

# **Circular economy in port areas: mussel shell and dredged sediment, from waste to a new market resource - GREENLIFE4SEAS Project**

**Matilda Mali\***, Rossella Petti, Claudia Vitone  
**DICATECh Department, Politecnico di Bari (Italy)**



**Politecnico  
di Bari**



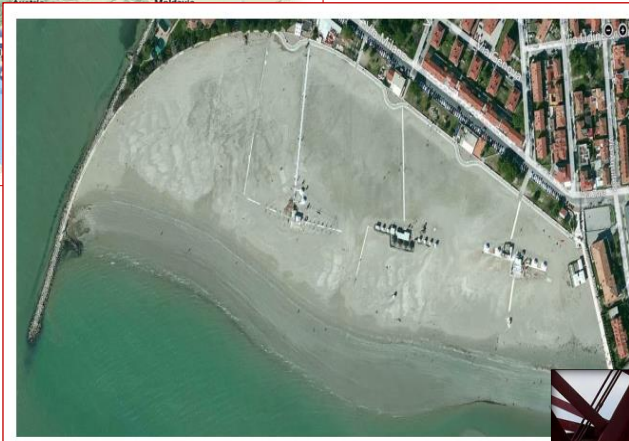
## GREENLIFE4SEAS Project: motivation



D.LGS. 152/06 art. 183 – EC 2008/98

### Sediment- Waste?

Any substance or object which the holder discards or intends or is required to discard.



D.M. 173/2016

### Sediment- Resources

The new Decree - now accepted assumption that sediment is a resource to be recovered and utilized.

Europe: about 200 Mm<sup>3</sup>/year (Source: SedNet).

Italy: about 50 Mm<sup>3</sup> dredged sediments. Increased trend of 5 Mm<sup>3</sup>/year (Source: Assoport 2009).



## GREENLIFE4SEAS Project: motivation



The global production of marine bivalves: 15 million tonnes/year (Wjisman et al., 2019). In Europe: 465 thousand tonnes, in decrease due **to huge difficulties and costs connected to the disposal of shells**. Europe is the second worldwide producer and **Italy and Greece** remain in the top ten of the world nations producers (Fao-Fishstat).

# GREENLIFE4SEAS (5 YEARS FROM OCT.2023) PROJECT CONSORTIUM and EXTENDED NETWORK

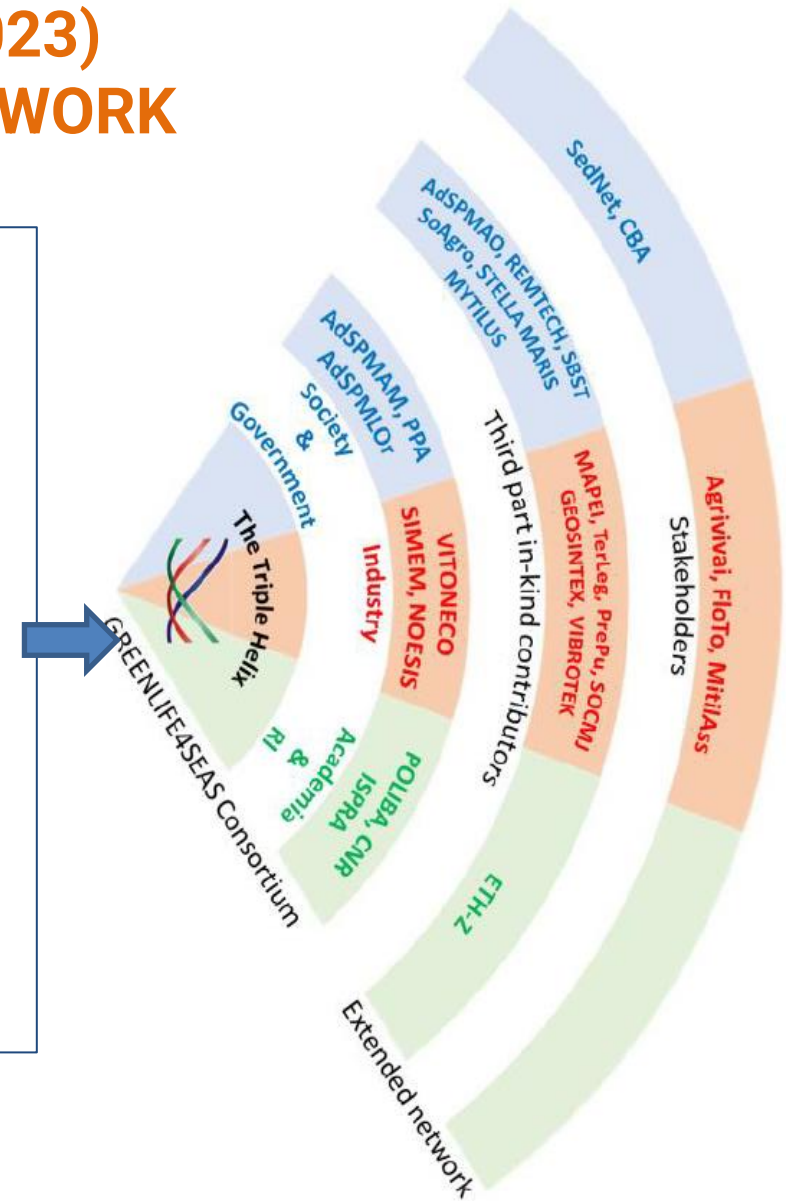
Academia & RI – Industry – Society & Government  
 INNOVATION IN ACTION

