R3PACK

REDUCE, REUSE, RETHINK PACKAGING

WP1.1-deliverable: progress monitoring report

Work package: WP1 - Project management
Task: 1.2 - Administration and Financial Management
Deliverable: 1.1 - Progress monitoring report

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INTRODUCTION

Almost 12 months have past since the launch of the project, on the 4th of June 2022. R3PACK has made a continuous progress following thoroughly the determined timeline.

This progress will be detailed in the following document by first presenting the evolution of the project management throughout the past year and the key events that have punctuated R3PACK's experience.

Then we will give an update per work package per started task specifying the status, the key takeaways, the encountered challenges and next steps to provide a clear overview of R3PACK's state of action and potential hurdles to overcome.

The consortium will meet physically in June 2023 to mark the 1-year milestone of the project and review the achievements to plan the next 2-years to come.

I / PROJECT OVERVIEW

Funded by the European Union

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1 YEAR OF PROJECT MANAGEMENT

Since June 2022, the official launch of the project, R3PACK's consortium has **launched all 7 work packages, has produced 10 deliverables for the European Commission and achieved 4 out of 10 milestones.**

(RE)SET's work as coordinator and in charge of project management has contributed in setting a solid ground for the other Beneficiaries to build on. Within the first 6-months of the project, (RE)SET has defined R3PACK's brand image and work tools (Logo, Font, Website, Teams channels). It has build-up of a solid legal framework (Consortium agreement, General Assembly, Third parties management, IPR). Together with the Communication partner Safe the communication and dissemination were secured (D&C plan, Data management plan, DOMP, repository, social media, newsletter). Finally, (RE)SET has carried out an analysis defining R3PACK's starting point and challenges to tackle for the reuse and the susbtitution demonstration (Data collection, Specifications of Industries, Packaged product perimeter). This first part of the project has allowed to build a strong work base for all partners aligning around the common goal of activating means to reduce single use packaging. The second part of the project was then dedicated to work on the first key deliverables (LCAs, food safety protocol, audit grid for washers, consumer study), conducting in-depth R&D for developping fibre-based alternatives and getting on the path to demonstration for reuse.

R3PACK's progress has been closely monitored; at the beggining of the project (RE)SET has set up project management meetings to boost action and follow the work at all level *(overview of the 3-year planning in appendix).*

All partners

- ***Every 6-months***: a physical meeting to gather the consortium
- ***Every 2-months:*** an online consortium meeting or webinar to collectively share progress and create synergies among the partners

Work package leaders

- ***Every 2 weeks***:
  - an online meeting between the Coordinator and the Work package leaders to break silos and address any challenges

Task leaders

  - an online meeting with all experts and enablers part of WP4 (Substitution) to update each other and align on the best ways forward
- ***Every 3 weeks:*** an online meeting with all food manufacturers and retailers part of WP3 (Reuse) to update each other and align on the best ways forward

R3PACK'S KEY EVENTS THAT HAVE SHAPED THE PROJECT'S PROGRESS

#PHYSICAL EVENTS

June 2022

Kick-off

All Beneficiaries met for the first time in June 2022 to share R3PACK's vision, create a common ambition, generate a bond within the consortium and lay the methodological backbone of the project for the next 6-months

Sept. 2022

General Assembly #1

The first General Assembly (GA) took place in September 2022 gathering all Beneficiary' representative to discuss : lay down GA's principles & rules, vote on the planification of future key common events, take note of the communication tools of the project, explain the reporting and budget management and validate the IPR management for R3PACK's third parties.

January 2023

R3PACK physical event #2

In January 2023, after setting a solid work base, the consortium collectively worked on getting on the tracks for the first demonstration phase for Reuse by the end of the year 2023

General Assembly #2

Only few non strategic topics were covered at the second General Assembly (GA). The Beneficiaries validated in writing the method for reviewing and approving position papers on key laws impacting R3PACK as part of its advocacy work.

June 2023

R3PACK physical event #3

All Beneficiaries will meet for the third time in June 2023 to evaluate the progress made within a year and pursue their efforts towards demonstration.

General Assembly #3

TBD

R3PACK'S KEY EVENTS THAT HAVE SHAPED THE PROJECT'S PROGRESS

#ONLINE EVENTS

Oct. 2022

Webinar @Safe

Safe, as work package leader on dissemination and communication (D&C), have presented their D&C activities, planning and available tools. The objective was to help and engage other Beneficiaries to be proactive in the communication about R3PACK.

Oct. 2022

Online consortium meeting @(RE)SET

Three new non-beneficiary partners were introduced on the occasion of this online gathering: Agrial, Biscuits Bouvard and Savencia, three French food manufacturers willing to participate in the substitution and reuse activities. It was also the opportunity for all Workpackage leaders to update on their first achievements since the launch of the project.

January 2022

Webinar @SGS

SGS as part of the deliverable 3.2 prepares a protocol for the food safety of reusable packaging and has shared their methodology to raise awareness among the industrials and retailers especially.

Webinar @SGS, Safe & Innovhub

All three partners were in charge of writing the state of the art of food safety and recyclability regulations in Europe as internal deliverable. They shared the key takeaways with the consortium to spread the knowlegde.

May 2023

Webinar @SGS

SGS will present the final version of the food safety protocol for reusable packaging

June 2023

Webinar @Aarhus & CNR, Innovhub & Polimi

Aarhus in charge of WP2, will together with CNR share the results of the consumer study they conducted in the demonstration countries about "consumer beliefs with regards to reuse and paper based packaging" and about "leveraging social norms for optimizing reuse systems and paper-based packaging". In addition, Innovhub and Polimi will present the outcomes of their LCAs for a selection of currently used packaging.

II / WORK PACKAGE PROGRESS

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#1

WP2 - MARKET ANALYSIS AND CONSUMERS' BEHAVIOURAL CHANGE AND INVOLVEMENT

OBJECTIVE & TIMELINE

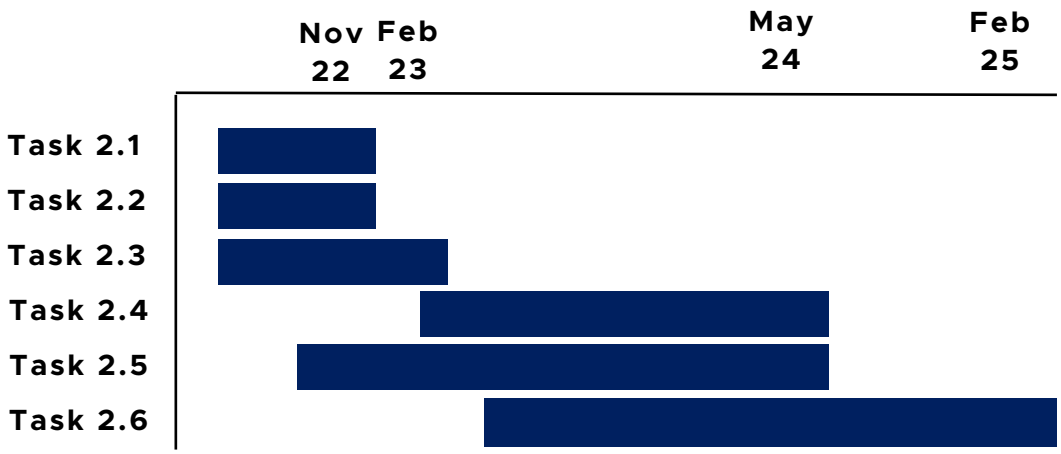
WP2

MAPP
DEPARTMENT OF MANAGEMENT
AARHUS UNIVERSITY

M1 to M34

- Identify **specific market needs** ensuring an optimal market launch of new solutions
- Provide **in-depth understanding of consumer behaviour drivers** to serve as a basis for the development of reuse and substitution systems

