch?v=Q5F6kdxrK-Q
  - ⇒ 192 views

4.7.5 Project group: Value Creation from Wastewater

The project group "Value Creation from Wastewater" was formed with the help of the Horizon 2020 booster services, especially the team from Trust-IT Services. Together, Trust-IT and the five projects created the following dissemination material:

- Flyer: www.afterlife-project.eu/wp-content/uploads/2021/11/hrb_afterlife_flyer_a4_nov2021_final.pdf
- Video: www.youtube.com/watch?v=IdBGbUl_HC4
- A joint web page

4.8 Dissemination outlook

The AFTERLIFE website will stay online for 5 more years. The publishable material can still be downloaded from the website.

AFTERLIFE partners can still upload their publications that are based on research from this project to the AFTERLIFE zenodo community: www.zenodo.org/communities/745737

All publications that were published within the AFTERLIFE project duration will be included on the EC portal, the AFTERLIFE website and the AFTERLIFE zenodo community.

The web page created by the project group "Value Creation from Wastewater" that was formed with the help of the Horizon 2020 booster services, especially the team from Trust-IT Services, will be implemented in the AFTERLIFE website.

5 Exploitation roadmap

5.1 List of Key Exploitable Results (KERs)

The initial list of KERs has been evolved during the project. Such an update gave, as a result, Table 7.

Table 6: List of KERs

ID	KER description	Responsible partner
KER 1	Multidisciplinary design optimisation (MDO) implementation	IDE
KER 2	PHB production scaling-up with an evolved R. eutropha strain	CSIC
KER 3	Integrated waste and wastewater conversion into VFA	INN
KER 4	Development of a cost-effective cascade of filtration units	VTT
KER 5	Optimised PHA production from food wastewater	NID
KER 6	Development of methodologies for the processing of biopolymers into thermoplastics	LUR
KER 7	Development of processes for the extraction of aminoacids	LUR
KER 8	Development of process for FOG removal	LUR
KER 9	Development of blown extrusion process	MIP
KER 10	Recycling process for PHA-based bioplastics	MIP

In the following section 5.2 the characterisation, risks, and the exploitation roadmap have been described for each KER. The description of the KER9 and KER10 has not been included due to the lack of enough experimental information due to the poor performance in the blown extrusion process and the impossibility to produce the target plastic goods for their recycling. Similarly, KER2 has not been included due to its similarity with KER5.

5.2 KER1: Multidisciplinary design optimisation (MDO) implementation

5.2.1 Characterisation of KER

Table 7. Description of KER1

Multidisciplinary design optimisation (MDO) implementation	
Problem	Applying new technologies in existing processes or industrial landscapes has significant barriers due to the uncertainty of a successful implementation. This is a problem for the industries that need modernisation in the technologies they use to reach sustainable operations and products. Other potential clients are the technology developers, which can use the tool to prove the feasibility and advantages of technology implementation and support their engineering work.
Alternative solution	Commercial process simulation tools can be used to foresee the performance and potential adaptation of the technology for a successful

	implementation. However, the current commercial process simulators are not focused on biotechnological processes (they are mainly oriented to the chemical industry), or they have not developed advanced optimisation functionalities.
Unique Selling Point USP - Unique Value Proposition UVP	The proposed tool will allow to test the suitability of the technology and quantify the potential economic and environmental advantages before its implementation. Specific and detailed models have been developed for the bioconversion processes in the AFTERLIFE scheme to ensure reliable results. It will also support the engineering works by calculating the optimal process parameters for each specific case.
Description	Development of a process simulation software with a focus on biotechnological operations. It includes the development of the mathematical modelling and optimisation strategy behind and of user interface and future extensions (i.e., the inclusion of additional technologies)
"Market" – *Target market*	European bio-based industry
"Market" – *Early Adopters*	Food industries, PHA producers, technology developers (i.e., SMEs or RTOs)
"Market" - Competitors	Other developers of process simulation tools (ASPEN, SUPREPRO)
Go to Market – Use model	Provision of a service/Software Licensing
Go to Market - Timing	2 years
Go to Market – IPR Background	Model and software development: IDENER Development of bioprocess technology: VTT, CELABOR, LUREDERRA, INNOVEN, CSIC, NID, BBEPP
Go to Market – IPR Foreground	Virtual plant (model) of the AFTERLIFE processes: IDENER AFTERLIFE technologies developed and validated: VTT, CELABOR, LUREDERRA, INNOVEN, CSIC, NID, BBEPP

Table 8. KER1’s Exploitation route (how the KER will be further exploited)

KER’s Exploitation route (how the KER will be further exploited)			
	Selected route	**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[1]	
		A group of partners[2]	X
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	
	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	
		By licensing	
	Other (*please describe*)		

Table 9: Exploitation roadmap of KER1

Exploitation roadmap	
Actions	Revision of the exploitation plan and business plan development Discussions with partners about IPR management and signature of agreements
Roles	Revision of the exploitation plan and business plan development: IDENER with subcontracted services Discussions with partners about IPR management and signature of agreements: all involved partners
Milestones	Clear IPR management strategy: 6 months after the end of the project Release of the first version of the software: 1 year after the end of the project
Financials Costs	External services (IPR, business plan development, legal): 3 k€ Software development: 16 k€
Revenues	Licensing (with technical support) 1 year: 3 k€/license Services providing (simulation of new units and scenarios): 5-10 k€/service Revenues after 1 year: 0 € Revenues after 3 years: 50 k€
Other sources of coverage	Own resources and other project grants
Impact in 3-year time	Conversion of bio-based industry into a sustainable sector embedded in circular economy. Reduction of waste generation and of water consumption

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

[2] Provide the names of the partners

5.2.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

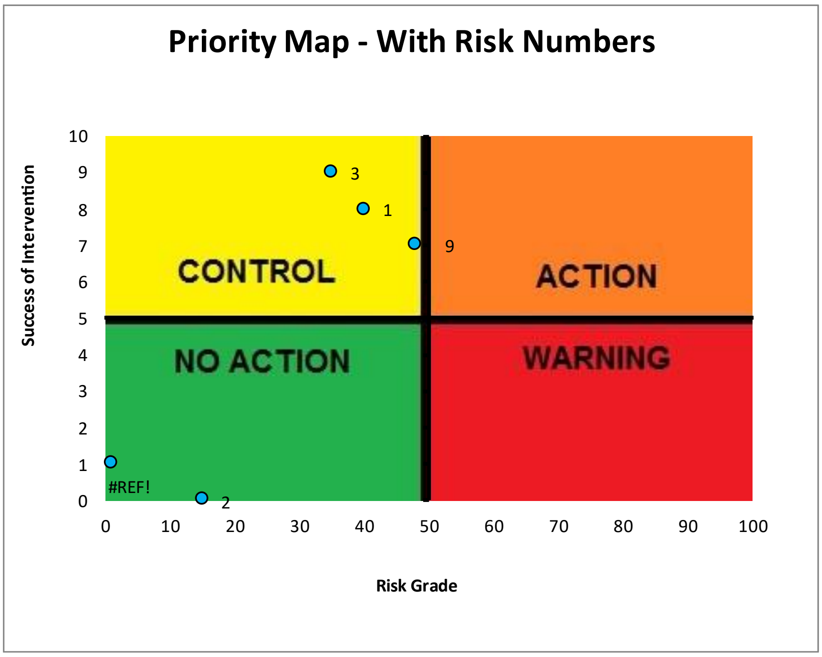

Figure 26: Priority map of KER1 – with risk numbers

Table 10. Summarising risks table of KER1

Summarising Risks Table	
Number of "No Action" Risks	1
Number of "Control" Risks	4
Number of "Action" Risks	1
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

5.3 KER3: Integrated waste and wastewater conversion into VFA

5.3.1 Characterisation of KER

Table 11. Description of KER3

Integrated waste and wastewater conversion into VFA	
Problem	Wastewater treatment is an energy-intensive process that produces a high amount of sludge with a high cost for disposal. Each year a huge amount of wastewater by food industries is generated (fruit processing, cheese manufacturing and sweets manufacturing in the Afterlife contest). Also, the need for renewable and innovative plastic materials is more and more important.
Alternative solution	Wastewater could be treated by conventional activated sludge process, which is not energy efficient, or by the disposal as liquid waste through expensive fee.
Unique Selling Point USP - Unique Value Proposition UVP	Integrated anaerobic process, such as acidogenic fermentation or biogas production, allows the valorisation of organic matter contained in the wastewater into bio-based building blocks useful for the chemical industry (e.g., volatile fatty acids) or biogas for the on-site production of renewable energy (heat and/or electricity) and potential upgrading of biogas to biomethane.
Description	This solution optimises the existing wastewater treatment by the production of volatile fatty acids and biogas from food-industry wastewaters employing biological processes, thus aiming the valorisation of the organic matter into high added-value products. The production is therefore eco-friendly, avoiding the use of petrol-based materials or substrates.
"Market" – *Target market*	This technology has been already applied in the municipal sector, and full-scale cases are operating in 2 Italian wastewater treatment plants. The same technology could be exploited in all industries of agro, food, the paper sector with waste and wastewater. The same technologies could also be applied for the treatment of the organic fraction of municipal solid waste (OFMSW).

	Other customers could be private and public companies involved in the management of municipal waste and wastewater.
"Market" – *Early Adopters*	Water utilities are interesting in these technologies because of the on-site production of suitable carbon sources to enhance the biological nutrients removal.
"Market" - Competitors	Engineering company that are offering services and consulting aiming resource recovery from waste and wastewater.
Go to Market – Use model	Innoven srl is a technology provider. It can offer the know-how and support to construction companies to realise the process. Innoven can give the support on the start-up and long-term monitoring assistance of the biological process.
Go to Market - Timing	The acidogenic fermentation was already applied in at least 2 full scale plants, while other 2 executive design were carried for next realisation withing 2 years of timing. The recovery and purification of VFAs will be a further upgrading of the acidogenic fermentation but will require around 10 years (estimated) before to have the first industrial prototype.
Go to Market – IPR Background	Development of anaerobic fermentation and digestion of wastes
Go to Market – IPR Foreground	The acidogenic fermentation could be integrated with other technology validated during the AFTERLIFE project. The downstream of the VFAs as well as the PHAs production from aerobic mixed cultures.

Table 12. KER3’s Exploitation route

KER’s Exploitation route (how the KER will be further exploited)			
	Selected route	**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[3]	
		A group of partners[4]	X (JAKE, CIT, HER, BBEU)
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	
	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	

---

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

		By licensing	
	Other (*please describe*)		

Table 13. Exploitation roadmap of KER3

Exploitation Roadmap	
Actions	Feasibility study and cost/benefit analyses for the implementation of acidogenic fermentation and biogas production within the industries involved in the project.
Roles	VTT could be involved in the recovery and purification of the VFAs produced by the acidogenic fermentation. NID could be involved in the PHA production using VFAs produced and purified.
Milestones	Not determined
Financials Costs	Not determined
Revenues	Not determined
Other sources of coverage	Application to other EU Projects to develop the technology and possible other substrates/by-products to be used for this application.
Impact in 3-year time	This solution optimises the existing wastewater treatment by the production of high-value intermediates/products by using food-industry wastewaters, thus aims the valorisation of waste into high added-value products. The production is therefore eco-friendly, avoiding the use of petrol-based materials or substrates.

