LOOP-Ports: network ed esperienze di economia circolare nei porti europei

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Simone Bandini, Luca Laghi ***CERTIMAC***
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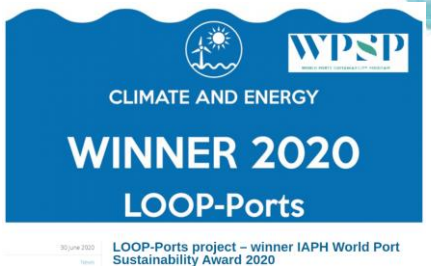
LOOP·Ports
Circular Economy Network of Ports

eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

Struttura della presentazione

- Cenni sul progetto LOOP-Ports



- Attuali pratiche di economia circolare (CE) per sedimenti di dragaggio in EU
- Prospettive future di riuso: ricerca e sviluppo
- Porto di Ravenna
- Link e news

LOOP-Ports
Circular Economy Network of Ports

LOOP-Ports project is funded by the EIT Climate-KIC initiative in the framework of the "SUSTAINABLE PRODUCTION SYSTEMS"

www.loop-ports.eu

LOOP-Ports aims to facilitate the transition to a more circular economy in ports through the creation of a Circular Economy Network in ports that will provide an innovation ecosystem around the port activity and stimulate circular economy initiatives in European ports

Biomass | Dredging | Construction materials | Metals | Water | Plastics | Gases | Mixed waste | Energy | Other

13 partners from 6 European Countries

France, Italy, Germany, Netherlands, Denmark, Spain

32 Port Authorities
4 Public Authorities
4 Port Associations
1 Environmental Management Organization
4 Industry Associations

+450 ports analysed
7 business models
3 training pilots
1 web tool
30 workshops

(All the port stakeholders are invited to participate in the network)