- Specifications matrix from industries *(Carrefour, M6)*
- Guidelines for promoting behaviour change and social innovation *(Aarhus M24, M33)*



R3PACK

PROGRESS

WP2

TASK 2.1 SPECIFICATION FROM INDUSTRIES

Leader: Carrefour **Status:** complete

Objective: *defining, collecting and assessing the industries' specifications for the project.*

Actions taken & key take aways:

The specification from industries consists in all necessary data to activate the different tasks that depend on it (e.g. task 3.3 for the reuse logistic models, task 6.1 for LCAs). The information is mainly related to the industrials food products, their packaging, the used machinery, logistics, location of factories and alike.

Collecting the specifications from industries has also allowed to assess the feasability level for substituting to a fibre-based packaging and/or switching to a reusable packaging for each product category targeted by the project.

(RE)SET has acted as a « black box » assessing the partners' information needs, centralizing the data collection from industrials, retailers and packaging manufacturers and matching the collected data with the few parners allowed to access the information. As a reminder this deliverable is confidential as the consortium is composed of competitors and actors that have a client – service provider relationship.

Challenges:

- Ensuring the confidentiality of the sensitive data collected (industrial secret, pricing, competitors, …)
- Accessibility to all wished data (time constraints, internal organization of the companies, detained by third parties)

Next steps :

- The data collection is spread over time for two reasons, to avoid burdening the information providers and when the information is only available at a later stage of the project (e.g. selected packaging by each food manufacturerfor reuse). So far two data batches out of three have been collected. The next one is planned end of the year 2023.

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PROGRESS

WP2

TASK 2.2 REGULATORY, SAFETY, ECONOMIC AND TECHNICAL BARRIERS AND STANDARDS

Leader: SGS **Status:** complete

Objective: *synthesize and map European regulations on food safety, materials recyclability and compostability*

Actions taken & key take aways:

Regulations mapping is essential in a project to avoid any spent time on a solution which cannot be driven. SGS has split the tasks with different contributors (Safe, Innovhub) in order to optimize the time of research and to collect maximal data.

Information on regulations, European or for all countries, and their details are not always unrestricted access. Contributors have shared together information on regulations, norms or standards to be able to gather as many elements as possible.

Mapping all regulations and sharing information on how each european country is assessing reuse or substitution allows the consortium to target the best solutions and examine possibilities to develop rapidly.

In general, we have noted a strong common regulation on plastics but nothing on reuse. Also, regarding the end of life, the PPWR is still under revision, but will most likely heavily impact the project.

Challenges:

- Gathering all regulations and data on packaging, including reuse and sustitution if any in Europe with countries specificities
- Making findings accessible in order for all the consortium to be aware of regulations to include in research

Next steps :

- Insuring a regulatory watch and communicate if any to the consortium
- Create a standardisation protocol for reuse

R3PACK

PROGRESS

WP2

TASK 2.3 CONSUMER BELIEFS AND CHOICE CONTEXT MAPPING

Leader: MAPP DEPARTMENT OF MANAGEMENT AARHUS UNIVERSITY **Status:** ongoing

Objective: *understand consumer beliefs in relation to reuse, recyclability and upcycling of packaging and paper-based packaging .*

Actions taken & key take aways:

A systematic literature review on consumer adoption of food packaging reuse have been carried out to identify existing knowledge. Additionally a literature review on fiber-based food packaging (subtitutiton) in relation to consumer adoption have been carried out.

Based on these findings, an exploratory survey study on both reuse and substitution (fiber-based packaging) have been carried out in both France (N = 959) and Belgium (N = 862) with the aim of acquiring insight to consumer perceptions and beliefs of both reuse and substitution. Further, the studies explores what factors influence the uptake and return of reusable packaging.

Lastly, two focus group interviews will be carried out (France and Belgium) to validate and gain qualitative insight from the survey results.

Challenges:

- Recruitment of participants for the focus group interview.
- Acquiring IRB for the survey from our institution.

Next steps :

- Provide a summary of key results from this task
- Identify the most prominent interventions to implement in next studies.
- Conclude on the factors that impact adoption of reuse schemes and return rate.

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PROGRESS

WP2

TASK 2.4 IMPROVING CONSUMER ACCEPTANCE OF REUSE SYSTEMS AND PAPER-BASED PACKAGING

Leader: MAPP DEPARTMENT OF MANAGEMENT AARHUS UNIVERSITY **Status:** ongoing

Objective: *Provide avenues to improve consumer acceptance of reuse systems (WP3) and sustainable packaging substitutes (WP4)*

Actions taken & key take aways:

To identify factors that improve the consumer acceptance, the findings from both task 2.3 and 2.5 will be leveraged within multiple communication experiments. For this, courses on Discrete Choice Experiments have been taken which will enable us to get insights into which factors affects consumer choices and acceptance the most. Further, different proposals on studies on messaging and framing strategies have been made.

An application for IRB will be handed in 2th of August, whereafter we can begin the studies. Arne Høeg has followed a course on Discrete Choice Experiments to ensure proper training and competence for the needs of this task.

Challenges:

- None so far.

Next steps :

- Develop research protocol
- Apply for IRB (deadline 2 August)

PROGRESS

WP2

TASK 2.5 LEVERAGING SOCIAL NORMS FOR OPTIMIZING REUSE SYSTEMS AND PAPER-BASED PACKAGING

Leader: 

Status: ongoing

Objective: *Exploring the extent to which social norms are 1) responsible for consumer behaviour and 2) can drive behaviour change*

Actions taken & key take aways:

The survey carried out in France (N=959) and Belgium (N=862) provides information of consumers' beliefs about fellow citizens behavior, and their degree of approval with regards of reusable packaging schemes solutions. This allows us to measure beliefs, expectations and social norms underlying the four re-use schemes considered: refill at home, refill on the go, return from home, and return on the go.

Subsequently, simulations and experiments will allow us to identify solutions aimed to overcome the consumers barriers' underlying the adoption of each scheme identified in the survey. This is crucial to understand the drivers of behavioral change in the domain of reusable packaging.

Challenges:

- The survey allows us to investigate opinions/intentions and not behavior.

Next steps :

- Developing experiments whose design will allow us to study consumers' behavior.