5.3.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

Figure 27. Priority map of KER3 – with risk numbers

Table 14. Summarising risks table of KER3

Summarising Risks Table	
Number of "No Action" Risks	0
Number of "Control" Risks	4
Number of "Action" Risks	1
Number of "Warning" Risks	1
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

5.4 KER4: Development of a cost-effective cascade of filtration units

5.4.1 Characterisation of KER

Table 15. Description of KER4

Development of a cost-effective cascade of filtration units	
Problem	Limits for wastewater discharge create the need for purification. Valuables in wastewater cause pure water and material loss when discharging without recovery. A sufficient good concept to recover value from wastewater of the food industry is not available for the companies.
Alternative solution	Wastewater goes to wastewater treatment plants without recovery of water and valuables.
Unique Selling Point USP - Unique Value Proposition UVP	Water for reuse and material recovery can be realised with the developed membrane-based concepts. The development of a cost-effective cascade of membrane filtration units for the separation and concentration of four different wastewaters were developed. The concepts can be multiplied for other similar types of wastewaters. Similar concepts do not exist yet in the market.
Description	Cost-effective cascade of membrane filtration units for the separation and concentration of wastewater for water reuse and valuables recovery.
"Market" – *Target market*	- Water/wastewater market; purification, reuse, valuables recovery - Customer segment is water-intensive process industry
"Market" – *Early Adopters*	Finnish food industry (dairy, brewery, candy)
"Market" - Competitors	Companies who can offer concept with equipment (e.g., Veolia, Suez, GE). However, before offering, they also need separation concept development, which is naturally done by research institutes having suitable knowledge. Devices are available for customer purchase (however, not necessarily the best one).

Go to Market – Use model	Purchase trademark for the concepts, publish development in scientific articles, direct industrial use.
Go to Market - Timing	Publication is accepted, trademark purchase is under consideration, concept will be marketed to Finnish companies in near future.
Go to Market – IPR Background	The knowledge needed for concept development is in the public domain.
Go to Market – IPR Foreground	It is agreed in the consortium that the concept will not be patented.

Table 16. KER4’s Exploitation route

KER’s Exploitation route (how the KER will be further exploited)			
Selected route		**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[5]	x
		A group of partners[6]	
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	
	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	x
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	
		By licensing	
	Other (*please describe*)		

Table 17. Exploitation roadmap of KER4

Exploitation roadmap	
Actions	Purchase trademark for the concepts, marketing for direct industrial use
Roles	Realised by VTT

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

Milestones	Trademark procedure clarified Q3 2022 Trademark proposal submitted Q4 2022 Direct industrial use marketed to Finnish food industry Q4 2022
Financials Costs	Not determined
Revenues	Not determined
Other sources of coverage	TRL high enough for KER
Impact in 3-year time	New business in circular economy, purer environment, savings in raw materials

5.4.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

Figure 28. Priority map of KER4 – with risk numbers

Table 18. Summarising risks table of KER4

Summarising Risks Table	
Number of "No Action" Risks	4
Number of "Control" Risks	1
Number of "Action" Risks	0
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0

Number of Risks Between Control & Action	0

5.5 KER5: Optimised PHA production from food wastewater

5.5.1 Characterisation of KER

Table 19. Description of KER5

Optimised PHA production from food wastewater	
Problem	Generation of a relevant volume of wastewater by food processing industries like fruit processing, cheese manufacturing and sweets manufacturing, that must be treated before discharge. On the other hand, there is a need for biodegradable plastic goods for packaging and agriculture applications. The organic matter present in the wastewater of these three water-intensive food processing industries can be converted into a high value-added biopolymer, namely PHA. For that, PHA production using mixed microbial cultures must be optimised.
Alternative solution	Wastewater from food processing industry is treated by biological methods for the removal of organic matter and nutrients without product valorisation.
Unique Selling Point USP - Unique Value Proposition UVP	Conversion of the organic matter coming from wastewater into a high value-added PHA biopolymer using a mixed microbial culture. The PHA production is optimised for a high biomass content in the selection bioreactor, high PHA content in the microbial cells and high overall volumetric productivity. Valorisation of wastewater into a high added-value product, contributing to the circular economy concept.
Description	The low value-added organic residues, after being converted into volatile fatty acids (VFA) by anaerobic fermentation, are used for the selection of a mixed microbial culture with high PHA accumulation capacity. The selected bacterial consortium can produce PHA from feedstocks with different origins and different fermentation product profiles than the ones used for culture selection. High PHA productivities can be attained.
"Market" – *Target market*	Food industry wastewater producers and/or PHA producing companies.
"Market" – *Early Adopters*	PHA producers interested in using wastewater as a cheaper feedstock. Due to issues related to material flow, the possibility of installing the PHA production units at the food industry facilities should be considered. This scenario should be considered when developing the business model.
"Market" - Competitors	Producers of biodegradable polymers, including PHA. The weaknesses are related to the use of pure cultures for PHA production, which can be less robust in the presence of feedstocks with variable composition.
Go to Market – Use model	Through licence agreement and publications.
Go to Market - Timing	1 year
Go to Market – IPR Background	NID has achieved a TRL-4 (development at bench-scale) in the PHA production by bacteria consortium using different industrial residues as carbon source. There is no previous patent.

	The technology was developed by NID. There is no need for technology agreement.
Go to Market – IPR Foreground	NID technology can be used with the technology developed by Innoven. For that, a joint ownership agreement will be necessary.

Table 20. KER5’s Exploitation route

KER’s Exploitation route (how the KER will be further exploited)			
Selected route		**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[7]	
		A group of partners[8]	
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	
	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	X
		A group of partners	X INNOVEN
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	
		By licensing	
	Other (*please describe*)		

Table 21. Exploitation roadmap of KER5

Exploitation Roadmap	
Actions	License the knowhow. To increase the TRL of the technology, NID will apply for further research funding.
Roles	Join the PHA production technology of NID with VFA production technology of Innoven.
Milestones	Accomplish the TRL5 of the technology in 6 months Apply for further research funding to increase the TRL Licence the technology
Financials Costs	6 months to accomplish TRL5: € 30,000.00 1 year to increase the TRL: € 500,000.00
Revenues	Technology Transfer Office (TTO) will help NID to licence the technology and to define the revenues and eventual profits.
Other sources of coverage	To further develop the technology and increase the TRL, NID will apply for another research project funding.

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

[8] Provide the names of the partners

Impact in 3-year time	Bring the technology to TRL7 to enable its licencing. Valorisation of wastewater into a high added-value product, contributing to the circular economy concept. Advancement of the commercially established PHA production routes.

5.5.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

Figure 29. Priority map of KER5 – with risk numbers

Table 22. Summarising risks table of KER5

Summarising Risks Table	
Number of "No Action" Risks	4
Number of "Control" Risks	1
Number of "Action" Risks	0
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

5.6 KER6: Development of methodologies for the processing of biopolymers into thermoplastics

5.6.1 Characterisation of KER

Table 23. Description of KER6

Development of methodologies for the processing of biopolymers into thermoplastics	
Problem	Bioplastics produced with PHA have technical limitations such as their difficulty in thermoforming, low ductility, or low thermal resistance. This means that the companies dedicated to its production, despite offering added value products such as their biodegradability, are not able to compete commercially with traditional plastics produced from hydrocarbons since they have properties that make them more attractive for different commercial applications such as packaging.
Alternative solution	At present, followed strategies for the commercialisation of PHA are the development of specific processes that allow better processing of PHA and the mixture of PHA with other polymers that can improve the mechanical properties of the resulting thermoplastic material. The mixture of PHA with other polymers is the most widespread method to make competitive thermoplastic materials. Among the polymers used in these mixtures are polymers originating from hydrocarbons, PP or PVC, with which excellent properties are obtained for industrial use but which make the plastic degradation capacity lose; and biopolymers, such as PLA, that maintains the degradability intact and with which improved mechanical properties are obtained.
Unique Selling Point USP - Unique Value Proposition UVP	Lurederra's under development method to produce PHA-based plastic materials also follows the PHA additivation strategy to improve its commercial limitations. The additivation followed by Lurederra includes biopolymers that do not affect the degradability of the final plastic material as in other commercial formulations, but the innovation, in this case, is the study of the incorporation of inorganic nanocomposites such as nano clays or sepiolite. These compounds improve some of the commercial limitations of PHA: -Nanoclay: help to improve the thermal stability of the PHA. -Sepiolite: improves the thermoforming of PHA. The use of composites with nanoscale size helps, in this case, to the good integration of the additive in the plastic matrix. In addition, the quantity of additive used is reduced thanks to the greater specific surface that the nanoparticles have. Furthermore, inorganic materials do not affect the degradability of the final product and are more economically affordable than biopolymers.
Description	The result obtained by Lurederra is a production method and a formulation for the manufacture of thermoplastic materials based on PHA with which mechanical characteristics are achieved that make their commercial use viable. Some of these mechanical characteristics have been characterised obtaining the following results: **RESULTS OF MECHANICAL CHARACTERISATION** **Young's modulus (mPa)** 1831.86039

	Maximum slope (N/mm) 69.14137 **Breaking force (N)** 108.61800 **Deformation to break (%)** 2.30805 **Elongation to break (mm)** 3.00047 **Deformation maximum by traction (mm/mm)** 0.02344
"Market" – *Target market*	The target market is companies focused on the production of thermoplastic materials, especially those that work with biopolymers, degradable materials, etc. and interested in productive systems in a circular economy. Some examples of companies in the sector are Artificial Nature, Green Dot Bioplastics or Futamura.
"Market" – *Early Adopters*	Not identified yet
"Market" - Competitors	Other technology centres or research organizations with departments focused on or experience in the design of thermoplastic materials, such as AIMPLAS Instituto Tecnológico del Plástico, AITIIP Centro Tecnológico or Fundación ANDALTEC I + D + i. These may have greater capacity to carry out tests and characterisation, while Lurederra has extensive knowledge and experience in the field of nanoparticles as an innovative element
Go to Market – Use model	Technology transfer
Go to Market - Timing	During the next two years after the completion of the project, the technological transfer of the results obtained to companies interested in said technology will be sought. If the results are satisfactory, the results will be commercially exploited through the company TECNAN (with which Lurederra collaborates closely).
Go to Market – IPR Background	Lurederra´s IPR background according to the consortium agreement is: Development of methodologies for the conversion of biopolymers into thermoplastic materials.
Go to Market – IPR Foreground	Lurederra has collaborate with Mi-Plast is the work related to this KER. Then, agreements between these organisations will be stablished in this sense.