The Triple Helix

Society & Government

Academia & RI

Industry



## EXTENDED NETWORK



SPECIALISTI IN PAVIMENTAZIONI ULTRA RESISTENTI



DIPARTIMENTO SVILUPPO SOSTENIBILE



REMTECH EXPO



COMUNE DI BARI

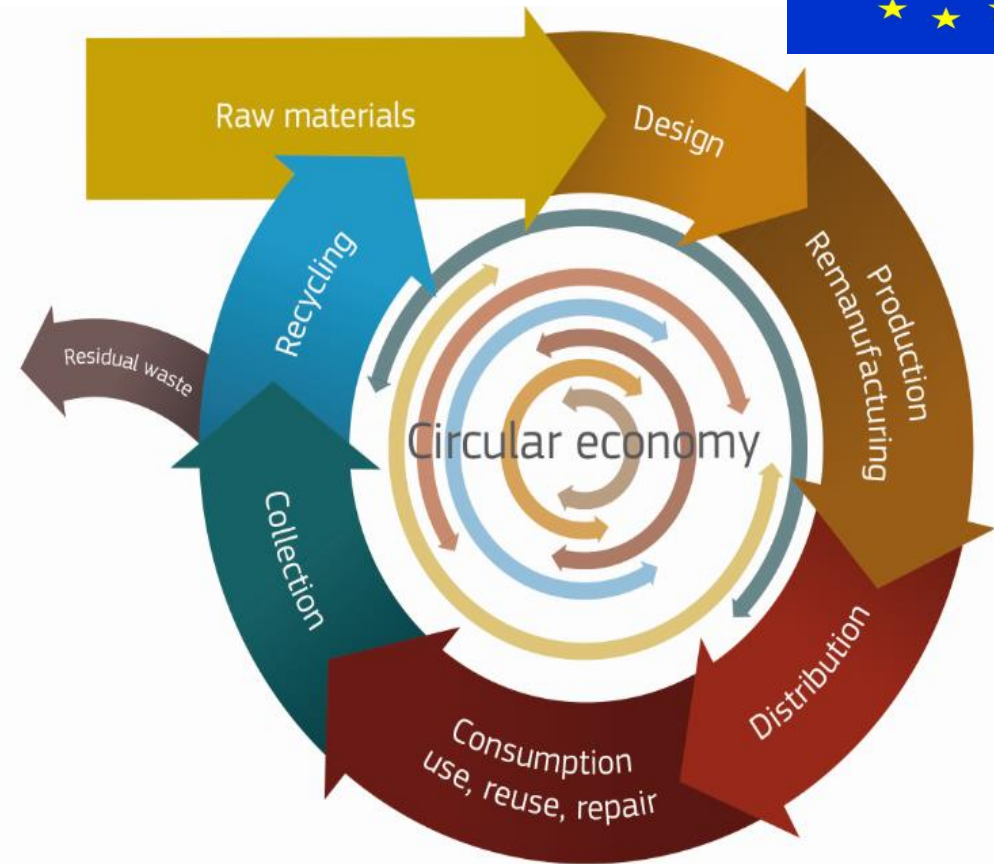
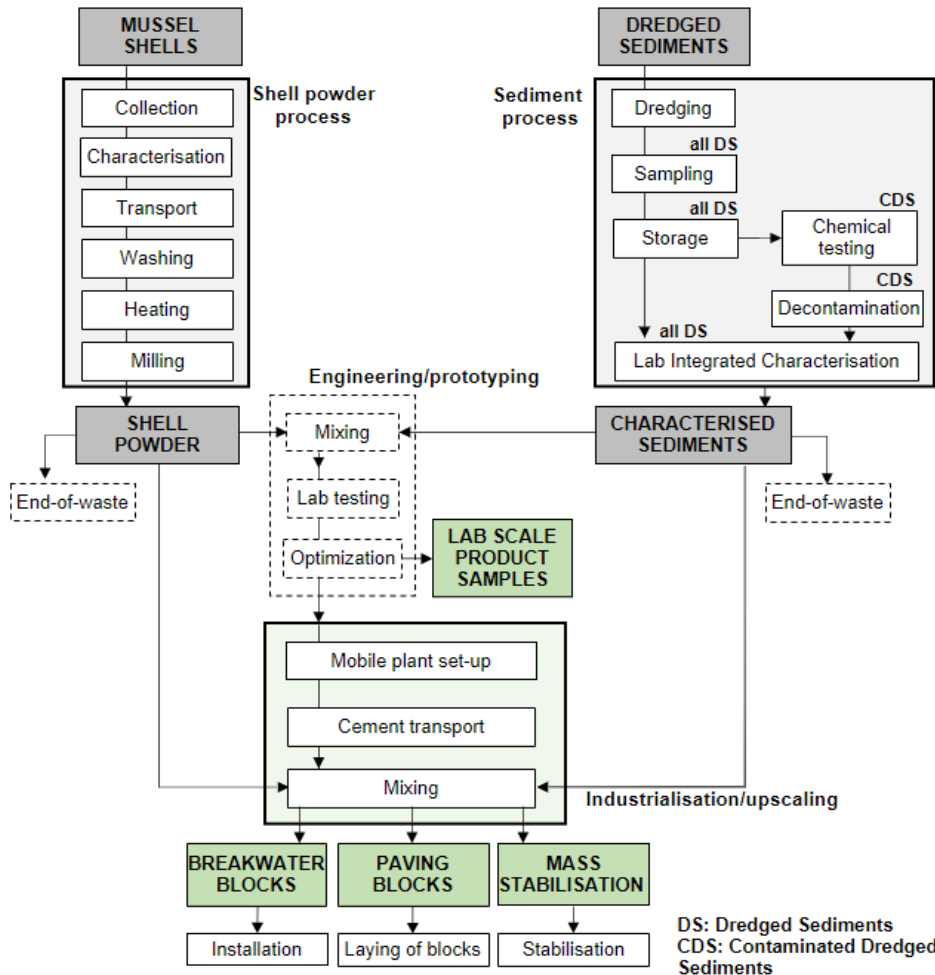