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PROGRESS

WP2

TASK 2.6 INTERVENTION STUDIES TO MAXIMIZE BEHAVIOR CHANGE

Leader: MAPP DEPARTMENT OF MANAGEMENT AARHUS UNIVERSITY **Status:** not started

…

Objective: *targeted intervention studies will be carried out supporting the demonstration activities in WP5*

Actions taken & key take aways:

This task is leveraging the knowledge from the previous task within WP2. For the first small-scale demonstration we plan to monitor the implementation to get some first-hand impressions on the consumer behaviour. Based on this, intervention studies on 50 household per countries will be carried out.

Challenges:

- None so far.

Next steps :

- …
- …

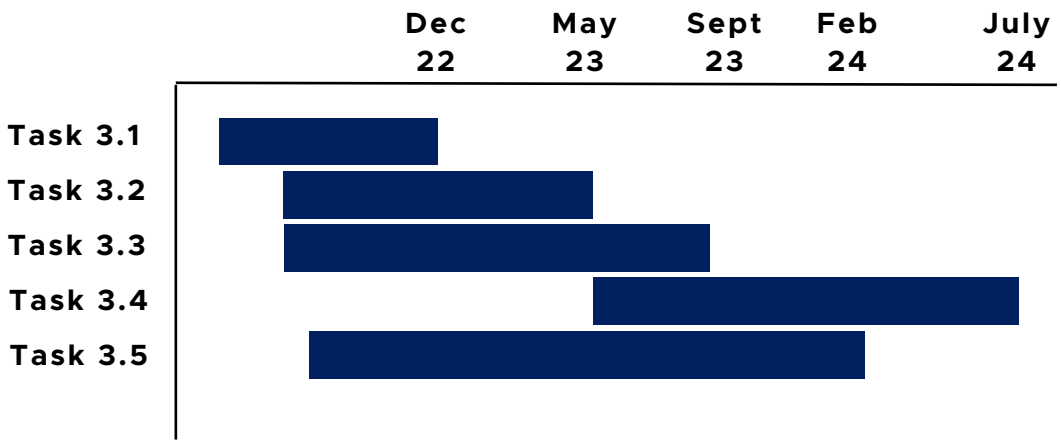
OBJECTIVE & TIMELINE

WP3

M1 to M26

Support the **optimization from an environmental, economic and social perspectives of industrial reuse** and its effective translation into successful and replicable business practices

- Selection of suitable packaging for reuse for each product type *(RE)SET, M7)*
- Food safety protocol *(SGS, M12)*
- Auditing protocol for washing centers *(SGS, M12)*
- Decision-support model for reuse logistic network design *(Unibo, M16)*
- Sensitivity analysis and multi-scenario network optimization with Guidelines about risk hotspots *(UniBo, M16, M26)*



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PROGRESS

WP3

TASK 3.1 SELECTION OF STANDARDIZED PACKAGING AND RECYCLABILITY ASSESSMENT

Leader: (RE)SET **Status:** complete

Objective: *selection of reusable packaging options relevant to the food product types covered by R3PACK*

Actions taken & key take aways:

The packaging selection has been a multiple step process. The intention is to help industrials with their choice of packaging, but more importantly favor the mutualization of packaging among them for a same product (e.g. yoghurt) and also similar use (e.g. yoghurt and sour cream). The standardization of packaging is a key success factor of reuse's uptake. (RE)SET has used existing groundwork on standardization for reuse (Citeo, Cetie) and started with collecting industrials' individual needs. On that base, groups with similar demands and constraints were created to align collectively on a short list. Following which a large scale sourcing was conducted resulting in about 250 packaging identified. The same process of first individual choice and then collective alignment has been repeated. Finally, the list has been narrowed down to 64 packaging options more or less suitable for all product categories. The full report is part of the deliverable 3.1 submitted December 2022 to the EU. The selection has allowed the industrials to chose from it the packaging they wish to test.

Challenges:

- To date, the reusable packaging offer on the market is very limited
- Sometimes it will be necessary to adapt these packaging initially meant for single use
- For some other food categories a whole new mold and packaging will have to be developped to meet the industrial constraints (e.g. yoghurts)

Next steps :

- Mutualize efforts of food manufacturers with similar constraints and that have no suitable packaging, to create a new common standard packaging for their products
- Finalize the choices of packaging for other food categories that have available options – this will depend on the conditioning and shelf life test results

R3PACK

PROGRESS

WP3

TASK 3.2 NORMALISATION OF FOOD SAFETY AND WASHING PROTOCOLS

Leader: SGS **Status:** ongoing

Objective: *Assessing the food safety of reusable packaging by defining a comprehensive food safety protocol and auditing protocol applicable to washing practices for industrial reuse.*

Actions taken & key take aways:

The task 3.2 includes 2 different streams, conducted at the same time. Firstly, based on selected packaging on task 3.1, SGS has selected key tests in order to simulate the daily use of packaging and then conducting, following specific existing regulations, food contact tests. A protocol has been defined for plastic materials in general for up to 20 cycles, but the tests were performed on 5 different resins. SGS is still waiting for results of some chemical tests. The finalized protocol is due on May 31st, 2023.

Secondly, SGS had to establish a grid audit for washers in order to help them on a methodology, ensuring the safety of reusable packaging in the loop before and after washing. Critical points have been communicated to washers and their feedbacks allowed SGS to improve it.

Challenges:

- Key elements from washers were difficult to collect to help writing the audit grid
- Choosing a limited amount of performance tests for reuse packaging for a simple and efficient protocol
- Conducting the protocol writing and tests at the same time

Next steps :

- Validate and publish the protocol
- Communicate results to the consortium
- Realize an on-site audit to test the audit grid
- Send the protocol with Buddie Pack, another Horizon Europe project working on reuse, to share findings and have it peer-reviewed

PROGRESS

WP3

TASK 3.3 REUSE LOGISTIC NETWORK MODELLING

Leader: **Status:** ongoing

Objective: *Defining the optimal strategy to optimize the packaging reuse network environmentally and economically.*

Actions taken & key take aways:

In this task optimal strategies for the design of an environmentally and economically sustainable logistic network for the reuse of packaging of food products have been exlpored through an optimisation decision-support model. The proposed optimisation model formulates the overall cost and impact resulting from the package manufacturing, storage, handling, washing and transportation operations as objective functions to minimize, whilst fulfilling the food products demand at the retailer's shops and meeting the capacity of the resources (e.g., warehouses, transportation systems, production lines, RVMs) over a broad geography. This model is fed by primary data collected from the Industrials partners and results into the optimal scenario of the closed-loop logistic network. It responds to the following questions: which resources to open and where, of which capacity, how to allocate packaging flows throughout the partners. Given its flexibility, it can be easily applied to different retailers' food supply chains in different geographic areas and with different products, representing a fruitful deliverable of the project.

Challenges:

- Definition of the entities involved in the project (Network stages and partners).
- Design of a database able to store input data from different industrial and research partners and manipulate the network solution.
- Formulation of the linear combination and inequalities composing the mathematical model.