eit Climate-KIC

LOOP-Ports PARTNERSHIP

Ottobre 2018 – Dicembre 2020

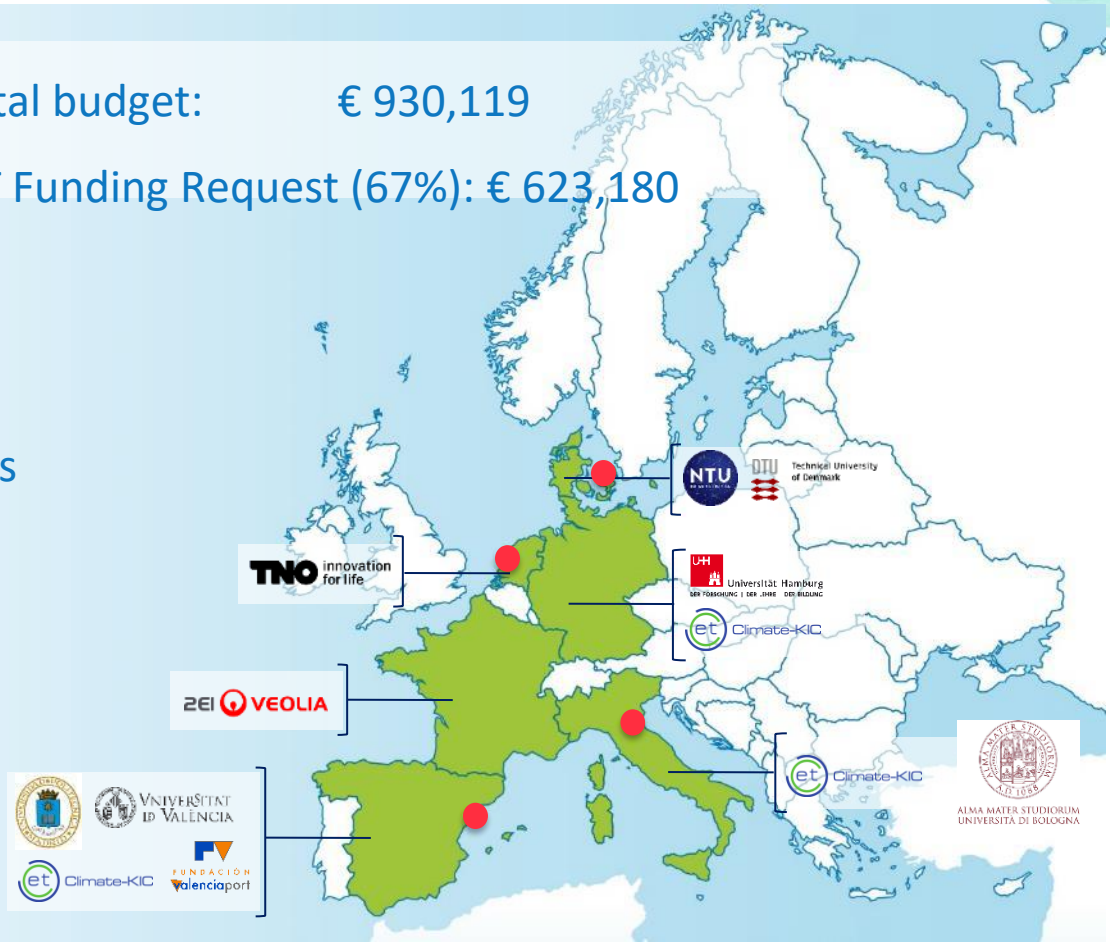
Total budget: € 930,119

EIT Funding Request (67%): € 623,180

13 partners

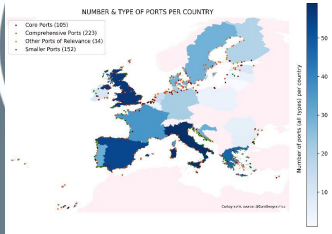
6 European Countries

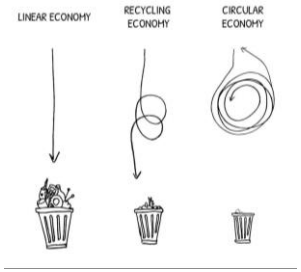
France
Italy
Germany
Netherlands
Denmark
Spain



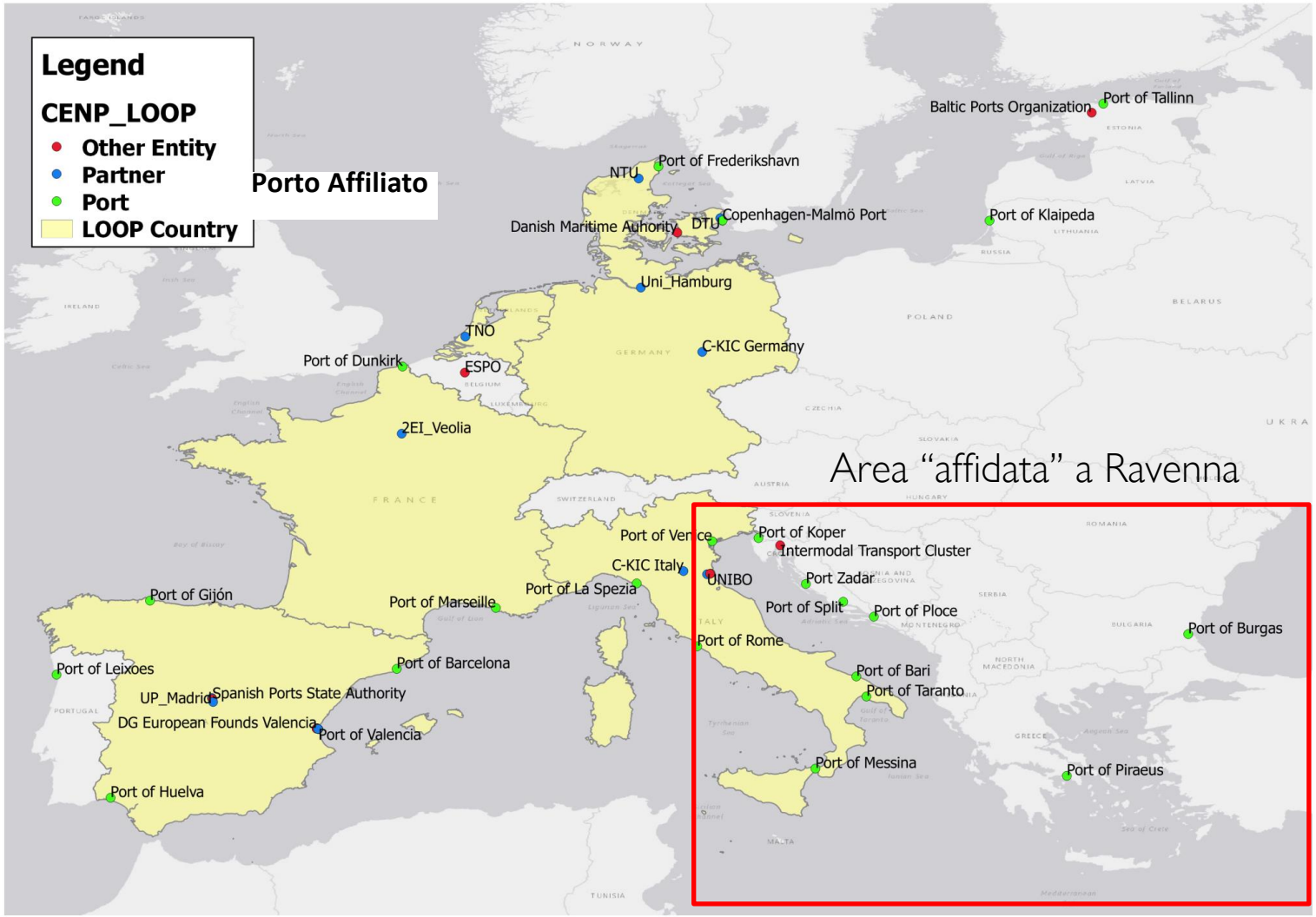
Project activities

WP1	WP2	WP3	WP4	WP5
MAPPATURA	DRIVER	FORMAZIONE	NETWORK	OUTREACH
Scoprire le attività di CE in corso e i porti europei in cui l'ambiente è più favorevole per l'economia circolare	Determinare e verificare i drivers di cambiamento per l'implementazione di iniziative di economia circolare	Formare key actors per aumentare strategicamente le conoscenze di CE (**IT**, **ES, DK**)	Creare un network di porti per interessati a iniziative di CE: base di conoscenze e contatti	Produrre strumenti per supportare il network di porti verso la transizione ad una CE



