

# FlexFunction2Sustain

Open Innovation Ecosystem for Sustainable Nano-Functionalized Plastic and Paper Surfaces and Membranes



This project has received funding from the European Union's Horizon 2020 research and innovation programme under [grant agreement n°862156](#)

# What is an Open Innovation Test Bed?



- **Open Innovation:** Increase innovation potential by accessing external partners in the innovation process
- **Open Innovation Test Bed - OITB:** Open platform for evaluation and maximisation of the innovation potential of novel ideas, technologies, and products.
  - Network of Suppliers for complementary innovation boosting services
- **Single Entry Point:** Commercial Company as Industry's Access Point to OITB Services







A photograph of a beach heavily littered with plastic waste, including numerous discarded plastic bottles, fragments of plastic, and other debris. The waste is scattered across the sand, extending from the foreground towards the water's edge. The water is visible on the right side of the frame.

**FlexFunction2Sustain** boosts innovation for sustainable and smart plastic and paper products

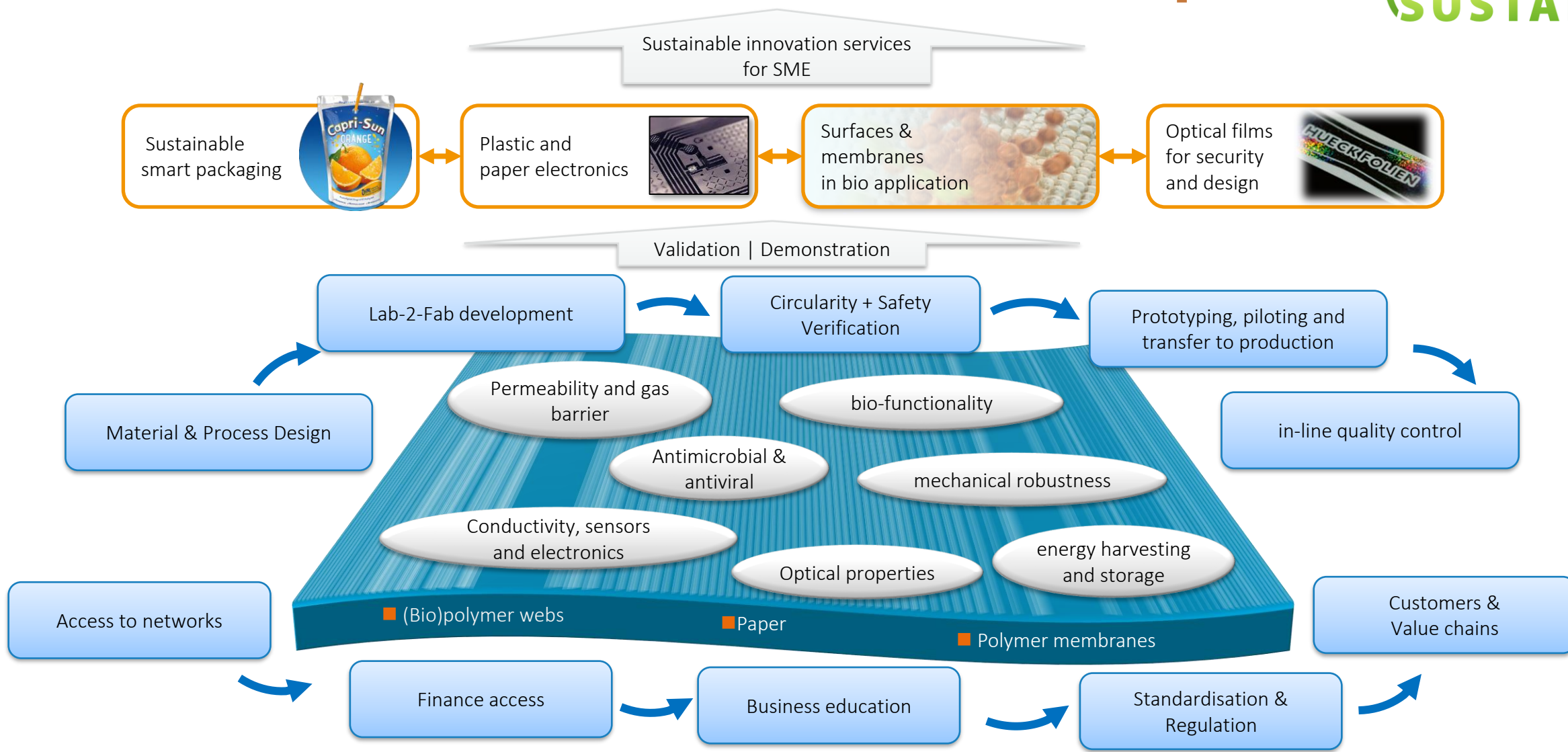
➔ drastically reduce plastic waste

➔ get ready for the digital age

making use of  
**nano-functionalization of novel plastic and paper surfaces**



# FlexFunction2Sustain OITB Concept



# The FlexFunction2Sustain Ecosystem



OITB Members

Industrial Validation

Potential Clients

External Stakeholders



Board of Investors and Foundations

External Advisory Board

(Networks, Regulations, Standardisation, and others)

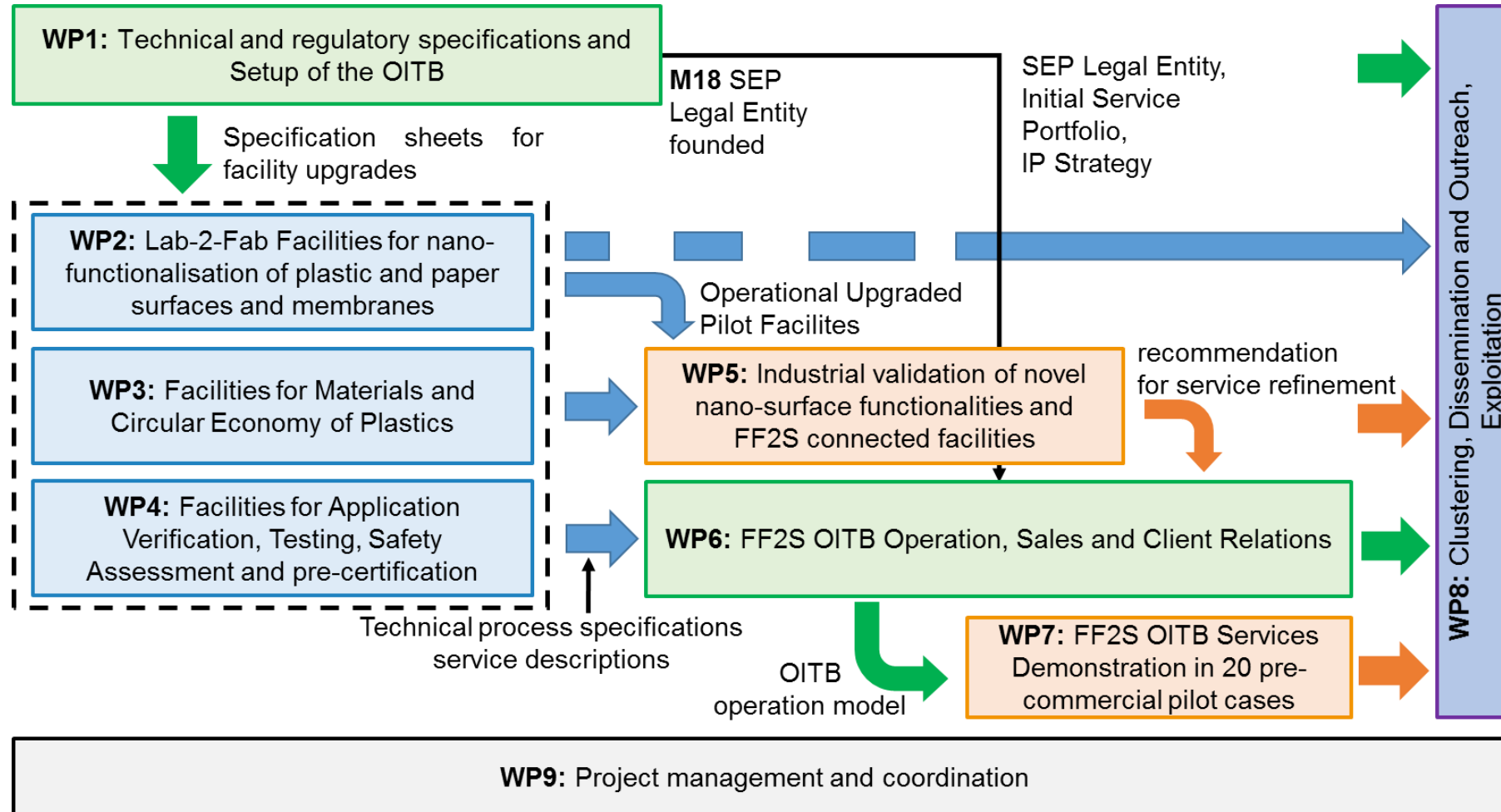
# Highlight Results of the First Year



This project has received funding from the European Union's Horizon 2020 research and innovation programme under [grant agreement n°862156](#)