Next steps :

- Finalizing data collection with all the industrial partners.
- Carrying out a multi-scenario what-if analysis using the model to explore potential savings or drawbacks resulting from the reuse network under different assumptions (return rate, consumers acceptance, costs)

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PROGRESS

WP3

TASK 3.5 DE-RISKING

Leader: (RE)SET **Status:** ongoing

Objective: *de-risk the approach for reuse by diversifying the choice for packaging, washers and any technologies involved in the reuse process (tracking, RVM, washeable labels…)*

Actions taken & key take aways:

(RE)SET is continuously on the look out for alternative stakeholders regarding packaging suppliers, washers, operators, traceability service providers and else. We have consolidated a database and built a network to allow flexibility at any time. A mapping of our partners' challenges at each step of the demonstration process provides us the bigger picture of any risk that might arise.

Challenges:

- The available operators and washers are limited and usually at an early stage of their development
- A risk might be their limited capacity to take on our volumes for the demonstration

Next steps :

- Selecting and securing a reuse operator that can take charge of the logistics, the collection of dirty packaging and ensure the traceability
- Selecting and securing a washer for the demonstration

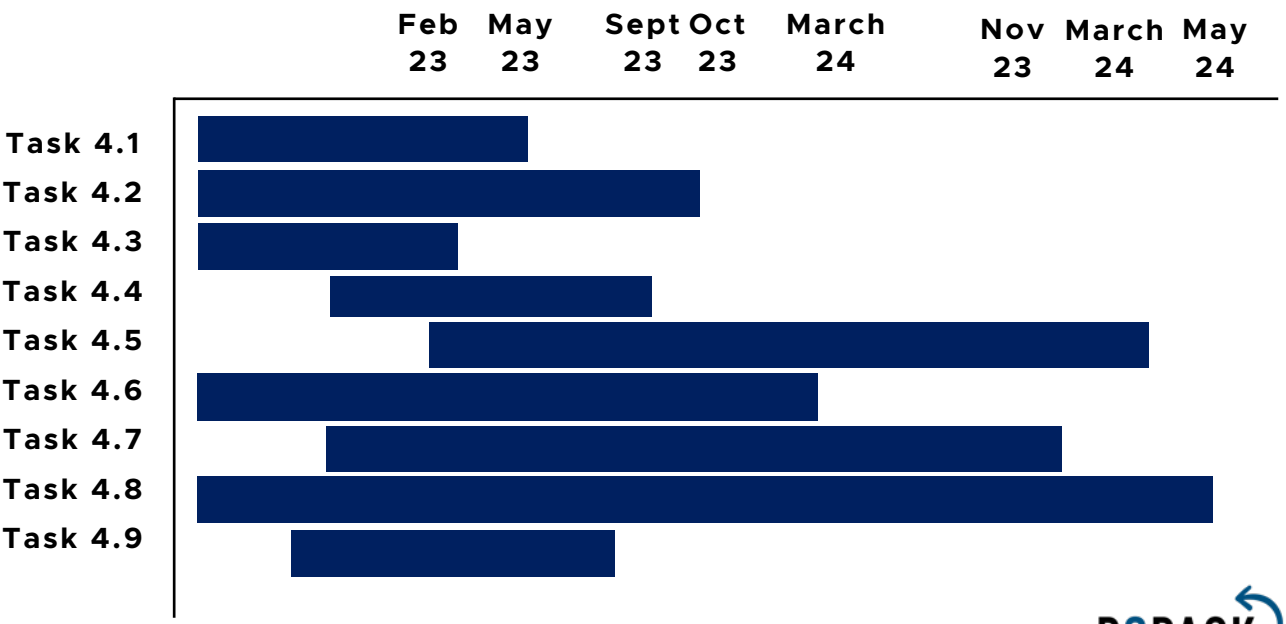
OBJECTIVE & TIMELINE

(RE)SET

M1 to M36

Secure the **development** of industrial renewable and primarily recyclable but secondarily compostable/biodegradable **fiber-based food packaging solutions**

- Identification of combined fibre-based packaging substrates, surface pre-treatments and barrier formulations *(RISE, M18)*
- Decision-matrix based on materials, barrier combination and application performance evaluation *(RISE, M16)*
- Final assessment report on shelf life *(Fraunhofer, M22)*
- Evaluation of recycling and compostability analysis *(Innovhub, M34)*
- Process methodology for producing fibre-based, high-barrier packaging that can be upscaled for commercialization *(RE)SET, M30)*



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PROGRESS

WP4

TASK 4.1 SURFACE ANALYSIS AND PREPARATION

Leader: RISE **Status:** ongoing

Objective: *find the optimal fibre-based substrate and surface treatment for improving the adhesion and performance state of suitable barriers AND to find the best combination substrate/treatment to meet the necessary physical performance requirements.*

Actions taken & key take aways:

Dispersions of CMC, Chitosan and combination of CMC and chitosan were prepared. Multiple combinations between uncoated or coated paper with MFC, and CMC or Chitosan were tested for their compatibility and then evaluation of barrier properties (water, grease, …). Spray coating of trays was also performed with a multilayer approach. The results from characterization of trays was promising and barrier properties (OTR and WVTR) are being evaluated at the moment.

Options with an inorganic SiOx layer were also tested, but had no big influence on the initial barrier properties.

Supply issues of the different materials were a bottleneck to conduct in time the planned combination characterization and evaluation.

Further details cannot be disclosed as the R&D process is classified as sensitive. The public information will be provided in the deliverable 4.1 end of November 2023.

Challenges:

- Availabilty of chitosan.
- Inorganic coatings like SiOx are very delicate and rigid. Therefore, the substrate needs to fulfil certain conditions to achieve the requirements for PVD.

Next steps :

- Decrease the coating grammages of each layer
- Finalize the OTR and WVTR analysis
- Test SiOx on a more suitable substrate

PROGRESS

WP4

TASK 4.2 FORMULATION, DEPOSITION AND EVALUATION OF BIO-BASED COATING SOLUTION AND ADDITIVES WITH NEW RAW MATERIALS

Leader: BIM **Status:** ongoing

Objective: *Development of an optimised coated paper or a pulp recipe in terms of barrier properties*.

Actions taken & key take aways:

BIM Kemi has performed formulation work with different bio-based materials, MFC, chitosan, PHA/PHBV and carnauba wax. Evaluation of lab-coated substrates was made through KIT-, Cobb-, and WVTR-test. So far, there are mixed up results, but the combination of materials are still considered as an interesting track, as some gave promising results. Formulation work to get a stable dispersion with the different materials has been challenging and is still ongoing. BIM Barrier products, were introduced to the project as alternatives when the materials did not perform. The solutions have approximately 80% and 50% bio-content respectively. They show impressive results together in a two-layer combination, however a plastic free solution is still seeked. Further details cannot be disclosed as the R&D process is classified as sensitive. The public information will be provided in the deliverable 4.1 end of November 2023.

Challenges:

- Food contact statements for the evaluated materials are not secured yet.
- Unsecure supply of evaluated raw materials.
- Difficulties in dispersing PHA/PHBV powder to a stable formulation.