# GREENLIFE4SEAS Project: concept



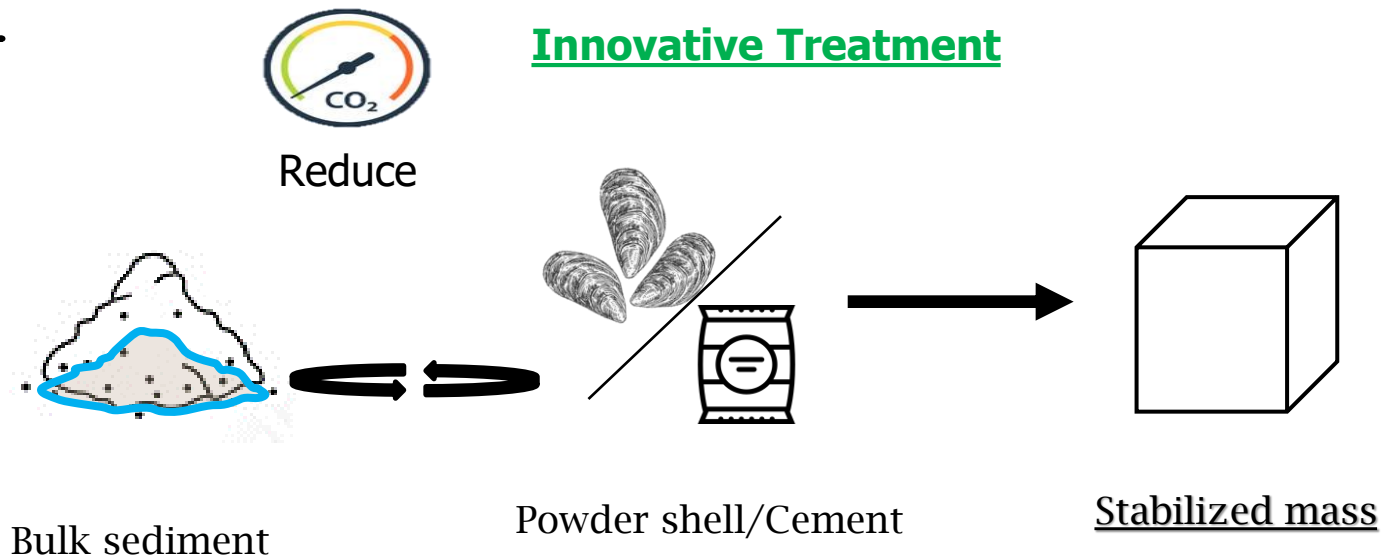
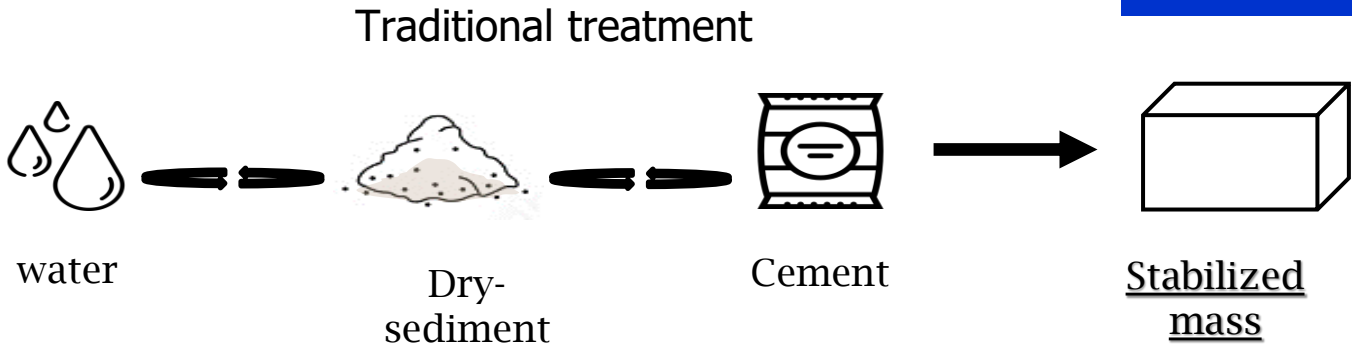
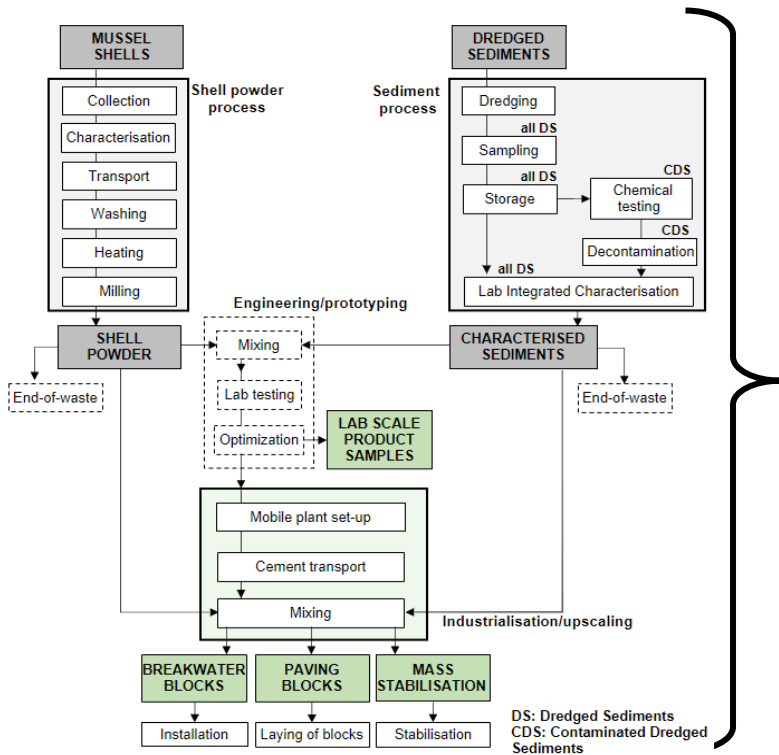
**SHELLS**  
 CER (EWC) 020103 - WASTES FROM AGRICULTURE, HORTICULTURE, **AQUACULTURE**, FORESTRY AND FISHING