FlexFunction2Sustain M13 Meeting

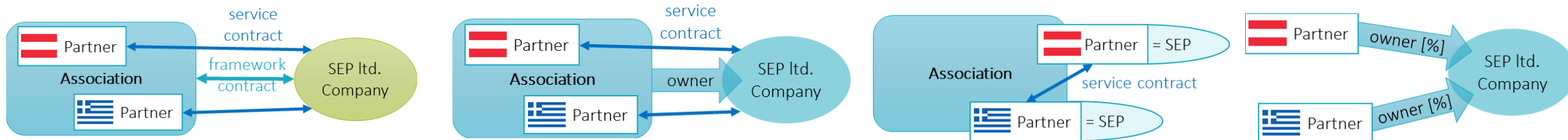
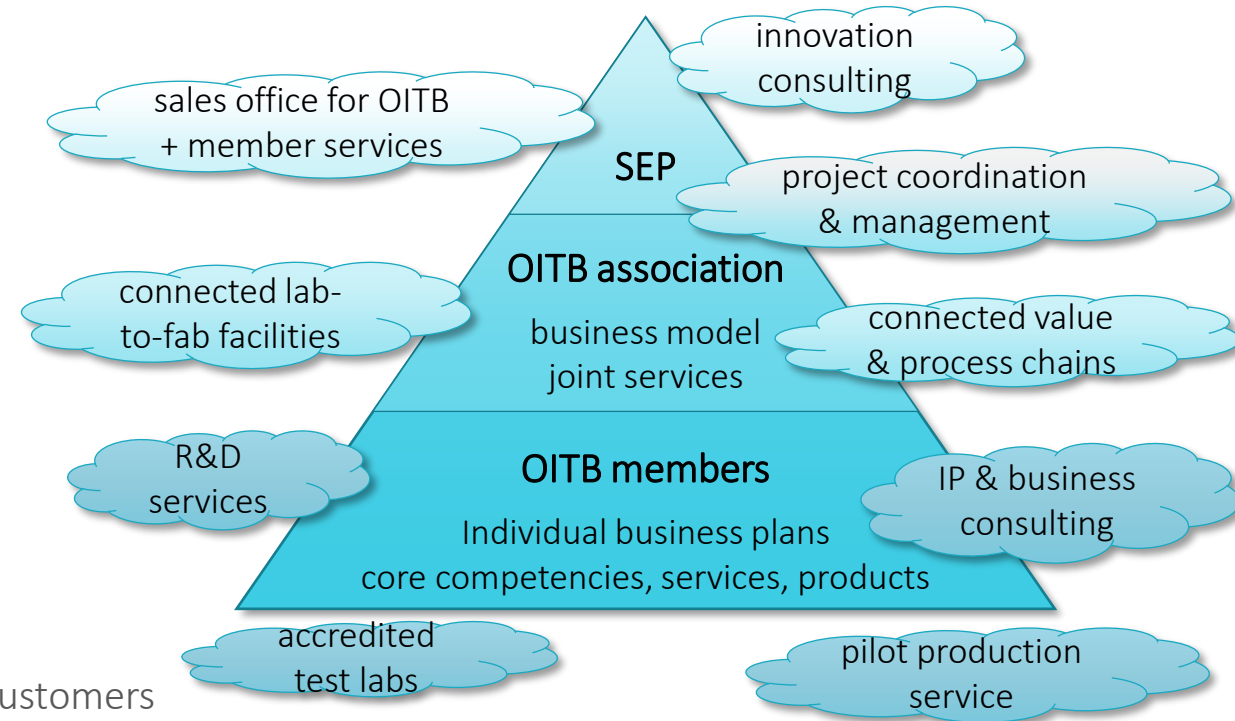
# Our work plan towards a sustainable Open Innovation Ecosystem ...