Next steps :

- Formulation work with chitosan, provided from a new supplier.
- Formulation work to stabilize PHA/PHBV powder in dispersion.
- Continue evaluate BIM solutions for the project, while testing plastic-free alternatives

PROGRESS

WP4

TASK 4.3 PREPARATION OF PHA

Leader: Bioextrax **Status:** ongoing

Objective: *produce 200 kg of PHA and formulate the material with adapted parameters for the targeted applications.*

Actions taken & key take aways:

There have been a delay in Bioextrax supply fo 200 kg PHA. This is mainly due to investment in new reactors and move to new facilities. Plan was to deliver 200 kg in month 9, now in month 12 still no big volumes delivered. Which grade to deliver not yet determined from tests at Bim and RISE

Actions taken:
-We have supplied samples to Bim and RISE, we have also supplied material from TianAn in order to speed up testing. TianAn grade is similar to one of the grades Bioextrax have the potential to produce.
-We have provided 4 different grades, produced by Bioextrax, all in 200-400 g quantities.
-Preparation for upscaling by installation of 1000 l reactors, ready in July 2023.

Now we need feedback on which grade to upscale.

Challenges:

- Grade selection for upscaling
- Get the new 1000 l reactors up and running for delivery of bigger quantities in August.

Next steps :

- Meeting with Bim and RISE to get feedback on which grade to produce in bigger quantities. Planned for week 21.
- Decide on specification, granularity and delivery form.
- Set time line for suppy of bigger quantities.

PROGRESS

WP4

TASK 4.4 DEPOSITION OF PHA AND INORGANIC SOLUTIONS AND INNOVATIONS TO ACHIEVE THE NECESSARY BARRIER ON PERFORMANCE ON CELLULOSIC SUBSTRATES

Leader: RI. SE **Status:** ongoing

Objective: *prepare multilayer barrier solutions on fibre-based substrates using PHA deposition in combination with other circular barrier formulations*

Actions taken & key take aways:

Different strategies of using PHBv have been evaluated. The measurements and evaluation are still ongoing. Further details cannot be disclosed as the R&D process is classified as sensitive. The public information will be provided in the deliverable 4.1 end of November 2023.

Challenges:

- PHBv recieved as flakes but after grinding it was possible to work with the material.

Next steps :

- Evaluate barrier properties of trays spray coated with PHBv and in combination with other products.

PROGRESS

WP4

TASK 4.5 SHELF LIFE ANALYSIS

Leader: Fraunhofer IVV **Status:** ongoing

Objective: *baseline assessment for the selected types of food, and an initial assessment of the shelf-life and the relevant spoilage mechanism*

Actions taken & key take aways:

The producers of food products selected for case studies have been interviewed regarding known spoilage mechanisms and currently used packaging in order to prepare meaningful shelf life studies. The foods for case studies can be divided into three groups with specific requirements: snack foods (peanut puffs, crackers; susceptible to humidity and oxygen), dairy products (butter, grated cheese, crème fraîche; mainly susceptible to oxidation) and fruits and vegetables (bagged salad, cut pineapple; requiring oxygen and stabilized by equilibrium modified atmosphere packaging). Experiments to characterize the oxygen consumption and, where applicable, sorption kinetics and thermodynamics have been planned. These experiments will help in determining the barrier requirements of the products via shelf life simulations. Samples are currently being collected from the companies.

Challenges:

- Slowly spoiling/acting foods may require a long time to characterize. This can be addressed using accelerating measurement conditions (oxidation) and model-based evaluation (sorption)
- Different samples of the same food can vary significantly. This will be addressed at the modelling stage

Next steps :

- Performing and evaluating characterization experiments
- Shelf life simulations

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PROGRESS

WP4

TASK 4.7 MACHINABILITY- FIELD TEST (1/3)

Leader: Fraunhofer IVV **Status:** ongoing

Objective: *Determination of the processing parameters, especially the sealing parameters (temperature, pressure, time/speed, etc.) for the processing and packaging lines.*

Actions taken & key take aways:

When processing the new materials e.g. into bags or trays, their sealability is a key element. The sealed seams must be sufficiently strong, tight and visually appealing. The investigations concentrate on the most commonly used heat conductive sealing process. For this purpose, the processing parameters must be determined in the laboratory for each individual material. The parameter sets serve as a starting point for tests on industrial machines. Seams produced in this way (as part of a package) must be analyzed and compared with the laboratory results. From this, optimization measures are derived for the process control and tool design, among others.

Kraft paper uncoated* / bleached	47 gsm @ 60 µm thick	[A]
Kraft paper uncoated* / unbleached	60 gsm @ 92 µm thick	[B]
Kraft paper uncoated* / bleached	60 gsm @ 92 µm thick	[C]
Kraft paper MFC coated / unbleached	80 gsm @ 102 µm thick	[D]
Kraft paper MFC coated / bleached	74 gsm @ 102 µm thick	[E]

* Without barrier coating on the paper

The following examinations were carried out:

- Determination of the parameter limits
- DoE-based determination of process windows by varying the sealing temperature, sealing pressure und sealing time
- sealing of layer steps and tight analyzing by dye penetration test and thin section analysis
- sealing of [A] against an uncoated fiber cast tray material

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TASK 4.7 MACHINABILITY- FIELD TEST (2/3)

For material [A], the dependence of the seam strength on sealing temperature and sealing pressure were determined.

The maximum achievable seam strength (**Fig 1**) is limited by the compound adhesion of the fibers in the substrate or the sealing layer with the substrate.

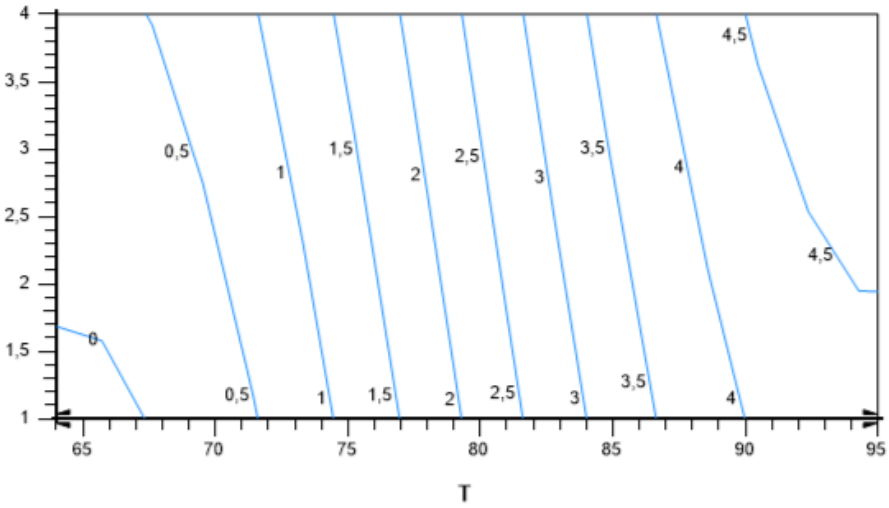


Fig 1 Predicted contour lines of the achievable seam strength F [N/15mm] (in blue) as a function of sealing temperature T [°C] and pressure p [MPa] exemplary for material A with 40 µm seal layer thickness (12 µm with a similar result)

When examining the results, it is to be noted that the results can change significantly if there are other layers below the sealing layer, e.g. for the realization of the barrier function.