Table 24. KER6's Exploitation route

KER's Exploitation route (how the KER will be further exploited)			
	Selected route	**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[9]	
		A group of partners[10]	x
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	x
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	x

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

[10] Provide the names of the partners

	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
INDIRECT USE	Assignment of the IPR	A partner	
		A group of partners	
	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	
		By licensing	
	Other (*please describe*)		

Table 25. Exploitation roadmap of KER6

Exploitation Roadmap	
Actions	-Carrying out a market study to define appropriate market prices -Search to identify the tests necessary for the validation of the properties of the product. -Star carrying out a scaling process to optimise the process on an industrial scale. For this, it will be valued the acquisition of a new extruder that will allow progress in the preparation of samples and scaling work will be assessed, which would mean about € 60,000.
Roles	Lurederra does not have partners for the exploitation of this KER, so for now all defined actions will be carried out by Lurederra, but conversations are being held with Mi-plast to be able to have it as a partner. In that case, Lurederra's role would be more to scale, optimise formulations, etc. While Mi-plast would focus on the part related to product validation.
Milestones	-Validation of product properties with respect to current legislation: mechanical characterisation, degradation test, certification for contact with food ... -Obtaining a production protocol on an industrial scale. -Signing of agreements with companies for technology transfer.
Financials Costs	The main expenses will be personnel and consumables for research or the exploitation of results, which will mean around € 50,000.
Revenues	The projected income and potential benefits are estimated at 200,000 € per year.
Other sources of coverage	In addition to personal and material resources, Lurederra has a close collaboration with the TECNAN company, which could carry out larger-scale production and commercialisation of the technology developed.
Impact in 3-year time	Over the next 3 years it is expected that technology transfer agreements will be reached with different bioplastics producing companies, seeking estimated economic benefits. In addition, to carry out the exploitation tasks, new jobs will be created in Lurederra. In addition, the knowledge

	acquired by Lurederra in the development of this solution will allow the carrying out of new research projects around bioplastics. After 3 years, with the most mature development, the commercialisation of the product developed directly through the company TECNAN (a company with which Lurederra collaborates very closely) will be studied.

5.6.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

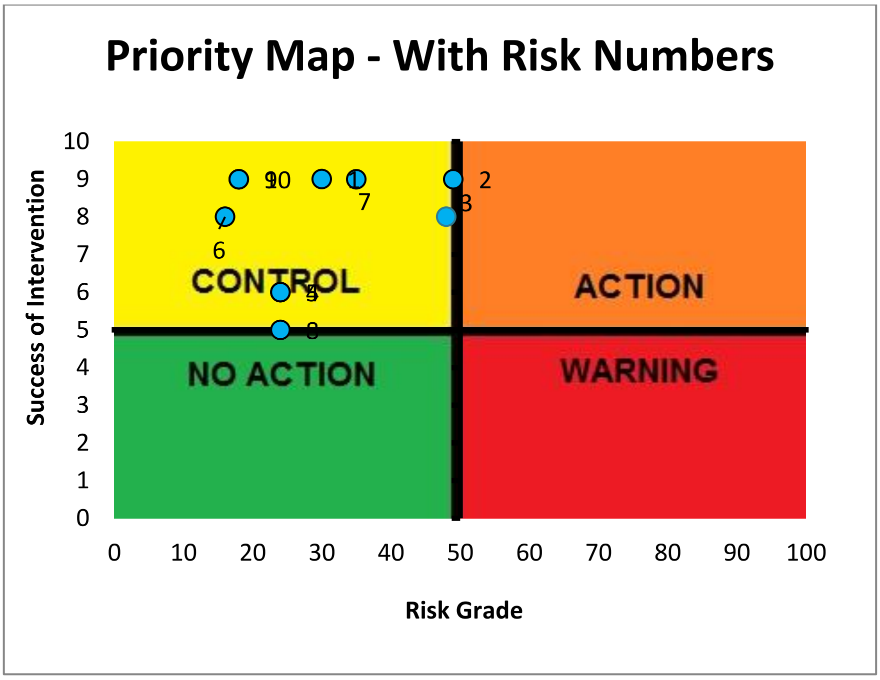

Figure 30. Priority map of KER6 – with risk numbers

Table 26. Summarising risks table of KER6

Summarising Risks Table	
Number of "No Action" Risks	0
Number of "Control" Risks	9
Number of "Action" Risks	0
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	1
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

5.7 KER7: Development of processes for the extraction of aminoacids

5.7.1 Characterisation of KER

Table 27. Description of KER7

Development of processes for the extraction of aminoacids	
Problem	The obtention free amino acids from wastes to revalorise them usually are carried out using strong mineral acids for the hydrolysis of proteins. On the one hand, this process implies the use of corrosive substances that imply the necessary waste management and, on the other hand, causes the racemisation of amino acids, reducing the amount of biological useful amino acids obtained.
Alternative solution	To avoid using strong acids and thus the racemisation of amino acids, enzymatic hydrolysis is used.
Unique Selling Point USP - Unique Value Proposition UVP	Lurederra has developed a hydrolysis method to obtain free amino acids using oxalic acid. It is a more environmentally friendly method since it does not involve corrosive substances and allows the amino acids to be separated from the acid easily by decanting them with calcium hydroxide in the form of calcium oxalate and their subsequent reuse. Furthermore, it makes it possible not to racemise amino acids, preserving their L form more economically than by using enzymatic hydrolysis.
Description	The developed process allows the hydrolysis of proteins to obtain free amino acids using oxalic acid as an alternative to strong acids. After hydrolysis, an amino acid concentrate is obtained after neutralising the acid by decanting the oxalic acid in the form of calcium oxalate and its subsequent filtration to separate this oxalate and other non-hydrolysable compounds from the sample. In the tests carried out throughout the AFTERLIFE project, the hydrolysis of the sample supplied by Celabor has been carried out, obtaining solutions with the following composition:

AminoAcid	Conc. AA (mg/L)	(%)
Aspartic Acid	1317,8	7,7%
Glutamic Acid	757,5	6,3%
Serine	205,1	2,6%
Glycine	158,0	1,2%
Histidine	1698,5	3,4%
Arginine	108,8	7,4%
Threonine	503,0	21,1%
Alanine	495,9	ND
Proline	180,0	9,2%
Tyrosine	453,4	2,7%
Valine	260,6	1,8%
Methionine	220,4	3,3%
Cystine	115,3	ND
Isoleucine	181,7	2,7%
Leucine	301,6	4,4%

Phenylalanine	248,4	2,8%
Lysine	251,4	23,3%
Total	**7457,4**	**100,0%**
Essential AA	**3665,6**	**62,8%**

"Market" – Target market	The target market are companies interested in implementing this alternative hydrolysis process to obtain free amino acids through the revalorisation of wastes. This involves companies from different sectors such as animal nutrition or sports nutrition. Some examples of these companies are: Daymsa (animal nutrition) and BFC (human and animal nutrition)
"Market" – Early Adopters	Early adopters are those companies that market free amino acids and are interested in improving their extraction processes making it more environmentally friendly and improving the racemisation problem.
"Market" - Competitors	Other technology centres or research organisations with departments focused on or experience in extraction and valorisation of nutritional interesting compounds, such as NEO ALGAE or AINIA.
Go to Market – Use model	Technology transfer.
Go to Market - Timing	During the next two years after the completion of the project, the technological transfer of the results obtained to companies interested in said technology will be sought.
Go to Market – IPR Background	Although this activity was not initially included in the project's memory, it was decided to carry it out due to the experience that Lurederra already had from previous projects in which residues including amino acids were revalued.
Go to Market – IPR Foreground	Based on the results obtained from the project and its exploitation, Lurederra hopes to obtain knowledge and experience that will allow it to participate in new research projects.

Table 28. KER7's Exploitation route

KER's Exploitation route (how the KER will be further exploited)			
	Selected route	**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[11]	
		A group of partners[12]	X
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	
	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	
IN DI	Assignment of the IPR	A partner	
		A group of partners	

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

[12] Provide the names of the partners

	Licensing of the IPR	A partner	
		A group of partners	
	Development of a new legislation/standard	A partner	
		A group of partners	
	Spin- off	A partner	
		A group of partners	
		By assignment	
		By licensing	
	Other (*please describe*)		

Table 29. Exploitation roadmap of KER7

Exploitation roadmap	
Actions	-Carrying out a market study to define appropriate market prices. -Identify those requirements that the sample obtained of amino acids must meet to have industrial value and carry out the necessary optimisations in the process to adapt to them -Identify possible legal or administrative obstacles in the implementation of the process developed in the market. -Continue carrying out a scaling process to optimise the process on an industrial scale.
Roles	Lurederra does not have partners for the exploitation of this KER, so for now all defined actions will be carried out by Lurederra. However, CTC's advice is being counted on in the definition of requirements to be met by the mixtures of amino acids obtained by the process.
Milestones	-Obtaining a suitable market price for the process developed -Identify the requirements for the amino acid concentrates obtained in the process to be of commercial interest. -Identify the legal requirements that the process must meet. -Definition of parameters on an industrial scale.
Financials Costs	The main expenses will be personnel and consumables for research or the exploitation of results.
Revenues	The projected income and potential benefits are estimated at 70,000 € per year.
Other sources of coverage	Not determined
Impact in 3-year time	Over the next 3 years it is expected that technology transfer agreements will be reached with different companies, as Daymsa and BFC, seeking estimated economic benefits. In addition, to carry out the exploitation tasks, new jobs will be created in Lurederra. In addition, the knowledge acquired by Lurederra in the development of this solution will allow the carrying out of new research projects.

5.7.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

Figure 31. Priority map of KER7 – with risk numbers

Table 30. Summarising risks table of KER7

Summarising Risks Table	
Number of "No Action" Risks	1
Number of "Control" Risks	5
Number of "Action" Risks	3
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

5.8 KER8: Development of a process for FOG removal

5.8.1 Characterisation of KER

Table 31. Description of KER8

Development of process for FOG removal	
Problem	The need to separate FOGs (fats, oils and Grease) in the purification of industrial waters
Alternative solution	The main method used is flotation

Unique Selling Point USP - Unique Value Proposition UVP	In Lurederra, the development of a method for separating FOG from water has been carried out, focusing on an absorbent material capable of trapping these compounds. This separation method has as its main advantage over flotation the possibility of working in continuous flow and in less time and space (flotation requires large surface tanks to be able to remove the fats that come to the surface). In addition, another of the main advantages of the process is the ability to remove the FOG from the absorbent by pressing it so that it can be reused.
Description	The process is based on a porous rubber-based material that, through nanotechnology, allows the FOG present in the water to be trapped. In the preliminary tests carried out in the laboratory and in the absence of the latest optimisations, percentages of FOG reduction of the wastewater exceeding 50% have been achieved.
"Market" – *Target market*	Companies that carry out their own water purification. Especially those in the food sector. Also, companies and organisations are specifically dedicated to water purification.
"Market" – *Early Adopters*	Not identified yet
"Market" - Competitors	Other technology centres or research organizations with departments focused on or experience on wastewater tratement as Centro de las Nuevas Tecnologías del Agua (Fundación CENTA) or Centro Tecnológico del Agua (CETaqua).
Go to Market – Use model	Technology transfer.
Go to Market - Timing	During the next two years after the completion of the project, the technological transfer of the results obtained to companies interested in said technology will be sought.
Go to Market – IPR Background	Lurederra´s IPR background, according to the consortium agreement, is: Know-how on wastewater treatment and new materials for separation and purification (resins, adsorbents, etc.) Coating technology for anti-stick and anti-fouling applications. Know how on polymers processing.
Go to Market – IPR Foreground	Lurederra has collaborated with VTT in work related to this KER. Then, agreements between this organisation will be established in this sense.