# Work Package 1 – Setup of the OITB

- **Three level Business Model:** Member ↔ OITB ↔ SEP
- OITB business plan in preparation – *moderated by Business Consultants*
- OITB added values:
  - synchronized **technologies from lab-to-fab** (TRL4...7) *e.g. vacuum coating from sheets to 2 m wide rolls*
  - **Full value and process chains** for future products *e.g. from a biopolymer granulate to a food package*
- Intended OITB structure:
  - **Non-profit association:** collaborative network of experts
  - **For-profit limited liability company:** commercial SEP to customers
  - Models for SEP ↔ OITB Interaction:



# WP2 – 4: Technical Facilities

## Nanofunctionalisation of Surfaces



R2R Vacuum Coating



Atmospheric pressure coating,  
printing and surface treatment



R2R micro- and nanostructuring



Printed electronics pilot lines

## Circularity by Design

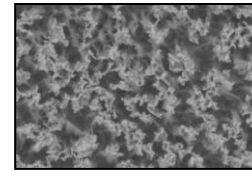


Compounding and  
Film Extrusion

Recycling and Bio-  
degradability Pilot Lines



## Characterisation, Quality Control, Verification



Physical and  
chemical properties

Functional  
Performance  
Evaluation



Application Certification



Nano-safety assessment



# Work Package 2 – Nano-Surface Treatment

## Objectives

- Complete lab-to-fab chain for each technology
- get ready for biopolymers and polyolefines with low thermal and dimensional stability
- Improve process reliability, yield, productivity, and quality control

## 36 Upgrades at 8 partners from facility clusters 1- 4

- Specifications and mechanical design of most upgrades completed ✓ → implementation phase started
- Some upgrades already installed – (by now) no major COVID-19 delay → most upgrades in operation by Month 24 (Q2 – 2022)

TRL4 [FHG-FEP]



A4 Sheets – 1 process

→ TRL5 [FHG-FEP]



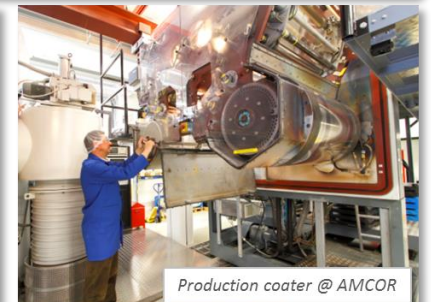
200 mm – 3 stations

→ TRL6 [FHG-FEP]

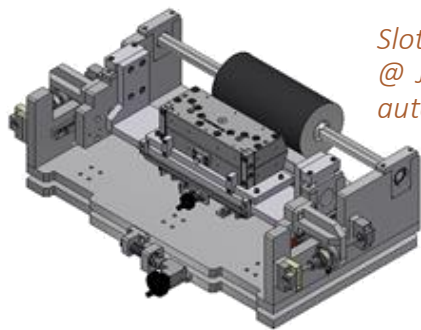


650 mm width – 5-6 stations

→ TRL7 [AMCOR]



715 mm ... 2000 mm width



*Slot-die coating module upgrade  
@ JOA pilot line [JOA; COA] with  
automatic layer thickness control*

**mechanical design  
finalized ✓**



*Roll-to-Roll Atomic Layer  
Deposition @ FHG-IVV  
upgrade to 300 mm  
web width*