For some of the other materials [B] – [D], DoE was carried out with the same parameter limits as for material [A]. Unfortunately, the results could not be used to create a verified model, since the measurements resulted in numerous outliers or zero values. This has shown that it is necessary to always determine the process limits for each material combination before performing the DoE. The measurements will be repeated.

In order to investigate whether a tight seal of the critical layer step, especially the two-layer areas of a bag or pouch, is possible with the materials, further seam patterns were made for material [A].

PROGRESS

TASK 4.7 MACHINABILITY- FIELD TEST (3/3)

Challenges:

- Sealability of the later fully treated and coated materials (incl. bleaching, barrier coating, adhesion promoters, etc.)
- Transfer of the results (determined parameter sets, seam strengths, tightness) for industrial production
- Previously achieved seam strengths of max. 4,5 N/15mm possibly too low for industrial requirements
- Adjustment/redesign of sealing tools probably required for tight sealing of layer steps

Next steps :

- Repetition of the failed measurements
- Examination of the remaining materials [B] – [D]
- Transfer the approach to another fibre-based packaging material commercially available through a project partner.
- Intensification the investigations of the layer step issue

PROGRESS

WP4

TASK 4.8 FINANCIAL MODELLING AND COSTS OPTIMIZATION

Leader: (RE)SET **Status:** not started

Objective: *perform economic evaluations leading to the determination of the final cost of production of each developed packaging solution.*

Actions taken & key take aways:

No actions taken yet.

Challenges:

- The Research & Development actions led by Work Package 4 have been extended as the results hope for are not achieved yet. The selected materials and substrates are still being tested. Therefore no final packaging solution has been fully developed yet. Once WP4 has made progress and reaches industrials' expectations in terms of barriers and machinability, (RE)SET will start performing the economic evaluations.

Next steps :

- Ensuring WP4 is making progress and heading in the right way in terms of research
- Derisking by sourcing other packaging alternatives with high fibre rate that are already on the market, to make sure:

- industrials have a solution to substitute their plastic packaging
- secure volumes as they can be significant in the food sector
- test in-real life the sales of fibre-based packaging that are ready to market and asses consumer behavior, as well as the economic, social and environmental impact to get learnings for the newly developped solutions to come

PROGRESS

WP4

TASK 4.9 DERISKING

Leader: (RE)SET **Status:** ongoing

Objective: *keep working on solutions based on the latest scientific work and avoiding dead-end in terms of resources used*

Actions taken & key take aways:

(RE)SET is continuoulsy on the look out for solutions providers that can supply alternative substrates, coatings, lamination, deposition technologies in line with the pre-requisistes in terms of biosourced content and barrier properties to be reached.

(RE)SET is curating a database with the latest packaging innovations to either replace a failing supplier or to complete a combination of solutions missing an element.

Since WP4's progress is slower than expected, more of these solutions might be activated in the near future to secure coming deliverables 4.1 and 4.2, ensuring the launch of machinability tests and the roll out of the demonstration phase. For that purpose (RE)SET has analyzed the food manufacturers barrier needs and conditioning settings to select a group of solution providers covering the full range of food products. Alongside a machine testing protocole has been established to harmonize and accelerate these steps. Preliminary tests will be centralized at Fraunhofer. Further tests will be carried out by other entities to be determined yet.

Challenges:

- Finding commercial solutions that match the pre-requisite of 100% biosourced content and reach the expected barrier properties at the same time (oxygen, water-vapour, grease to protect the packaging and preserve the foods shelf life).

Next steps :

- Activate sourced alternative packaging solutions to start the machinability tests and ensure they can run on the food manufacturers conditioning lines.

OBJECTIVE & TIMELINE

WP5

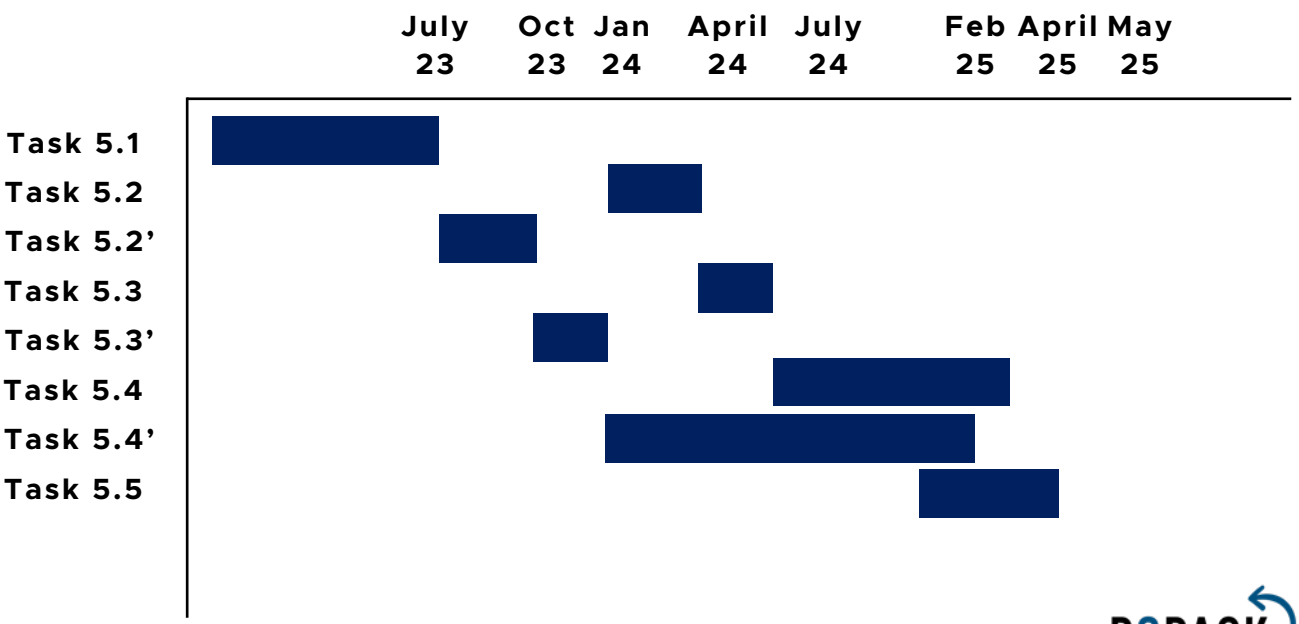
Carrefour

M7 to M36

MAPP DEPARTMENT OF MANAGEMENT AARHUS UNIVERSITY · ALTHO · europe snacks · Florédale · Laiterie de Saint Denis de l'Hôtel · (RE)SET · Schreiber · SODIAAL · U

Demonstrate in the pilot countries the packaging innovations developed within WP4 **and the reuse schemes** defined in WP3 with the aim to adapt and tailor them to the **real-life scenarios** and different economic, geographical and social conditions offered by the defined pilot experiments

- Framework for the demonstrator *(Carrefour, M14)*
- Comparative analysis for the scenarios from phase 1 to phase 3 *(RE)SET, M23/M33)*
- Decision tool model / guidelines adapted to the feedback *((RE)SET, M36)*



R3PACK

PROGRESS

WP5

TASK 5.1 DEFINITION OF THE FRAMEWORK

Leader: Carrefour **Status:** ongoing

Objective: *set a framework for the project demonstration pilots and the study*

Actions taken & key take aways:

Task 2.1 has allowed to assess the feasability level for substituting to a fibre-based packaging and/or switching to a reusable packaging for each product category targeted by the project.