**DREDGED SEDIMENTS**  
 CER (EWC) 170505  
 WASTES FROM DREDGING ACTIVITY - SLUDGES



Funded by  
 the European Union

# GREENLIFE4SEAS Project: concept



DS: Dredged Sediments  
 CDS: Contaminated Dredged Sediments





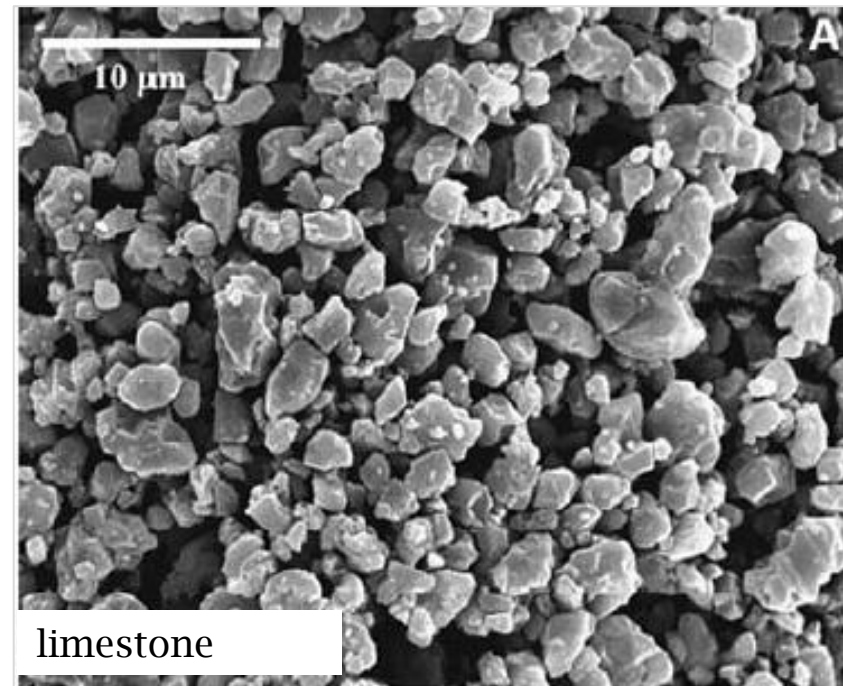
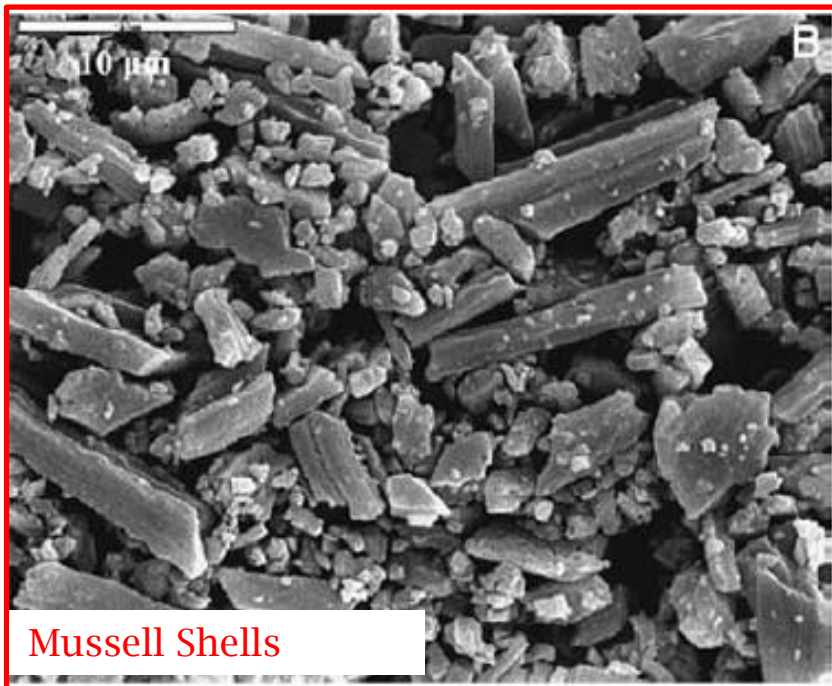
## GREENLIFE4SEAS Project: concept

### Morphology:

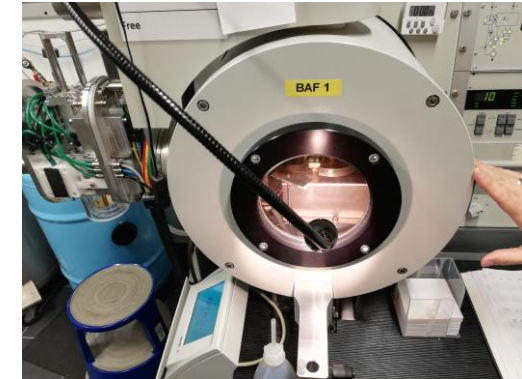
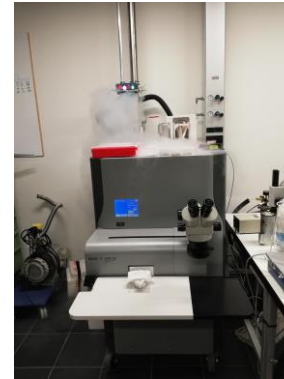
Needle aragonite forms that hydration products due to the increased number of chemical reactions between cement minerals, mussel shells and clay particles of sediments

### Chemical composition:

Mainly calcium oxides/carbonates, main component of concrete/cements.



## GREENLIFE4SEAS Project: concept



Clay Lab – ETH Zurich

**Cementing products**

# GREENLIFE4SEAS OUTPUT FIRST PRODUCTION LINE – SHELL POWDER

MUSSEL SHELLS

Washing

Heating treatment  
 (105°C for 48h)