Table 32. KER8’s Exploitation route

KER’s Exploitation route (how the KER will be further exploited)			
Selected route		**Implementing actor**	**Yes**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to the target markets)*	One partner[13]	
		A group of partners[14]	
	Contract research (*new contracts signed by the research group with external clients*)	A partner	
		A group of partners	X
	A new research project (*application to public funded research programmes*)	A partner	
		A group of partners	X

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

[14] Provide the names of the partners

	Implementation of a new university – course (*Note that a training course is a service*)	A partner	
		A group of partners	
		A new partnership	

Table 33. Exploitation roadmap of KER8

Exploitation roadmap	
Actions	-Carrying out a market study to define appropriate market prices. -Identify possible legal or administrative obstacles in the implementation of the process developed in the market. -Continue carrying out a scaling process to optimise the process on an industrial scale.
Roles	Lurederra does not have partners for the exploitation of this KER, so for now all defined actions will be carried out by Lurederra.
Milestones	-Obtaining a suitable market price for the process developed -Identify the legal requirements that the process must meet. -Definition of parameters on an industrial scale.
Financials Costs	The main expenses will be personnel, consumables for research or the exploitation of results and the purchase or development of new devices, such as roller mill, that allow the material to be produced on a larger scale. that will mean around 60,000 €.
Revenues	The projected income and potential benefits are estimated at 80,000 € per year.
Other sources of coverage	Not determined yet
Impact in 3-year time	Over the next 3 years it is expected that technology transfer agreements will be reached with different companies and organisations that carry out water purification processes that involve the separation of FOG, seeking estimated economic benefits. In addition, to carry out the exploitation tasks, new jobs will be created in Lurederra. In addition, the knowledge acquired by Lurederra in the development of this solution will allow the carrying out of new research projects. Furthermore, if the situation is favourable and market data make it possible, the creation of a spin of company could be considered for the exploitation and direct sale of absorbent material.

5.8.2 KER risk assessment map

The priority map and risk summary are depicted below. A description of the related risks is included in Annex IV.

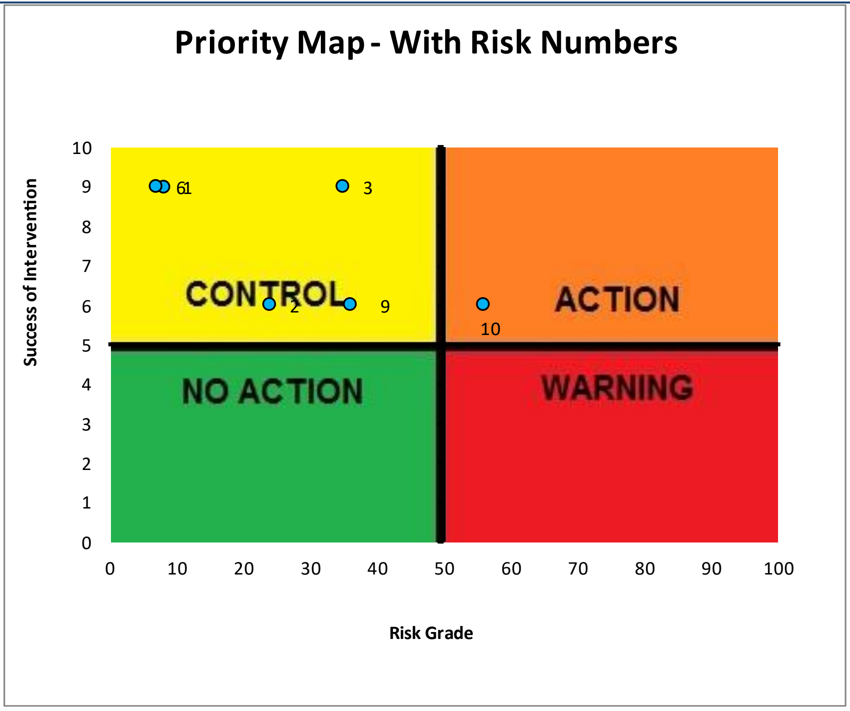


Figure 32. Priority map of KER8 – with risk numbers

Table 34. Summarising risks table of KER8

Summarising Risks Table	
Number of "No Action" Risks	1
Number of "Control" Risks	9
Number of "Action" Risks	1
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

6 AFTERLIFE Technology: Market analysis and exploitation model

Several discussions within the consortium and with the support of LC Innoconsult have drawn the following conclusions:

- AFTERLIFE target market will be, ultimately, the high-water demanding food industry
- The value proposition will be linked to the in-situ treatment of wastewater to produce clean wastewater that could be reused in the process
- The concentrated/sludge produced after the filtration step can be commercialised as a raw material to produce value-added products (mainly PHAs)
- For this, it is necessary the presence of actors able to convert the sludge into PHAs (i.e., biorefineries)
- The PHA technology developed in AFTERLIFE (by mixed or pure cultures) could be licensed to these companies able to make the conversion

According to these conclusions and going a step further than the exploitation analysis typically done at this TRL level, a preliminary business plan structure and exploitation model has been drafted considering the filtration technology developed in AFTERLIFE for water cleaning (KER4). Regarding PHA production technology, it has been compared with benchmarking PHA production technologies in techno-economic (deliverable D.7.4) and LCA (deliverable D.7.2). The social assessment has also considered the PHA-based products to determine their public acceptance (deliverable D.7.5). Potential improvements and steps forward to increase their competitiveness are described in these deliverables.

The wastewater from the food processing industry is generally pre-treated in-situ before (1) discharging into the sewage network or (2) being received by an authorised waste manager. These practices aim to deplete water before discharging into the water bodies but not the valorisation of the organic matter inside. In the same specific cases, part of the waste streams can be valorised (e.g., cheese whey). But it does not imply a recovery of clean water for the process, and it is made only for concentrate streams and not for the diluted streams from the project, which are the majority.

The common technology that is applied in water depuration is the active sludge process. This technology uses mixed bacterial cultures (sludges) to degrade the organic matter in the wastewater. It is an aerobic process (thus required air injection) that produces a significant amount of biological sludge, which should be treated. The main disadvantages associated with the benchmarking are:

- No product valorisation → Not compliment with a circular economy approach

- Organic matter in wastewater goes to waste

- Energy-consuming if no biological method is used

On the other hand, its advantages are:

+ Easy to conduct

+ Traditional method → Investments already made

+ No partners needed for organic matter valorisation

6.1 Market assessment

The global water technology market for the food and beverage segment was estimated at €3.3 bn in 2011 and €6.0 bn in 2020 (6.7% CAGR) with water & wastewater treatment equipment and operation & maintenance services are accounting for € 2.2 and 1.8 billion, respectively. As the population grows and demand for food increases, along with the industrialisation of nations like China and India, demand for processed food is increasing.

The developed technology targets a wider application as wastewater technology in the food industry. Nevertheless, suppose you look at the early adopters of the technology (those with a trickier situation in wastewater management and then more susceptible to adopt the technology). In that case, the main food sectors in Mediterranean countries hoard on 13% of the overall food sector investment in wastewater treatment. So, the initial percentage of the market targeted will be around 13% (Frost & Sullivan 2012, Global Water Intelligence 2012).

The global water and wastewater processing services (treatment, transfer, and disposal) market was valued at €425 bn in 2012 and estimated at €625 bn in 2016 with a predicted CAGR of 10% in the outsourcing of services sector. Sustainability measures will be the core driver of market growth. The global operating cost of wastewater treatment systems was expected to run to 58% of this market. This clearly makes outsourcing of industrial water treatment attractive to major players, with outsourcers such as General Electric and Siemens combining product and equipment companies between 2004 and 2010. In Europe, domestic wastewater is the largest burden on wastewater processing infrastructure, according to the "UN Sick Water?" report (https://digitallibrary.un.org/record/760768?ln=es). However, agriculture and industry frequently produce the greatest damage unit count in the developed world. Food processing accounts for 90% of the world's use of potable water, implying that it is disproportionately represented in damaged units discharged to a public sewerage and surface water. The global water technology market for the food and beverage segment was estimated at €3.3 bn in 2011, and €6.0 bn in 2020 (6.7% CAGR) with water & wastewater treatment equipment and operation & maintenance services are accounting for € 2.2 and 1.8 billion, respectively. As the population grows and demand for food increases, along with the industrialisation of nations like China and India, demand for processed food is increasing. Thus, effective water treatment for the agri-food industry is paramount to a sustainable, circular food chain and an opportunity for European enterprises to competitively position and impact in a global, fast-growing market.

The main competitors are the established wastewater treatment companies (AQUALIA, VEOLIA).

Here are listed their weakness and strengths concerning the AFTERLIFE KER:

(-) Their solutions are mainly suitable for huge flows (urban wastewater treatment or large industries)
(-) Their innovation component is limited. They priories the use of well-established solutions
(+) They have a well-established team of experts for the commercialisation and implementation
(+) They are well-known, and they have a solid network

As stated, the target market is the food processing industry. It can be segmented by location: (1) from regions with imminent danger of water scarcity (e.g., Mediterranean countries) [marketing strategy focused on reducing the water demand by reusing]; and (2) from the rest of regions [marketing strategy focused on waste reduction and circular economy approach]

Food industries located in regions with hydric stress and/or with that produce wastewaters with characteristics that make necessary the application of special (pre)treatments [e.g., with very high COD (chemical oxygen demand) or with recalcitrant/harmful compounds]

According to this, the industries in Mediterranean countries would be potential early adopters and, among them, the industries with the highest COD in their wastewaters.

Economic information for the implementation in JAKE, a candy industry (which typically produces wastewater with a high COD), is described below.