**prototype in  
evaluation ✓**

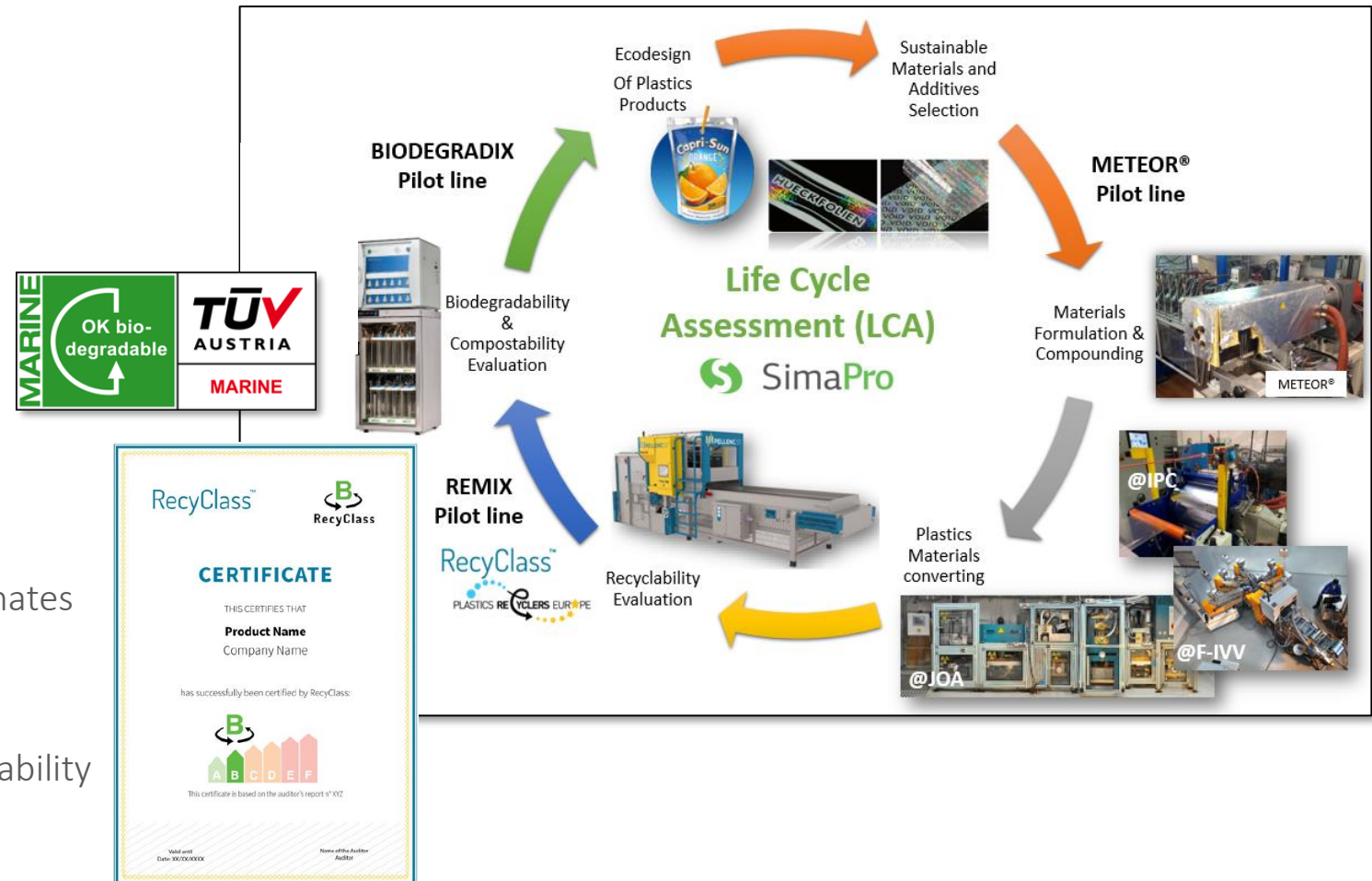


*Inert lamination and  
thermal nanoimprint  
module @ [COA]*

**assembly  
completed ✓**

# Work Package 3 – Circular Economy of Plastics

- Holistic Circular Economy Approach *from design to product assessment*
- Upgrade pilot lines for accreditation by relevant authorities in progress
  - Biodegradability assessment
  - Recycling process chains
- Validate approach in 2 application scenarios
  - Polypropylene mono material laminates for drink pouches → recyclability
  - PLA film based security labels / holographic structures → compostability