Grinding

Sieving

Collection

Characterisation

Transport

Washing

Heating

Milling



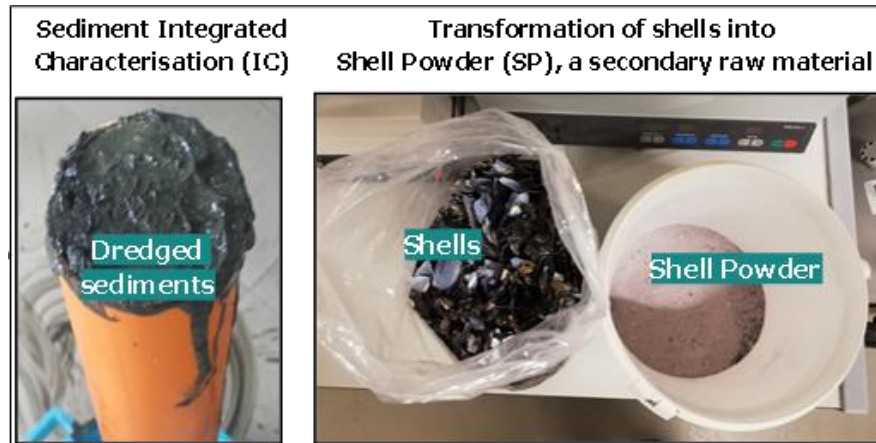
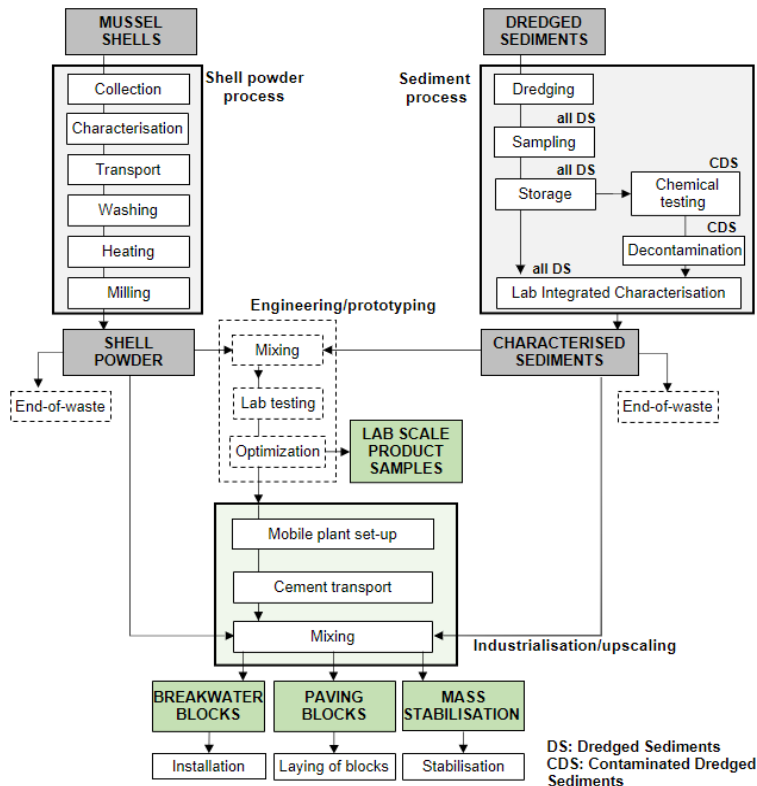
SHELL POWDER