6.2 Exploitation model

6.3 Next steps and further development paths

The following steps and milestones have been proposed as a potential pathway to follow the exploitation:

- Six months: Assessment and evaluation of exploitation potential, the definition of final business model and communication in place with the early adopters by the defined channels
- Two years: Get funding for starting the construction of a prototype in an early adopter site (agreement for testing the technology at a larger scale for TRL evolution)
- Three years and a half: Demonstration performed and legal agreements among the team members to exploit the technology
- Five years: Implementation of the technology in several countries (providing of a service or licensing)

The following costs have been initially estimated:

Six months: € 30,000.00

- Travels for meetings: 5,000 €
- Personnel costs: 20,000 €
- Dissemination & Communication companies: 5,000 €

Three years: € 720,000.00 (to run the prototype)

- Cost of prototype design, building, equipment, and operation: 500,000 €
- Personnel costs: 180,000 €
- Travels: 20,000 €
- Marketing companies: 20,000 €

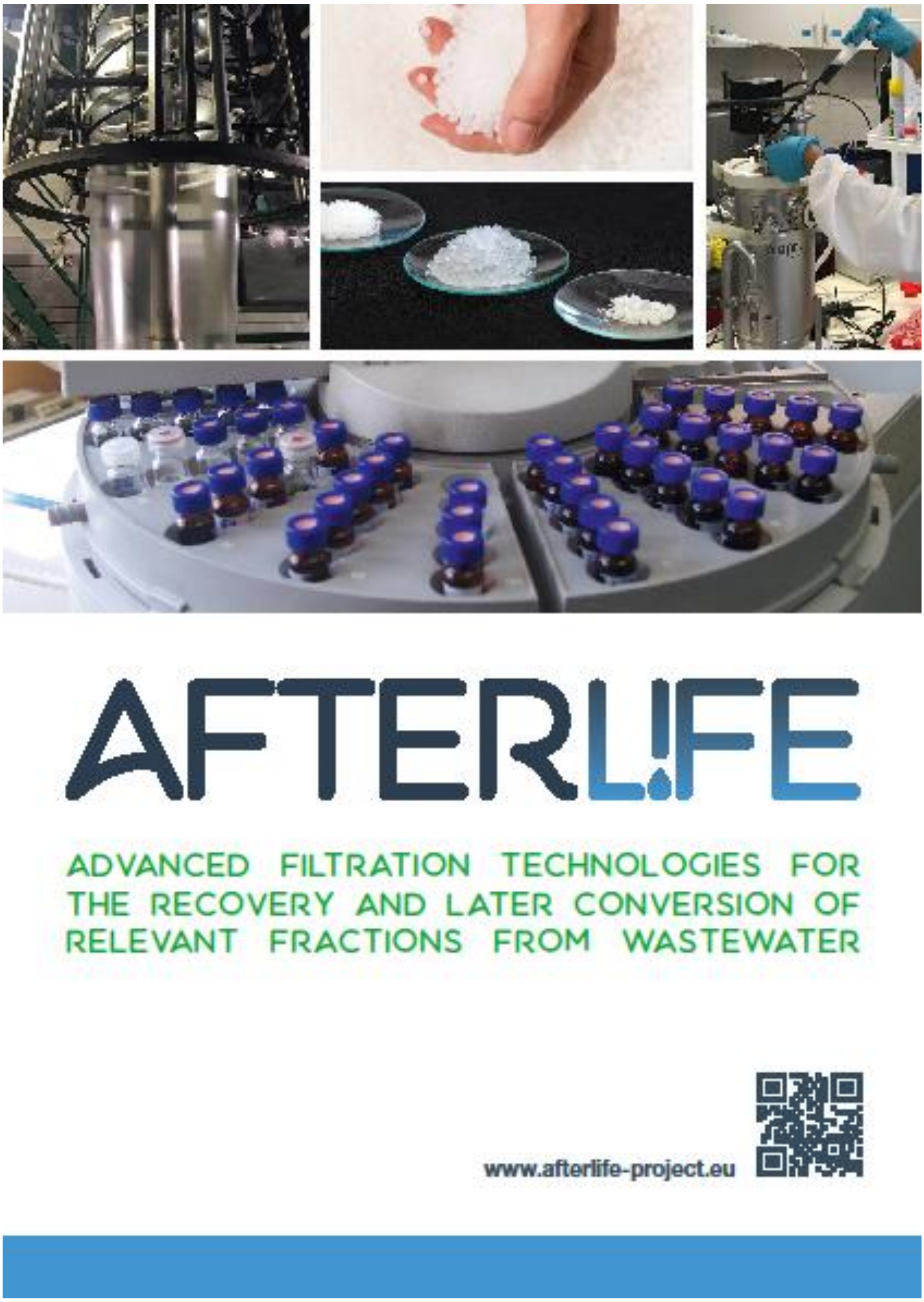
To get funding to build and run the prototype, the contemplated option is applying for another research project funding under Fast Track to Innovation (FTI) call or similar.

This previous information is based on a draft business plan developed in the framework of an exploitation booster service offered by the EC for Horizon 2020 projects. This business plan was developed with the aid of LC Innoconsult International and is attached as Annex V.

7 Conclusion

In summary, the actions planned for dissemination and exploitation of the AFTERLIFE project, were conducted according to the planning. The COVID pandemic impacted the project from 2020 on until the very last General Assembly Meeting. It caused many meetings to happen online, also the MS8 BBI JU Workshop on bio-based polymers. Printed leaflets or flyers were not distributed in large numbers during this period of the project due to the travel and contact restrictions all over Europe / the world. Nevertheless, the public was informed about project and outcomes and new contacts and partnerships were formed, mainly during the events and within the project group “Value Creation from Wastewater” that was formed with the help of the Horizon 2020 booster services, especially the team from Trust-IT Services.

Annex I. Leaflet A5

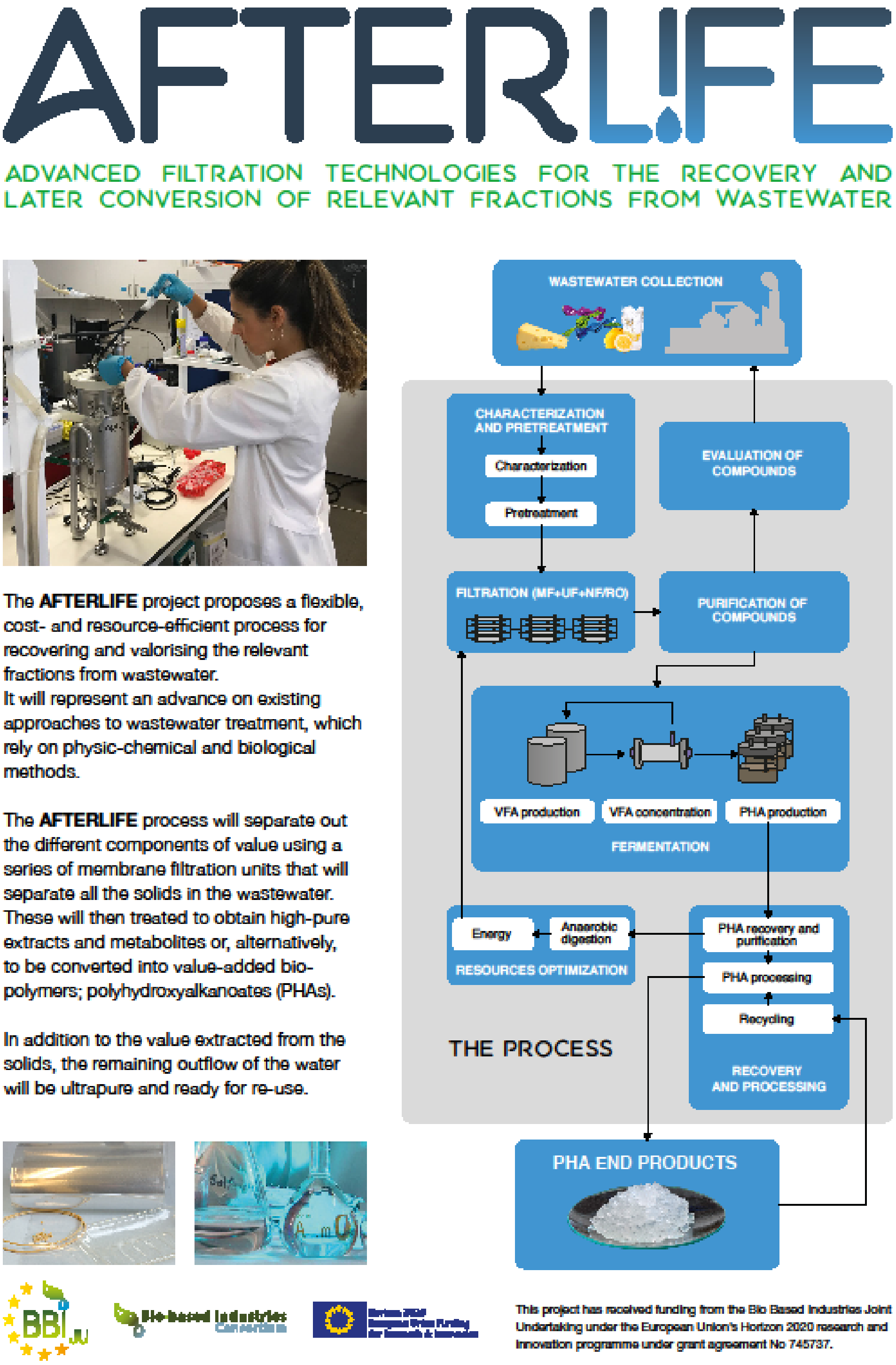


AFTERLIFE

ADVANCED FILTRATION TECHNOLOGIES FOR THE RECOVERY AND LATER CONVERSION OF RELEVANT FRACTIONS FROM WASTEWATER

www.afterlife-project.eu

Annex II. Leaflet A4



AFTERLIFE

ADVANCED FILTRATION TECHNOLOGIES FOR THE RECOVERY AND LATER CONVERSION OF RELEVANT FRACTIONS FROM WASTEWATER

The **AFTERLIFE** project proposes a flexible, cost- and resource-efficient process for recovering and valorising the relevant fractions from wastewater.
It will represent an advance on existing approaches to wastewater treatment, which rely on physic-chemical and biological methods.

The **AFTERLIFE** process will separate out the different components of value using a series of membrane filtration units that will separate all the solids in the wastewater. These will then treated to obtain high-pure extracts and metabolites or, alternatively, to be converted into value-added bio-polymers; polyhydroxyalkanoates (PHAs).

In addition to the value extracted from the solids, the remaining outflow of the water will be ultrapure and ready for re-use.

WASTEWATER COLLECTION

CHARACTERIZATION AND PRETREATMENT

Characterization

Pretreatment

EVALUATION OF COMPOUNDS

FILTRATION (MF+UF+NF/RO)

PURIFICATION OF COMPOUNDS

VFA production

VFA concentration

PHA production

FERMENTATION

Energy

Anaerobic digestion

RESOURCES OPTIMIZATION

PHA recovery and purification

PHA processing

Recycling

RECOVERY AND PROCESSING

THE PROCESS

PHA END PRODUCTS

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737.