The overall flow model between the different stakeholders has been determined, but will most likely evolve throughout the experiment.

The shop selection and different service providers are ongoing.

The testing hypotheses and KPIs to measure the success of the demonstration have yet to be determined.

Challenges:

- Retailers' administrative processes, the lack of reusable containers currently commercialzed suited to the food product categories, the mistmatch between the reusable packaging and conditioning lines, the sometimes long ageing tests have significantly delayed the planning of the three demonstration launch phases.

Next steps :

- Collective workshop with R3PACK partners to define the framework's KPIs
- Finalize the shop selection for all three phases
- Determine the production distribution per phase

R3PACK

OBJECTIVE & TIMELINE

WP6

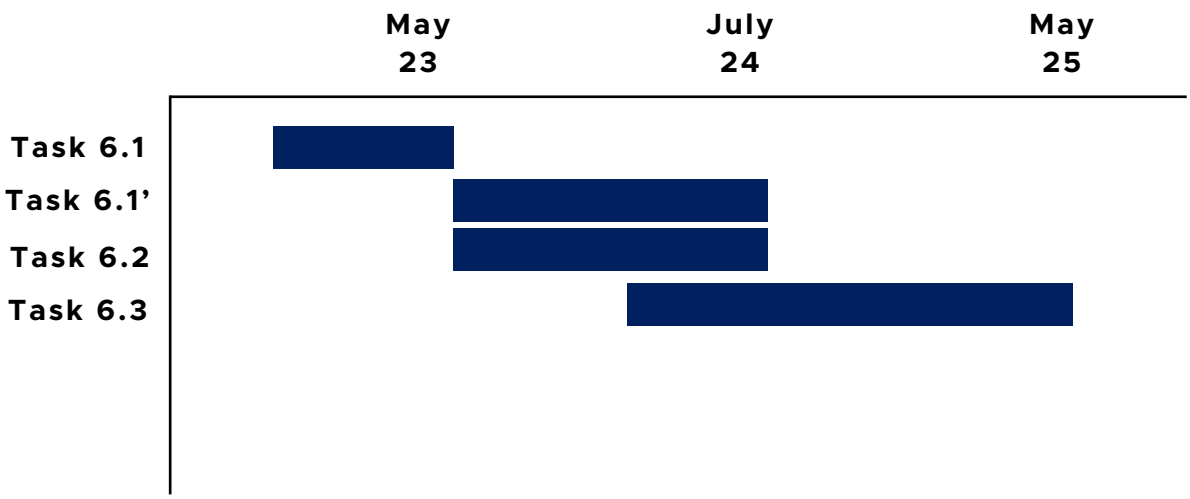
INNOVHUB STAZIONI SPERIMENTALI PER L'INDUSTRIA
innovazione e ricerca

M5 to M36

POLITECNICO MILANO 1863 (RE)SET SGS

Verify the **environmental benefits of the solutions** developed by the project

- Report on the state-of-the-art packaging - LCA of existing packaging solutions selected to be SUBSTITUTED - part A *(Innovhub, M12)* and LCA of suitable solutions selected for REUSE - part B *(PoliMi, M22)*
- Report and data repository: LCA Inventory and scenario building, divided into SUBSTITUTION and REUSE data *(Innovhub, M26)*
- Comparative analysis: LCA of SUBSTITUTION packagings - part A *(Innovhub, M36);* LCA of REUSE loops - Part B *(PoliMi, M36)*
- Guidelines for efficient environmental reuse scenarios *(Innovhub, M18, M36)*



R3PACK

PROGRESS

WP6

TASK 6.1 STATE OF THE ART PACKAGING LCA

Leader: INNOVHUB STAZIONI SPERIMENTALI PER L'INDUSTRIA innovazione e ricerca **Status:** ongoing

Objective: *assess the environmental impact of the existing solution for both Reuse and Substitution*

Actions taken & key take aways:

Different Life Cycle Assessment (LCA) studies of existing packaging solutions selected to be SUBSTITUTED were carried out - part A of the Task.
The goal of the work has been the environmental impact evaluation of the state-of-the-art related to the packaging solutions selected to be substituted with innovative solutions under development within WP4.
LCAs were carried out through SimaPro software and following the PEF method with some adaptations.
The Deliverable D 6.1 Part A summarizing these assessments has been produced, including the analysis of ten primary packaging belonging to nine different food categories defined in the project.
This state-of-the-art analysis will be necessary to set the baseline for comparisons with the newly developed cellulose-based packaging.

Challenges:

- Collection of the necessary information and data of the selected packaging products for the LCA studies.

Next steps :

- Carry out LCA studies of existing packaging solutions selected for Reuse (part B of the Task).
- Set the baseline for comparisons with the newly developed cellulose-based packaging products.

R3PACK

OBJECTIVE & TIMELINE

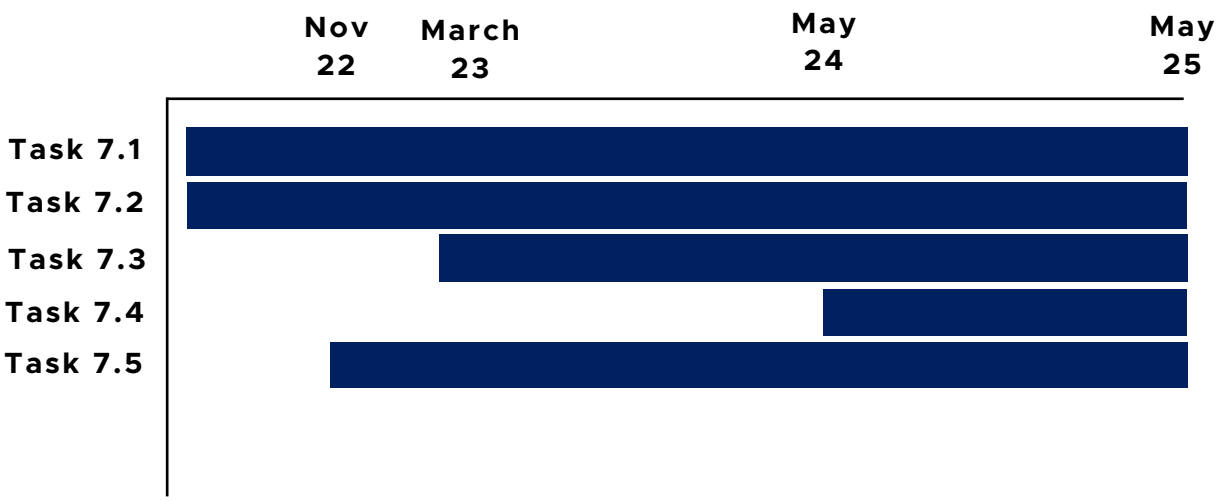
WP7

safe

M1 to M36

- Efficient **dissemination and communication** activities
- Provide a **clear business case and exploitation strategy** to scale-up R3PACK's innovations at EU level
- **Ignite policy-change by advocating** for the transition towards paper based packaging and rapid and enhanced uptake of industrial reuse schemes