End-of-waste

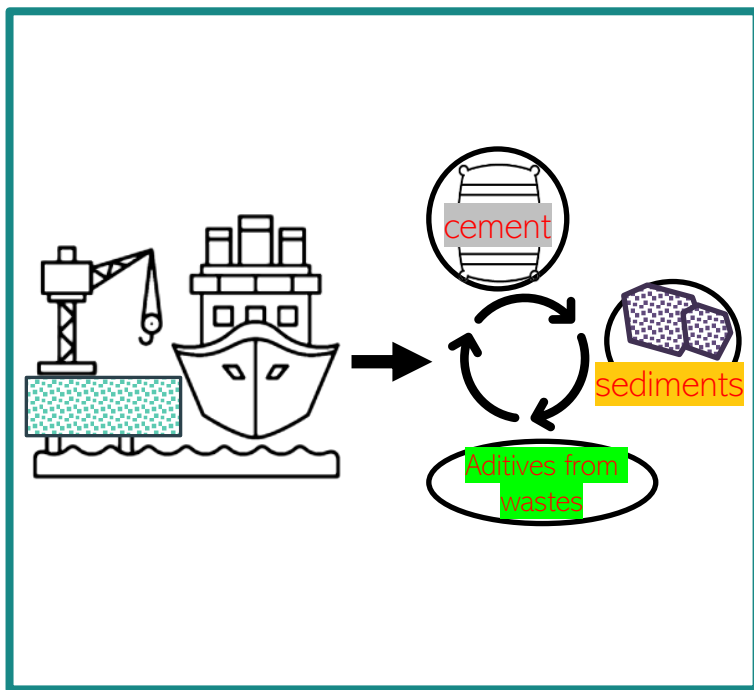


# GREENLIFE4SEAS OUTPUT

## SECOND PRODUCTION LINE: SEDIMENTS-CEMENTS- SHELL POWDER MIXTURES




# FROM THE LABORATORY TO THE INDUSTRIAL APPLICATIONS: ENGINEERING THE MIXTURES




## PRODUCTION

Industry




*Moby Mix plant*


## PROTOTYPES




Eco-briks



Paving Blocks

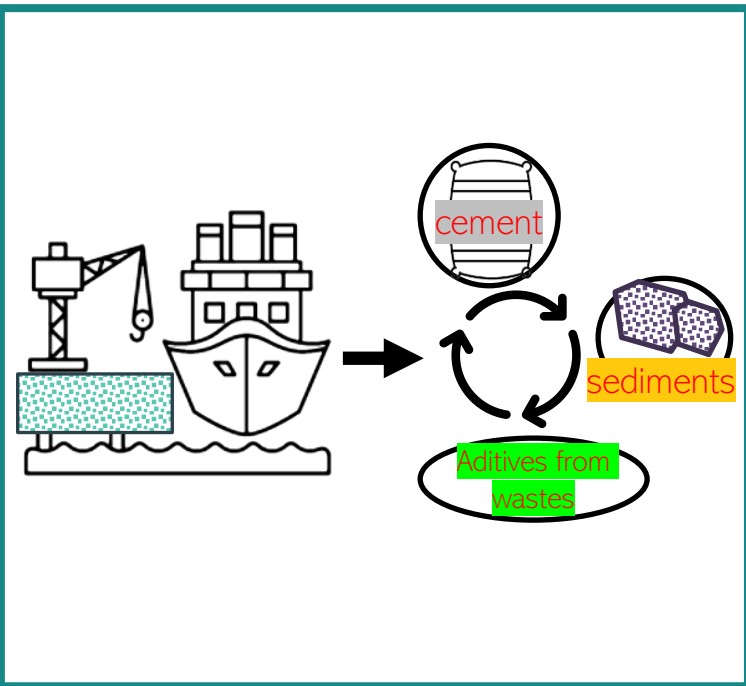


Physical models





Breakwater/quays