Annex III. Roll-up

AFTERL!FE

ADVANCED FILTRATION TECHNOLOGIES FOR THE RECOVERY AND LATER CONVERSION OF RELEVANT FRACTIONS FROM WASTEWATER

Lab scale optimization

Pilot demonstration: target TRL 5

Life Cycle Assessment (LCA) & Techno-Economic Analysis (TEA)

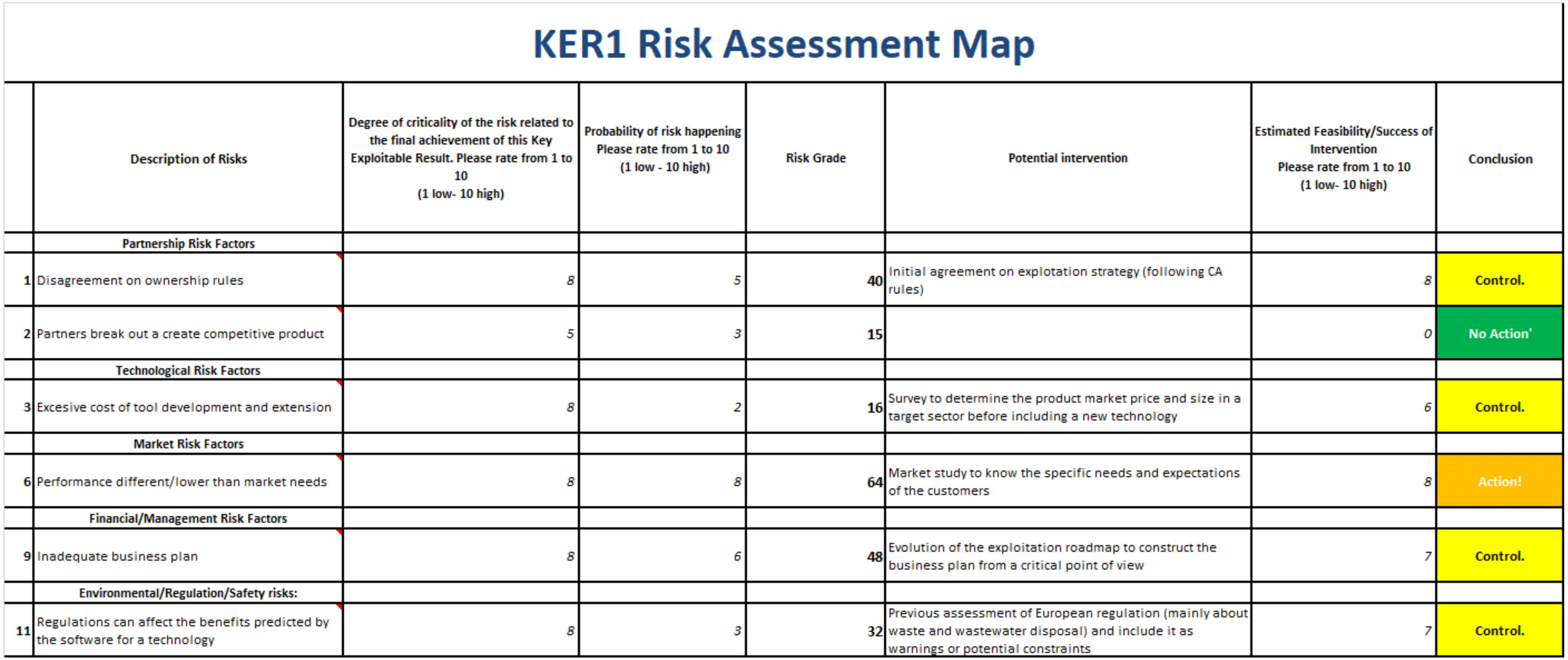
AFTERLIFE is a European collaborative project framed on the Bio-based Industries (BBI) call. 14 partners from 7 European countries (Belgium, Germany, Finland, Croatia, Italy, Spain and Portugal) participate in this European 4 million € project.

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745737.

Horizon 2020
European Union Funding
for Research & Innovation

www.afterlife-project.eu

Annex IV. Risks assessment maps



KER1 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Disagreement on ownership rules	8	5	**40**	Initial agreement on explotation strategy (following CA rules)	8	**Control.**
2	Partners break out a create competitive product	5	3	**15**		0	**No Action'**
	Technological Risk Factors						
3	Excesive cost of tool development and extension	8	2	**16**	Survey to determine the product market price and size in a target sector before including a new technology	6	**Control.**
	Market Risk Factors						
6	Performance different/lower than market needs	8	8	**64**	Market study to know the specific needs and expectations of the customers	8	**Action!**
	Financial/Management Risk Factors						
9	Inadequate business plan	8	6	**48**	Evolution of the exploitation roadmap to construct the business plan from a critical point of view	7	**Control.**
	Environmental/Regulation/Safety risks:						
11	Regulations can affect the benefits predicted by the software for a technology	8	3	**32**	Previous assessment of European regulation (mainly about waste and wastewater disposal) and include it as warnings or potential constraints	7	**Control.**

KER3 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Partners do not follow the training schedule but invent new content	8	6	**48**	Regular meetings to improve performance and update partners on new devlopments, exchange on experiences etc	6	**Control.**
2	Partners carry out low quality trainings/consultancy	7	5	**35**	Regular meetings to improve performance and update partners on new devlopments, exchange on experiences etc	6	**Control.**
3	Partners ccompetition in the external market. (ex. NID and INN)	6	5	**30**	Make clear agreements before going to market.	9	**Control.**
	Technological Risk Factors						
6	Dependency on stable wastewater production in terms of composition and amount.	8	6	**48**	Monitor the industrial wastewater production and indicate a possible solution within the end of the project.	8	**Control.**
	Market Risk Factors						
11	Low interest in using a waste-derived intermediate/product	9	9	**81**	Search for alternative markets.	4	**Warning;**
	Financial/Management Risk Factors						
21	Marketing and distribution fails due to a weak strategy	7	9	**63**	Revise the strategy	6	**Action!**

KER4 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Technological Risk Factors						
6	Valuables are not pure enough for reuse	*7*	*3*	**21**	Good pretreatment		No Action'
7	Concentrations are not sufficient for reuse	*5*	*3*	**15**	Step by step concentration when needed		No Action'
	Market Risk Factors						
11	Nobody buys the product: Too expensive	*6*	*8*	**48**	Regulations oblige to buid up purification and recovery concept		No Action'
12	Worthless result: performance lower than market needs	*5*	*5*	**25**	Rethinking of the concept		No Action'
	Financial/Management Risk Factors						
21	Marketing and distribution fails due to a weak strategy	*7*	*6*	**42**	Revise the strategy	*6*	**Control.**

KER5 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Partners desagree on investments needed to integrate the two tecnhologies. Further reserach is needed and we might not agree on the split of	8	6	48	Draft contignecy plans. Potential of partners leaving. List alternative partners.	6	Control.
2	No manufacturer for large-scale PHA production.	8	5	40	List alternative manufacturers.	6	Control.
3	Disagreement on ownership rules	8	10	80	Clarify issues during the project.	9	Action!
4	Partners competing in the same market. Both NID and Innoven have the technology to produce VFA and PHA, but in the context of the AFTERLIFE project, each partner is responsible for only one part of the process	6	6	36	Clarify issues during the project.	9	Control.
	Technological Risk Factors						
8	Dependency on other technologies, i.e., VFA production in a stable and enough quantity.	8	1	8	Evaluate potential dependencies during the duration of the project. Can be mitigated by the end of the project.	3	No Action'
	Market Risk Factors						
11	Partners competing in the same market	8	1	8	Draft a contingency plan. License it seperatly.	3	No Action'
12	Partners with divergent interests	8	1	8	Draft a contingency plan	3	No Action'
13	Low market interest in adopting these technologies	10	3	30	Search for alternative markets.	3	No Action'
	Financial/Management Risk Factors						
21	Fails in communication among partners	8	5	40	Draft a contingency plan.	6	Control.
22	Inadequate business plan	8	1	8	Involve experience business developers.	2	No Action'

KER6 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	There is not a defined agreement with partners.	3	10	**30**	Contact with potential partners to build agreements	9	**Control.**
	Technological Risk Factors						
2	The method of production and formulation of the thermoplastic material have not been sufficiently developed for its commercialization	7	7	**49**	Strengthen research and development activities	9	**Control.**
3	The raw material (PHA) has variable properties	6	8	**48**	Establish points to detect differences in properties and vary the formulation to obtain a thermoplastic material with the same properties in all cases.	8	**Control.**
	Market Risk Factors						
4	The developed solution is not well received in the market	8	3	**24**	a) Optimization of the solution developed to better adapt to the needs of the sector. b) Value the environmental benefits of the proposed solution compared to other conventional plastic products.	6	**Control.**
5	A market need is detected that was not considered in the development of thermoplastic material.	6	4	**24**	Modifications in formulation or production process to adjust to market demand	6	**Control.**
	IPR/Legal Risk Factors						
6	Early patern exist	8	2	**16**	Tecnical changes in the methodology / technology	8	**Control.**
	Financial/Management Risk Factors						
7	As LUREDERRA is a small technology center, lack of personnel or resources to carry out the necessary actions for the correct exploitation of the developed solution	7	5	**35**	a.) Adapt strategy to low cost activities b.) Dedicate staff more specifically	9	**Control.**
8	Production costs do not match market prices	8	3	**24**	a) Modifications in the production and formulation process b) Emphasize environmental benefits to justify the higher price	5	**Between Control & No Action**
	Environmental/Regulation/Safety risks:						
9	The developed solution does not comply the food safety regulation	9	2	**18**	periodic reviews to detect possible breaches or changes in legislation. If changes are necessary in the developed formulation	9	**Control.**
10	The developed solution does not comply the degradable plastics regulation	9	2	**18**	periodic reviews to detect possible breaches or changes in legislation. If changes are necessary in the developed formulation	9	**Control.**

KER7 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Early patern exist	8	5	**40**	Tecnical changes in the methodology / technology	8	**Control.**
2	Better tecnology/methodology exist	6	9	**54**	Optimization of the methodology to have better results	6	**Action!**
	Technological Risk Factors						
3	An busnies partner leaves the market	8	2	**16**	Find new partners that fulfill the role of the partner who has left	6	**Control.**
4	Disagreement on ownership rules	6	6	**36**	Search for new agreements	8	**Control.**
	Market Risk Factors						
6	Little success in technology transfer	8	8	**64**	Offer services that do not demand investment by the partners (replicable material like tutorials etc). Bad for business but good for social impact	8	**Action!**
	IPR/Legal Risk Factors						
7	Legal problems: proceeding againt us	8	1	**24**			**No Action'**
	Financial/Management Risk Factors						
9	Marketing and distribution fails due to a weak strategy	6	6	**36**	Revise the strategy	6	**Control.**
10	Marketing and distribution fails due to a lack of resources	7	8	**56**	a.) Adapt strategy to low cost activities b.) Dedicate staff more specifically	6	**Action!**
	Environmental/Regulation/Safety risks:						
11	Product/service does not comply with the standards	8	4	**32**	changes in methodology / technology to perform meet standards	6	**Control.**