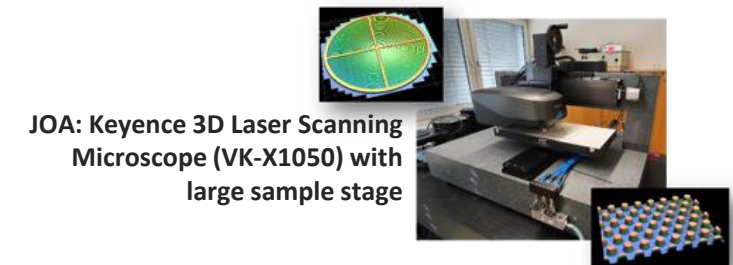




# WP4 - Characterisation & Verification

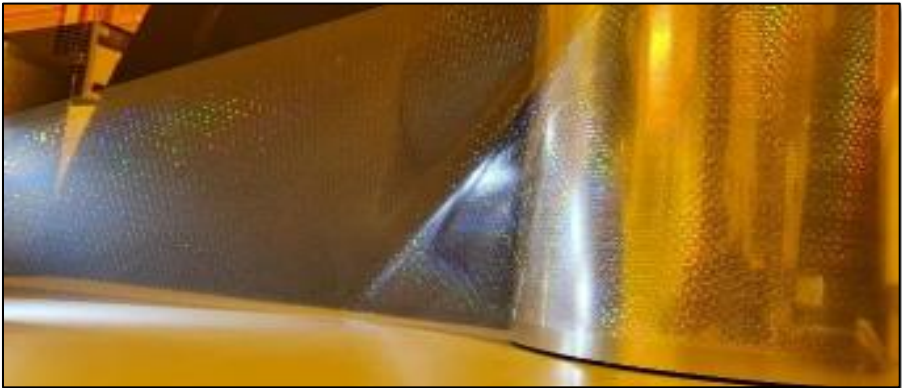


- Novel specialized characterisation available through FlexFunction2Sustain
- Large area ( $300 \times 600 \text{ mm}^2$ ) surface profiling, defect characterisation and die distance measurements by 3D Confocal Laser Scanning Microscopy @JOA – ready to use
- Combined mechanical testing with gas permeability test (optical Ca-test) @IAP/FEP – design complete, device under construction
- New Antimicrobial Surfaces Test Lab @AUTH – ongoing, procurement completed
- Upgraded Microbiology Laboratory & Automated Inhibition Zone reader at INL – ongoing, laboratory works finished



- Interlaboratory test for barrier and mechanical properties @IAP, FEP, IVV, IPC, AUTH, and INL to validate services.
- First results for anti-COVID activity testing methodology developed at INL

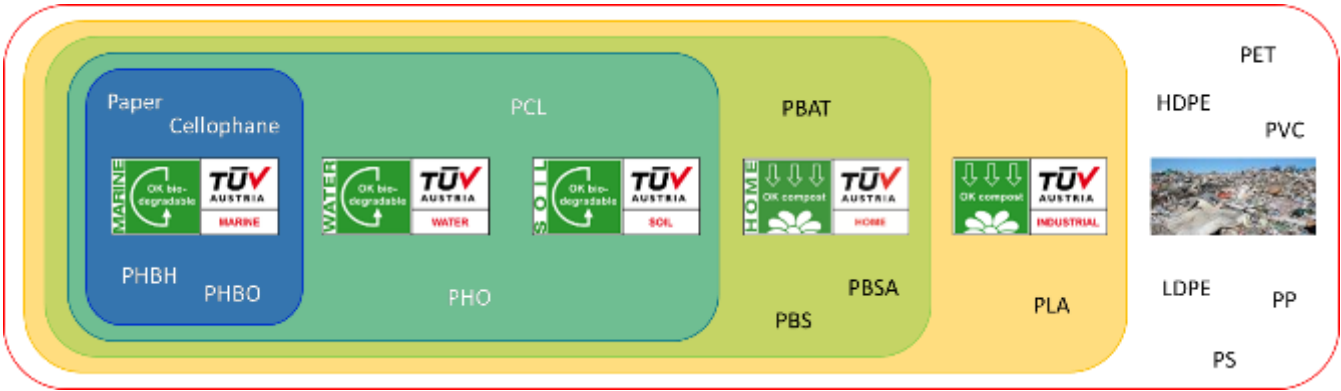
# WP5 – Industrial Use Cases



5.1 Hueck Folien: Compostable Security Labels  
1500 m optical films produced by JOA

### 5.3: I3 Membrane

Selective and switchable water filter membranes  
Successful deposition of gold layer on membranes by FHG-FEP



### 5.2: Procter & Gamble

Marine degradable Shampoo Pouches  
List of sealant materials evaluated





# WP5 – Industrial Use Cases



## 5.4: Fiat Research Center

Innovative Plastic Surfaces in Car Dashboards

Wear resistance test @ 5000 cycles on ITO-coated PET  
for multifunctional touch-sensor / displays