- Communication, Dissemination, Exploitation and Awareness Rising plan - including DOMP *(SAFE, M6/M24/M36)*
- R3PACK Business Plan *[(RE)SET, M12, 18, 24, 36]*
- R3PACK "What if" scenarios and policy recommendations *[(RE)SET, M36]*



R3PACK

PROGRESS

WP7

TASK 7.1 COMMUNICATION, DISSEMINATION, AWARENESS RAISING AND ENGAGEMENT ACTIVITIES

Leader: safe **Status:** ongoing

Objective: *secure the development of Dissemination and communication strategy and material*

Actions taken & key take aways:

The Action Plan consists of R3PACK's communication and advocacy plans. It outlines (1) the target groups the project seeks to impact, (2) the main messages of the project, (3) the actions to be carried out to reach them, (4) the general and specific obligations regarding Dissemination and Communication of the project that all partners must be aware of and (5) the Advocacy Strategy. Since its adoption, R3PACK has:

- ✓ Launched the project's website and visual identity;
- ✓ Launched its social media accounts in Twitter and LinkedIn, posting regularly every week and growing its number of followers. The Instagram (IG) account is undergoing and will be published by end of M12;
- ✓ Published three newsletters and grown its number of subscribers;
- ✓ Published press releases covering the launch of R3PACK;
- ✓ Started planning the drafting and publication of vulgarization and scientific articles;

Challenges:

- Engagement of partners in social media (reposting)
- Audience outreach & increasing newsletter suscribers
- Flexibility of validation process for posts

Next steps:

- Continuing the development of the communication activies, which are spread over the duration of the project
- Launch of IG account (M12) & development of strategy
- Development and publication of vulgarization articles over the duration of the project
- Newsletter #4 in M14

R3PACK

PROGRESS

WP7

TASK 7.2 OPEN SCIENCE PRINCIPLES APPLIED TO C,D & E

Leader: (RE)SET **Status:** ongoing

Objective: *assure that publishing and dissemination activities are grounded on OS principes throughout the project.*

Actions taken & key take aways:

(RE)SET has opened a community in the name of R3PACK on the public and open science repository Zenodo funded by the European Commission and OpenAire, an open Scholarly Communication Infrastructure creating and operating services for Open Science.

All partners will have to share their deliverables, scientific publications, data sets and other relevant documents onto this open access community according to a publishing guide written by (RE)SET.

R3PACK's website www.r3pack.eu also serves as a dissemination tool and open platform to gain access to the project's work.

Finally deliverable 7.1 describes R3PACK's actions to be compliant with the FAIR principles.

Challenges:

- Getting trafic to the repository Zenodo for the work to be actually visible

Next steps :

- Ensure all public work is being published onto Zenodo

R3PACK

PROGRESS

TASK 7.3 EXPLOITATION POTENTIAL AND NEW MARKET CREATION

Leader: (RE)SET **Status:** ongoing

Objective: *final project business plan will be produced, showing how profitable it can be for identified private partners and stakeholders to further invest into the project results and adopt them as widely marketed solutions.*

Actions taken & key take aways:

(RE)SET is currenlty working on the final project's business plan highlighting expected results, benefits and costs per type of stakeholder when investing in reusable and substitution solutions, reachable market size and potential of plastic reduction per food category in Europe.

In parallel, (RE)SET has already managed to recruit four additional industrials to participate in R3PACKs project and adopt the soon to be developped solutions. When possible they will participate in the demonstration adding to the learnings for their specific food category.

Challenges:

- Collecting the necessary data in order to measure the impact of reuse and substitution uptake

Next steps :

- Once the structure of the business plan is defined, collecting the needed data to measure the costs and benefits, the impact of the solutions' implementation
- Planned update M18

PROGRESS

WP7

TASK 7.5 TARGETED ACTIONS FOR POLICY DIALOGUE AND CAPACITY BUILDING

Leader: safe **Status:** ongoing

Objective: *develop advocacy strategy at EU level*

Actions taken & key take aways:

The Advocacy Strategy (included in the Action Plan) covers actions (press releases, position papers) to support policy change at EU level promoting alternative sustainable packaging and the uptake of reuse schemes. Since its adoption, R3PACK has developed this strategy by:

- ✓ Publishing press releases covering EU policy development;
- ✓ Establishing a procedure for adopting R3PACK position papers and relevant documents, as well as an emergency procedure when time is pressing;
- ✓ Following the legislative procedure of the Packaging and Packaging Waste Regulation (PPWR) proposal, organising calls with partners to work on a position paper, conducting meetings with relevant stakeholders as well as EU policy-makers, attending relevant events on packaging. Work on a position paper on the file is undergoing;
- ✓ Following other EU initiatives, i.e. food contact materials revision, restrictions on harmful chemicals (bisphenol A, PFAS);
- ✓ Developing a (tentative) calendar for future R3PACK actions.

Challenges:

- Developing strong R3PACK positions when the WPs' work is still ongoing and there are no results;
- Engaging partners to provide technical comments on EU initiatives

Next steps:

- Continuing the development of the advocacy activies, which are spread over the duration of the project
- Drafting a R3PACK position paper on the PPWR

R3PACK

CONCLUSION

Overall, R3PACK is observing positive results after a first year of collective work. For the past 12-months, R3PACK has build a strong consortium, implemented good practices and tools, launched a multi-channel communication, kick-started its 7 work packages and submitted 10 deliverables in due time to the European Commission.

The research phase is soon ending, as the demonstration phase approaches. However, a few challenges need to be overcome to roll out the initial planning in time.

The challenge for WP 4 will be to accelerate the development of the alternative fibre-based solutions as multiple unplanned iterations occured and cost time. The progress is conditioned by the supply of the necessary materials (PHA, Chitosan, …) among other things. To minimize the risk, ready-to-market solutions with high fibre content will be adopted by the food manufacturers in the demonstration phase alllowing to gather the necessary learnings about industrialization, consumer behavior and economic and environmental aspects.

The challenge for WP 3 are numerous, as depending on the food categories :

- There are no suited packaging available on the market, which implies making new molds from scratch in partnership with a packaging supplier
- The shelf-life tests can take up to a year (e.g. savory and sweet biscuits)
- The conditiong lines are not adapted to reusable packaging (e.g. flexible for single use vs rigid packaging fore reuse)

Overall, the adaptation of marketing tools has very long lead time (label, merchandising, …) and the complexity of establishing a new common traceability system is time consuming. Finally, actors such as shop owners and retail employees need to be reassured as their business as usual is being disrupted.

All challenges have been identified and are collectively being addressed to meet R3PACK's expectations.

APPENDIX

Funded by the European Union

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R3PACK'S TIMELINE

PROJECT MANAGEMENT CALENDAR