# FROM THE LABORATORY TO THE INDUSTRIAL APPLICATIONS: ENGINEERING THE SHELL POWDER

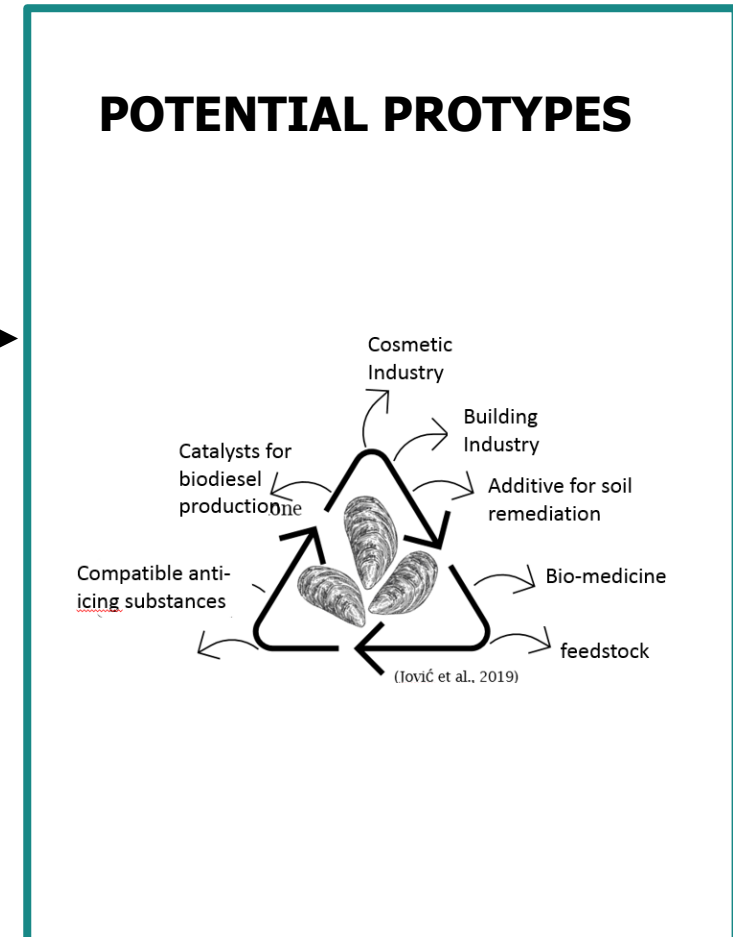


## PRODUCTION Industry



### Shells Treatment plant

The 'PRODUCTION Industry' section contains two photographs. The top one shows a laboratory or industrial production facility with various pieces of equipment. The bottom one shows a 'Shells Treatment plant' with a large industrial machine and a conveyor belt.