## 5.5: SONAE: Paper based fresh food packaging

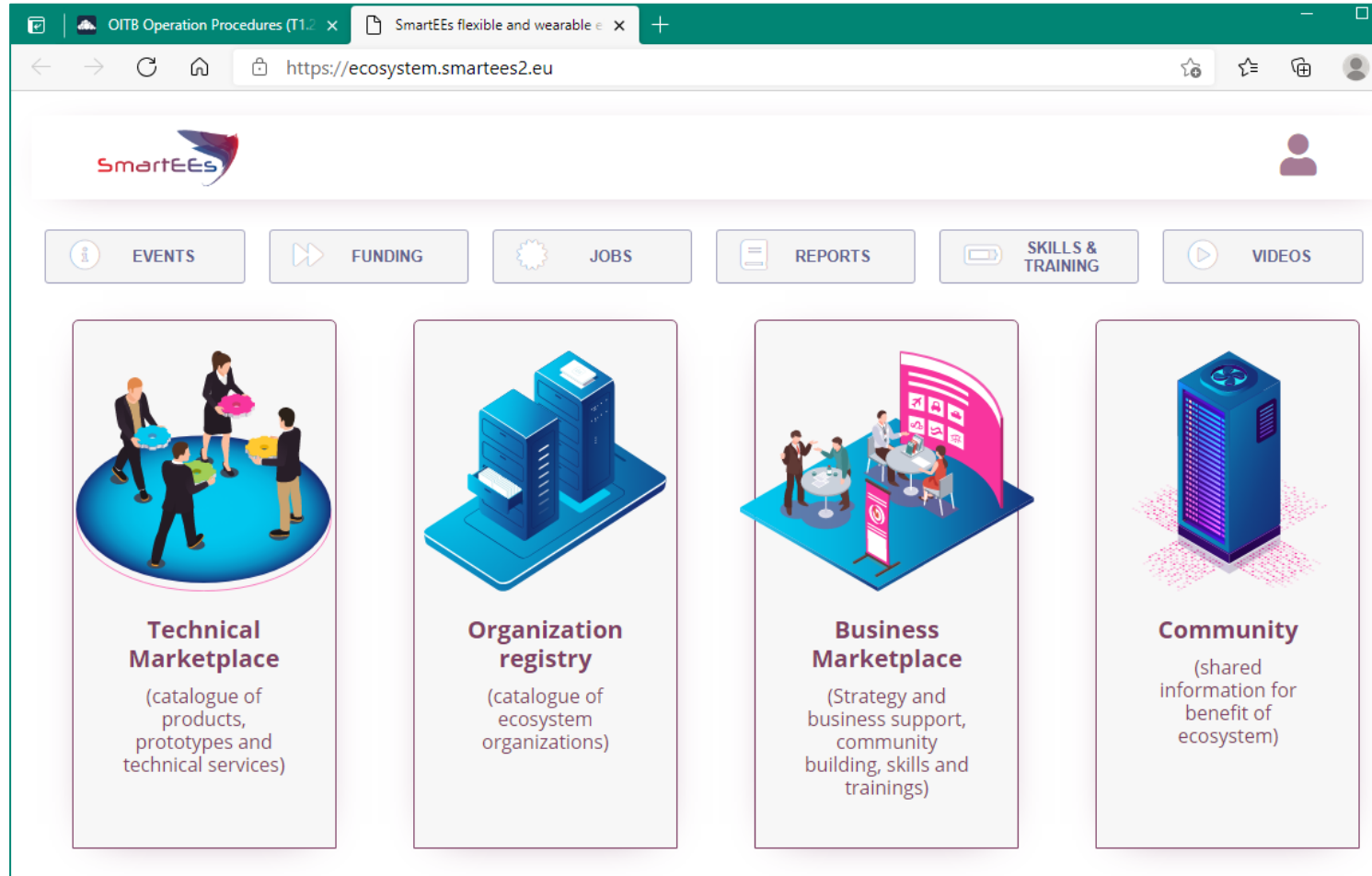
Nozzle system for deposition of new coating formulations on  
paper upgraded @ INL

## 5.6: Capri Sun

Fully recyclable mono-polymer drink pouches  
 $O_2$  – permeability on the pouch at FHG-IVV