KER8 Risk Assessment Map

	Description of Risks	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)	Conclusion
	Partnership Risk Factors						
1	Early patern exist	8	1	**8**	Tecnical changes in the methodology / technology	9	**Control.**
2	Better tecnology/methodology exist	6	4	**24**	Optimization of the methodology to have better results	6	**Control.**
	Technological Risk Factors						
3	Clients do not like the platform and thus also the trainings are not of interest	7	5	**35**	Adapt the trainings so that they are more methodological and focus less on one specific software	9	**Control.**
4	An busnies partner leaves the market	8	2	**16**	Find new partners that fulfill the role of the partner who has left	6	**Control.**
5	Disagreement on ownership rules	6	6	**36**	Search for new agreements	8	**Control.**
	Market Risk Factors						
6	Unsuitable sales force	7	1	**7**	hire staff	9	**Control.**
7	Little success in technology transfer	8	2	**16**	Offer services that do not demand investment by the partners (replicable material like tutorials etc). Bad for business but good for social impact	8	**Control.**
	IPR/Legal Risk Factors						
8	Legal problems: proceeding againt us	8	1	**24**			**No Action'**
	Financial/Management Risk Factors						
9	Marketing and distribution fails due to a weak strategy	6	6	**36**	Revise the strategy	6	**Control.**
10	Marketing and distribution fails due to a lack of resources	7	8	**56**	a.) Adapt strategy to low cost activities b.) Dedicate staff more specifically	6	**Action!**
	Environmental/Regulation/Safety risks:						
11	Product/service does not comply with the standards	8	4	**32**	changes in methodology / technology to perform meet standards	6	**Control.**

Annex V. The Business Plan Structure

The Business Plan Structure

KER Form	
Problem	*Describe the problem you are addressing (the problem your potential users have). Potential users are the people, companies, organisations, etc. that you expect will use the result (and generate an impact). They are your "Customers".* Potential users: Food processing industry Generation of a relevant volume of wastewater by food processing industries like fruit processing, cheese manufacturing and sweets manufacturing, that must be treated before discharge. The reported costs for the treatment of the wastewater in the project are around 1.5€/m^{3} (project internal communications). On the other hand, they have an important demand of clean water for their production process. The sum of wastewater treatment and water consumption implies between 150,000 and 200,000 € (considering an average price of 3.16 €/m^{3}) per year for a small size food industry. Moreover, these highly demanding water activities have associated social and environmental impacts. The consumption of water is a key problematic that is gaining more and more weight due to climate change. It is even more important in the southern European regions, such as South Spain, where, together to the scarce rains, there is an important farming activity and a huge concentration of food industries with a high demand of water. This fact would imply a growing discomfort towards the presence of these industries by a part of the population and potential additional taxes due to the associated environmental burdens. Source: Tap water price (average from Europe's Water in Figures (2021): https://www.eureau.org/resources/publications/eureau-publications/5824-europe-s-water-in-figures-2021/file)
Alternative solution	*Describe how your "customer" has solved the problem so far.* Wastewater from food processing industry is generally pretreated in-situ before (1) discharging into the sewage network or (2) being received by authorized waste manager. The purpose of these practices is the depuration of water before discharging into the water bodies but not the valorisation of the organic matter inside. In same specific cases, part of the waste streams can be valorised (e.g., cheese whey); but it does not imply a recovery of clean water for the process, and it is made only for concentrate streams and not for the diluted streams from the project, which are the majority. The common technology that is applied in water depuration is active sludge process. This technology uses mixed bacterial cultures (sludges) to degrade the organic matter in the wastewater. It is an aerobic process (thus required air injection) that produces a significant amount of biological sludge, which should be treated. The main disadvantages associated to the benchmarking are:

	- No product valorisation → Not compliment with circular economy approach - Organic matter in wastewater goes to waste - Energy-consuming if no biological method is used On the other hand, its advantages are: + Easy to conduct + Traditional method → Investments already made + No partners needed for organic matter valorisation
Unique Selling Point USP - Unique Value Proposition UVP	*Describe the competitive advantages, the innovative aspects. What does your solution do better, what are the benefits considering what your user wants, how does your solution solve his/her problem better than alternative solutions, what distinguishes the KER from the competition / current solutions?* A solution for in-situ cleaning of process wastewater to produce clean water and recover organic matter in it for its commercialisation as raw material of value-added products. Its main advantages in comparison with current benchmarking: + In-situ water depuration (not need of dependency on external companies or storage space) + Availability of clean water (reduction of grid water acquittance) + Additional revenues thanks to the valorisation of organics and nutrients in the wastewater, which are not typically valorised + Improvement of the brand image due to the implementation of circular economy practices
Description	*Describe in a few lines your result and/or solution (i.e., product, service, process, standard, course, policy recommendation, publication, etc.). Use simple wording, avoid acronyms, make sure you explain how your UVP is delivered.* The solution consists of a filtration cascade system able to separate 100% of suspended solids and nutrients from wastewater and produce clean water that can be reused in the process. The filtration equipment parameters can be fine tunned to apply the solution to different food industry wastewaters.
"Market" – *Target market*	*Describe the market in which your product/service will be used/can "compete", answering the following questions:* *- What is the target market?* *- Who are the customer segments?* Target Market: Food processing industries Customer segments: - By location: (1) from regions with imminent danger of water scarcity (e.g., Mediterranean countries) [marketing strategy focused on reducing the

	water demand by reusing]; and (2) from the rest of regions [marketing strategy focused on waste reducing and circular economy approach]
"Market" – *Early Adopters*	*Early adopters are the "customer you are willing to address first. They are usually the ones that feel the problem harder than all the others. (they are not the project partners).* Food industries located in regions with hydric stress and/or with that produce wastewaters with characteristics that make necessary the application of special (pre)treatments [e.g., with very high COD (chemical oxygen demand) or with recalcitrant/harmful compounds] According to this, the industries in Mediterranean countries would be potential early adopters and, among them, the industries with the highest COD in their wastewaters. Economic information for the implementation in a candy industry (which typically produces a wastewater with a high COD) is described below.
"Market" - Size	*What is the market size for your solution?* *What is the percentage of that market you will be targeting?* The global water technology market for food and beverage segment was estimated at €3.3 bn in 2011 and €6.0 bn in 2020 (6.7% CAGR) with water & wastewater treatment equipment and operation & maintenance services accounting for € 2.2 and 1.8 billion respectively. As population grows and demand for food increases, along with the industrialization of nations like China and India, demand for processed food is increasing. The developed technology targets a wider application as wastewater technology in food industry. Nevertheless, if you look at the early adopters of the technology (those with a trickier situation in wastewater management and then, more susceptible to adopt the technology), the main food sectors in Mediterranean countries hoard on 13% of the overall food sector investment in wastewater treatment. So, the initial percentage of market targeted will be around 13%. Source: Frost & Sullivan 2012, Global Water Intelligence 2012
"Market" - Trends	What are the market trends related to your solution? The global water and wastewater processing services (treatment, transfer and disposal) market was valued at €425 bn in 2012 and estimated at €625 bn in 2016 with a predicted CAGR of 10% in the outsourcing of services sector. Sustainability measures will be the core driver of market growth. The global operating cost of wastewater treatment systems was expected to run to 58% of this market. This clearly makes outsourcing of industrial water treatment attractive to major players, with outsourcers such as General Electric and Siemens combining product and equipment companies between 2004 and 2010. In Europe, domestic wastewater is the largest burden on wastewater processing infrastructure, according to the "UN Sick Water?" report (https://digitallibrary.un.org/record/760768?ln=es). However, agriculture and industry frequently produce the greatest damage unit count in the developed world. Food processing accounts for 90% of the world's use of potable water, implying that it is disproportionately represented in damage units discharged to public sewerage and surface water. The global water technology

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<td>market for food and beverage segment was estimated at €3.3 bn in 2011 and €6.0 bn in 2020 (6.7% CAGR) with water & wastewater treatment equipment and operation & maintenance services accounting for € 2.2 and 1.8 billion respectively. As population grows and demand for food increases, along with the industrialization of nations like China and India, demand for processed food is increasing. Thus, effective water treatment for the agro-food industry is paramount to a sustainable, circular food chain and an opportunity for European enterprises to competitively positioning and impacting in a global, fast-growing market.</td>
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<td>Settings – Acceptance</td>
<td>
<p><i>What is the public acceptance?</i>
Circular economy / low environmental footprint is generally regarded as positive in comparison with conventional practices. The understanding of these terms however is mostly poor and should and will be improved in the future.
A recently conducted small social acceptance study within AFTERLIFE implicates that there is at least a small green premium that buyers are willing to pay. Thus, it is possible to increase products prices when it is claimed that circular economy practices or measurement to reduce the environmental footprint are implemented in their production process (from AFTERLIFE social acceptance study, available on project website)</p>
<p><i>What is the social impact?</i>
The SWOT analysis of the AFTERLIFE process shows that there are many socio-economic aspects that need to be considered in the development. A major strength is the legal situation, as there are still no restrictions on the use of wastewater. In addition, there is a high urgency in the southern regions to optimize resources and especially water flows, which is particularly requested by the authorities. The AFTERLIFE process has the strength of being able to significantly optimize resource and water use. The introduction of this process also offers great opportunities for governance and education, as agencies can learn from the development what opportunities there are to increase water and resource efficiency. In addition, building the biorefinery plant near a university could also provide opportunities for students to get involved (from AFTERLIFE social acceptance study, available on project website).</p>
<p><i>What is the environmental impact?</i>
The environmental impact associated to the implementation of the technology is lower than common alternative in most of the categories as depicted in the Table 1:</p>
<p>Table 1. Results for the different environmental impact categories of the comparison between AFTERLIFE technology applied in a candy industry and a common wastewater treatment plant</p>
<table>
<tr><th>Impact category</th><th>Unit</th><th>Water purification (AFTERLIFE)</th><th>Common WWTP*</th></tr>
<tr><td>Climate change</td><td>kg CO_2 eq</td><td>0.078</td><td>0.327</td></tr>
<tr><td>Acidification</td><td>mol H+ eq</td><td>0</td><td>-</td></tr>
<tr><td>Eutrophication, freshwater</td><td>kg P eq</td><td>0</td><td>1.33E-04</td></tr>
<tr><td>Eutrophication, marine</td><td>kg N eq</td><td>0</td><td>-</td></tr>
<tr><td>Eutrophication, terrestrial</td><td>mol N eq</td><td>0.001</td><td>-</td></tr>
</table>
</td>
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<tr>
<td></td>
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<table>
<tr><td>Ecotoxicity, freshwater</td><td>CTUe</td><td>0.853</td><td>1.9</td></tr>
<tr><td>Land use</td><td>Pt</td><td>0.226</td><td>-</td></tr>
<tr><td>Resource use, fossils</td><td>MJ</td><td>1.625</td><td>1.02-2.29**</td></tr>
</table>
*Raghuvanshi et al (2017). Wastewater treatment plant life cycle assessment: treatment process to reuse of water
**Capodaglio and Olson (2019). Energy Issues in Sustainable Urban Wastewater Management: Use, Demand Reduction and Recovery in the Urban Water Cycle