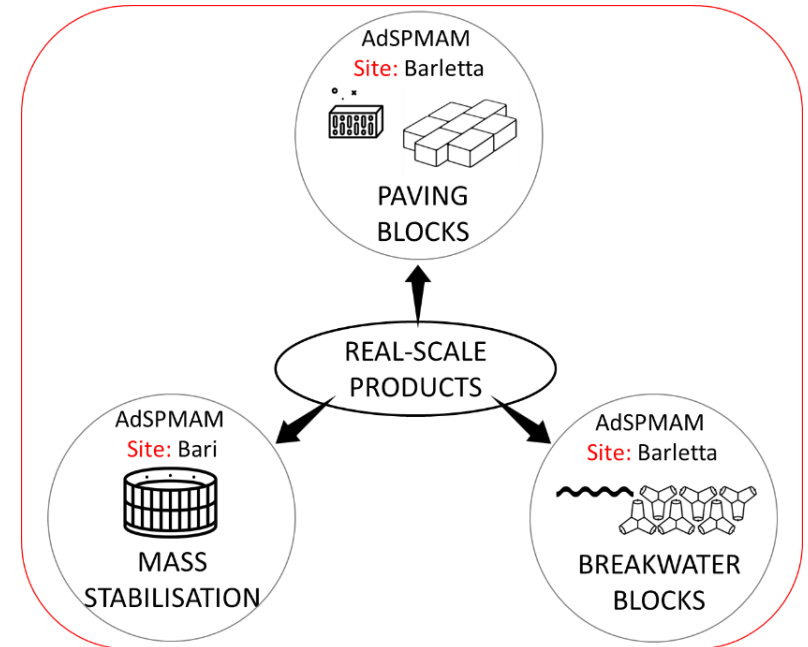
## FROM THE LABORATORY TO THE IN-SITU SCALE: BARI AND BARLETTA PORT (AdSPMAM)



Fig. 1.4.4 - Map of Barletta port (AdSPMAM) showing the sites for the realisation of real-scale products. Key: 1) possible site for sediment dredging and sampling; 2) sediment storage in tanks; 3) laying outdoor paving blocks; 4) installing breakwater revetment blocks.



Fig. 1.4.5 - Map of Bari port (AdSPMAM) showing the sites for the realisation of real-scale products. Key: 1) site for sediment dredging and sampling; 2) sediment storage in tanks; 3) installing physical models.



## FROM THE LABORATORY TO THE IN-SITU SCALE: LA SPEZIA (AdSPMLOr) and PIREO PORT



Fig. 2.5.2 - Replication 1. La Spezia port (AdSPMLOr). Key: (1) area for sediment dredging and sampling; (2) area for sediment storage in tanks; sites where installing (3) paving blocks and (4) physical models.

Fig. 2.5.3 - Replication 2. Piraeus port (PPA). Key: (1) area for sediment dredging and sampling; (2) area for sediment storage in tanks; sites where installing (3) paving blocks and (4) breakwaters.

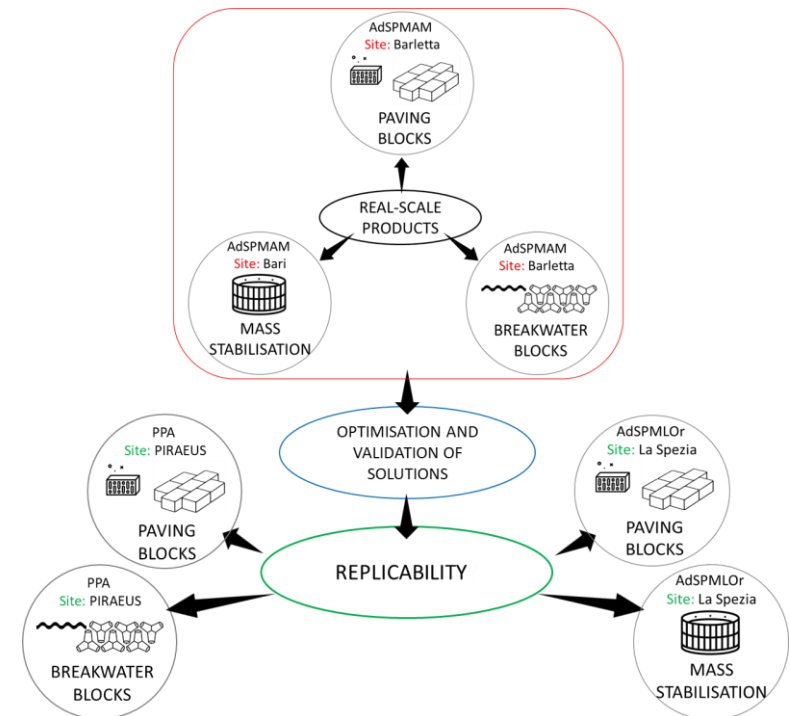






Fig. 4.1.2 - Ports of Port Network Authority of the Southern Adriatic Sea. In red the ports involved in GREENLIFE4SEAS



Fig. 4.1.3 - Ports of Port Network Authority of the Eastern Ligurian Sea. In red the Port involved by GREENLIFE4SEAS.

## MED-LONG TERM PERSPECTIVES

- Implement innovative, sustainable and economically viable technical solutions for the effective management of dredged sediments, even if contaminated, in the Port Management Authority.

# Thank you!



[matilda.mali@poliba.it](mailto:matilda.mali@poliba.it);



[rossella.petti@poliba.it](mailto:rossella.petti@poliba.it),



[claudia.vitone@poliba.it](mailto:claudia.vitone@poliba.it)