# WP6 – OITB Operation and Implementation



## Start in M18

- Ecosystem Management Platform  
→ database about network and services
- Quality Assurance in Service Delivery  
→ increase efficiency and reduce liability risk
- OITB ↔ Customer Relation Management  
→ targeted marketing and customer support
- IPR and Innovations landscaping  
→ IPR as a services, market intelligence
- OITB Service Portfolio  
→ Maintain and readjust to market needs
- Investor Relations  
→ Offer Finance Services to SME customers

*Ecosystem management platform (example from SmartEEs project - [www.smartees.eu](http://www.smartees.eu)) (AMIRES)*



# WP7 – Open Calls for industrial pilot projects!

34 letters of interest from potential OITB clients from 15 countries

- information about their needs and requested services
- initial pool of companies for potential Pilot Cases

## Open Calls for Pilot Projects

- Objective: Create Success Stories | Test Services and OITB Procedures
- EU SME can receive discounted services – up to 100% subsidized support
- OITB member services financed from FlexFunction2Sustain budget (2.25 M€ for approx. 20 projects)
- Application procedure: short project proposals
- Technical + administrative helpdesk and promotional material in preparation
  - OITB members promote open calls and suggest + support applicants
- Proposal evaluation with internal and external reviewers



## Expected cutoff dates:

- January 2022
- July 2022
- January 2023

# WP8 Dissemination + Clustering

- Visual Identity and Dissemination of the Project and OITB Idea
  - Project Webpage & Promotional Material
  - FlexFunction2Sustain in Press and Media: 5 magazine articles published about FF2S in year 1
- FlexFunction2Sustain Events
  - Industry Workshop on 21 Oct 2020 → ≈ 40 participants
  - get in touch with innovative companies and future users
- Clustering with other OITB & NanoSafetyCluster
  - Regular bilateral exchange: NGM, SNMT, NewSkin, MDOT, ...
  - 1<sup>st</sup> OITB Stakeholder workshop: 4<sup>th</sup> May 2021
- Interaction with thematic associations and intermediaries
  - OE-A Working Group Encapsulation
  - EUPC, LINPRA, NanoSafetyCluster → EAB Members
- Standardisation and Regulation Activities
  - 6 standardisation projects with direct FF2S participation

## FF2S Print materials



<https://flexfunction2sustain.eu/>





# OITB Stakeholder Workshop on 4<sup>th</sup> May 2021

- Morning session (9:30 – 12:00)
  - European Commission and OITB Members only
  - Discuss OITB Business Models and Legal Structures
- Afternoon session (14:00 – 17:30)
  - Open to public, Industry, OITB, EC
  - Discuss user needs
  - Present OITB Service Portfolio



The poster features the 'FLEX FUNCTION 2 SUSTAIN' logo at the top left. The main title 'OITBs WORKSHOP' is in large orange letters, followed by 'OPEN INNOVATION TEST BEDS AS A SERVICE TO THE INDUSTRY' in green. A green graphic of a lightbulb with gears inside is on the right. Below the title, there are two buttons: 'PROGRAMME AND REGISTRATION' and 'VIRTUAL EVENT'. Below these, it says 'Free registration'. At the bottom left is the European Union flag and text about funding from the Horizon 2020 programme. At the bottom right, it says 'Supported by:' followed by 'safe' and 'nmt' logos. The date and time 'Date: MAY 4<sup>th</sup> 2021 14:00 – 17:30' are in the bottom right, along with the 'EuroNanoForum 2021' logo.

**OITBs WORKSHOP**  
**OPEN INNOVATION TEST BEDS  
AS A SERVICE TO THE INDUSTRY**

**PROGRAMME AND REGISTRATION** **VIRTUAL EVENT**  
**Free registration**

 This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under the grant agreement no. 862156, project FlexFunction2Sustain

Supported by:  
 

**Date: MAY 4<sup>th</sup> 2021**  
**14:00 – 17:30**

 EuroNanoForum 2021

- Please share workshop info with your industrial network
- [www.euronanoforum2021.eu/satellite-events](http://www.euronanoforum2021.eu/satellite-events)

# Thank You for your attention!



Coordinator Contact:

Dr. John Fahlteich, Fraunhofer FEP, Winterbergstrasse 28, 01277 Dresden  
Phone: +49 351 2586 136; E-Mail: [john.fahlteich@fep.fraunhofer.de](mailto:john.fahlteich@fep.fraunhofer.de)

<https://www.flexfunction2sustain.eu>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under [grant agreement n°862156](#)