<i>What is the economic impact?</i>
The benefits for the technology users are describe below (Please, check section Go to Market – Pricing for further information).
The regional economy will also be favoured by the creation of blue collar and high qualified jobs.
</td>
</tr>
<tr>
<td>Settings – Legal and regulatory aspects</td>
<td>
<i>What are the legal requirements?</i>
<i>What are the normative requirements?</i>
<i>What are the ethical requirements?</i>

Regulatory Framework: At European level, there is not direct regulation on wastewater utilization. Just general legislation (Urban WasteWater Management Directive, UWWD). The national regulation should be applied

Attending to the regulation in Spain where two of the validation cases are located (CITROMIL- citric fruit processing and JAKE – candy manufacturer), the quality parameters for the reuse of treated wastewater as process and cleaning water for use in food industry are described in RD 1620/2007 and in Table 2.

Table 2. Quality parameters to validate a water stream as suitable for clean and process water in food industry (RD 1620/2007)
<table>
<tr><th>Use</th><th>Nematodes</th><th>E. coli</th><th>Suspended Solids</th><th>Turbidity</th><th>Other criteria</th></tr>
<tr><td>Clean and process water in food industry</td><td>1 egg/10 L</td><td>1.000 UFC/100 mL</td><td>35 mg/L</td><td>N.A.</td><td>Legionella spp.:100 UFC/L</td></tr>
</table>
Ethical issues have not been identified.
</td>
</tr>
<tr>
<td>Go to Market – Use model</td>
<td>
<i>Explain what is your “use model”, how the KER will be put in use (made available to "customers" to generate an impact). Examples of use models: manufacturing of a new product, provision of a service, direct industrial use, technology transfer, license agreement, contract research, publications, standards, etc.</i>
<i>Note training is a service.</i>

Through provision of a service to food processing industries or, alternatively, licence agreement with engineering and construction firms that will commercialised and deploy the technology in food processing industries
</td>
</tr>
</table>

"Market" – Competitors	*Who are your "competitors" (note: they are the ones offering "alternative solutions")?* *What are their strengths and weaknesses comparing to you?* Competitors: established wastewater treatment companies (AQUALIA, VEOLIA) - Their solutions are mainly suitable for very large flows (urban wastewater treatment or large industries) - Their innovation component is limited. They priories the use of well-established solutions + They have a well-established team of experts for the commercialisation and implementation + They are well-known, and they have a solid network
Go to Market – IPR Background	*What is the Background (type/ partner)?* VTT has expertise in the development of membrane filtration solutions for different process. This expertise includes different membrane filtration technologies There is no previous patent.
Go to Market – IPR Foreground	*What is the Foreground (type/ partner)?* VTT has developed during the project a cascading filtration system by combining different filtration technologies and optimising process conditions for the four tested wastewaters
Go to Market – Timing	*What is the time to market?* 6 months: Assessment and evaluation of exploitation potential, definition of final business model and communication in place with the early adopters by the defined channels 2 years: Get funding for starting of the construction of a prototype in an early adopter site (agreement for testing the technology at larger scale for TRL evolution) 3.5 years: Demonstration performed and legal agreements among the team members to exploit the technology 5 years: Implementation of the technology in several countries (providing of a services or licensing)
Go to Market - Channels	*How will you reach the Early Adopters?* Channels: - Stakeholders' webinar (2 stakeholders webinars developed during the project; some of the attendees have sent mails to know more about the technology): DONE - Contacts in technical congresses: PENDING - Contact with regional food industry cooperatives (e.g., ASAJA in Andalusia region): PENDING - Meeting with External Advisory Board (EAB) members since some of them are industries involved in the filtration and PHA markets: DONE

- Publications on open access journals (1 publication about filtration step) and production of project newsletters: DONE
- Results published in the project website: DONE

Go to Market - Pricing

What will be the eventual price of the solution?
Estimation of price / unit and number of units sold to reach breakeven point (cover costs).

The wastewater from a Spanish candy manufacturer (JAKE) has been treated with a filtration cascade (Microfiltration, Ultrafiltration and Nanofiltration steps). The characteristics of the input and output streams are described in Table 3.

Table 3. Characteristics of the raw wastewater and of the output treated stream

	Suspended solids (mg/L)	**Turbidity (NTU)**	**Conductivity (mS/cm)**	**COD (mg/L)**
Input	34000	3600	2.2	77500
Output	0	0.12	0.17	180

There is a wide variability in the national regulations about wastewater reuse and water quality. If we consider the Spanish regulation (Table 2), the suspended solid level is adequate for reuse. On the other hand, the last filtration steps ensure the rejection of microorganisms (mesh size is lower than microorganisms' size). Thus, the final water seems suitable for reuse in food industry.

As expected, the economic data at lab scale (from VTT work) are not attractive (Table 4), if we consider that the costs of the clean water are around 3.16 €/m^3.

Table 4. Cost associated to the filtration step for Jake wastewater

	Treatment capacity (m^3/day)	CAPEX	OPEX
	84		
M€		2.09	0.68 (per year)
€/(m^3/y)		68	
€/m^3			22

However, when we consider the economic data from simulations (process model) which considers industrial equipment and economics of scale (Table 5):

Table 5. Cost associated to the filtration step for Jake wastewater (from simulations with process model)

	Treatment capacity (m^3/day)	CAPEX	OPEX	BENEF
	84			
M€		0.617	0.23 (per year)	
€/(m^3/y)		20		
€/m^3			8.58	1.55 (avoided wastewater treatment cost) 2.84 (avoided freshwater cost for the process) *

				MSP** (sludge for PHA production)

*Tap water price (average from Europe's Water in Figures (2021): https://www.eureau.org/resources/publications/eureau-publications/5824-europe-s-water-in-figures-2021/file). Recovery of clean water: 70%
**Considering the previous figures, the minimum selling price for sludge as feedstock for PHA production is 5.52 €/34 kg of solids recovered from water (plant life spam: 15 years, for depreciation calculations), that is, 0.16 €/kg

The MSP of the sludge (160 €/ton) can compete in an advantageous position with common raw materials for PHA production (first generation: 200-460 €/ton of sugar crop; second generation: 90-2800 €/ton cellulosic sugar*).

It should be noted that other additional products can be obtained depending on the specific composition of the wastewater (i.e., food additives). PHA (the cheapest one) has been the only one considered in this preliminary analysis.

*Ming-Hsun Cheng. The Costs of Sugar Production from Different Feedstocks and Processing Technologies (https://www.osti.gov/pages/servlets/purl/1495027)

The Team

Describe the team responsible for making sure the result is used (responsible to implement the exploitation plan) include, if possible, names and qualifications of the team members.

Profile	Partner in AFTERLIFE	Main contact	Main activities
Technology developer	VTT	Hanna Kyllönen Antti Grönroos	Technology owner
Exploitation partner	IDENER/NOVA	Maria Lopez Freya Sautner	Draft Business Model Contact with external team members
Dissemination and communication partner	NOVA	Freya Sautner	Development of D&C compaign

The Team – External providers

If you need to integrate your "team, whom do you need (new) external partners? Which type of external providers?

Profile	Main activities to do
IPR expert	Definition of IPR related to the solution and preparation of agreements and legal documents required for its exploitation
Marketing expert	Identification and contact with potential early adopters
Exploitation expert	Development of the final business plan
External engineering company	Deployment of the prototype in the early adopter premises

<table>
<tr><th colspan="2">Exploitation roadmap</th></tr>
<tr><td>Actions</td><td><i>Briefly describe actions planned to be executed 3-6 months after the end of the project.</i>

3 months: involved of external team members

6 months: Definition of final business model and communication in place with the early adopters by the defined channels</td></tr>
<tr><td>Roles</td><td><i>Roles of partners involved in the actions defined above.</i>
<table>
<tr><th>Profile</th><th>Partner in AFTERLIFE</th><th>Main contact</th><th>Main activities</th></tr>
<tr><td>Technology developer</td><td>VTT</td><td>Hanna Kyllönen
Antti Grönroos</td><td>Technology owner</td></tr>
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<tr><td>IPR expert</td><td>--</td><td>--</td><td>Definition of IPR related to the solution and preparation of agreements and legal documents required for its exploitation</td></tr>
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<tr><td>External engineering company</td><td>--</td><td>--</td><td>Deployment of the prototype in the early adopter premises</td></tr>
</table></td></tr>
<tr><td>Milestones</td><td><i>List the milestones and KPIs to be used for monitoring the implementation of the actions listed above. Add timeline.</i>

- First meeting with the whole team (month 3)
- Deliver of the final business model (month 6)</td></tr>
<tr><td>Financials
Costs</td><td><i>Cost estimation to implement planned activities (1 year, 3 years).</i>

6 months: € 30,000.00</td></tr>
</table>

	- Travels for meetings: 5,000 € - Personnel costs: 20,000 € - Dissemination & Communication companies: 5,000 € 3 years to run prototype: € 720,000.00 - Cost of prototype design, building, equipment, and operation: 500,000 € - Personnel costs: 180,000 € - Travels: 20,000 € - Marketing companies: 20,000 €
Revenues	*Projected revenues and eventual profits once the KER will be used (1 and 3 years after use)* Licensing of the technology: around 30 k€ per license 1 year: 0 € 3 years: 0 € 4 years: 150,000 € (5 licenses sold per year) Providing as a service: benefits after technology implementation in a food industry: around 10% (80 k€) 1 year: 0 € 3 years: 0 € 4 years: 240,000 € (3 implementations per year)
Other sources of coverage	*Resources needed to bridge the investment needed to increase TRL and ensure the result is used.* To build and run the prototype, the team will apply for another research project funding: Fast Track to Innovation (FTI) or similar.
Impact in 3-year time	*Describe impact in terms of growth/benefits for the society* The impact at 3 years is still limited since it is not expected a wide adoption of the technology up that date. In general terms, the implementation of this solution will contribute to: Reduction of water demand by the food industries by reutilising water Valorisation of wastewater into a high added-value product, contributing to the circular economy concept Blue collar and high qualified jobs creation in, mainly, rural regions where the food industries are located