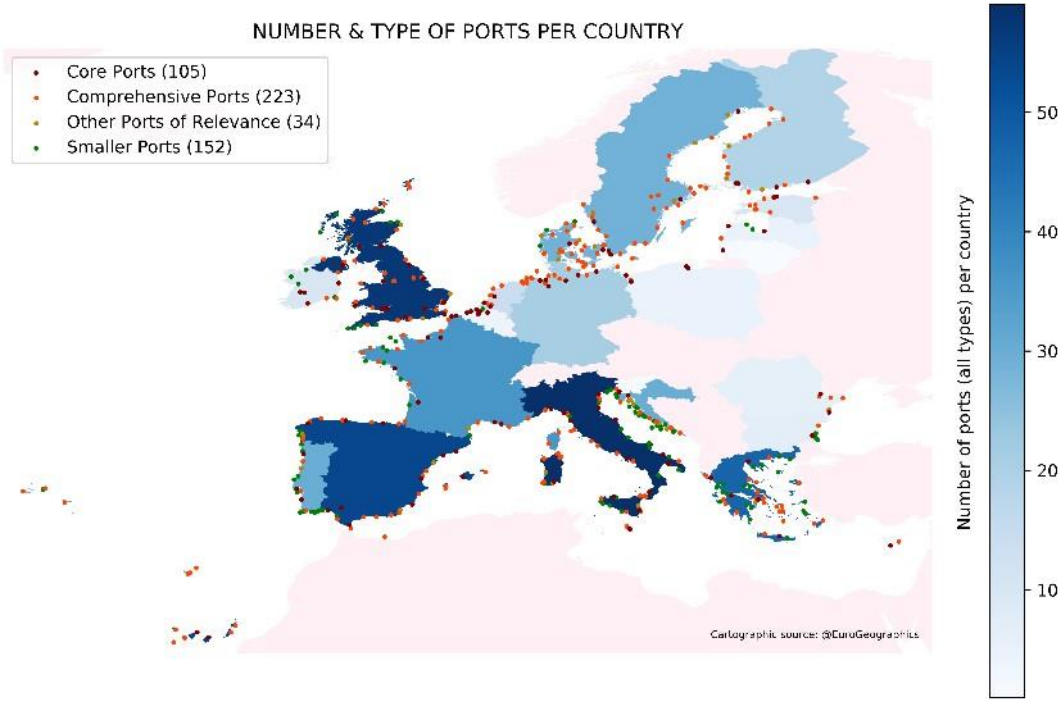


Affiliazione di altri Porti, Enti e Organizzazioni
mediante lettere d'interesse



LOOP·Ports
Circular Economy Network of Ports

Georeferenziazione e caratterizzazione



Total of 480 main European Ports:

- All ports considered by the European Commission as **Core** (105 ports) and **Comprehensive** (223 ports)

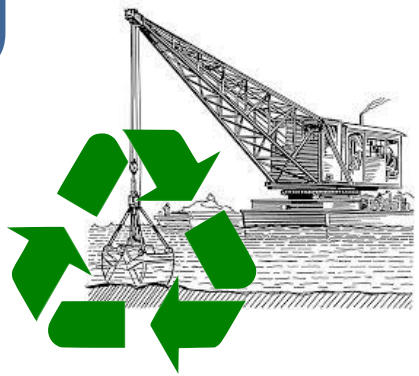
(As part of the TEN-T network, are the hubs for main goods and passengers traffics inside and outside Europe)

- **Other Ports of Relevance** (34 ports), handling more than 1,000,000 tons per year or with a traffic higher than 1,000,000 passengers per year

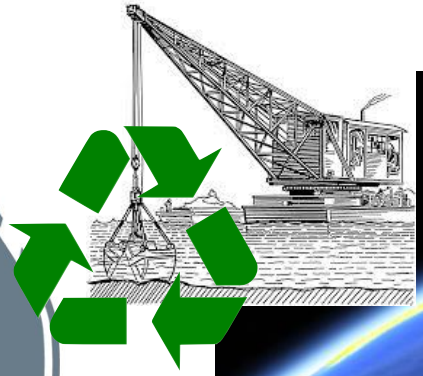
- **Main Fishing Ports** (390 ports, from which 152 have been classified as **Smaller Ports** for not being core, comprehensive or other of relevance), with more than 100 fishing vessels registered, according to the Fleet Register of the European Union

Climate-KIC is supported by the EIT, a body of the European Union

Pratiche CE in corso per sedimenti di dragaggio in EU

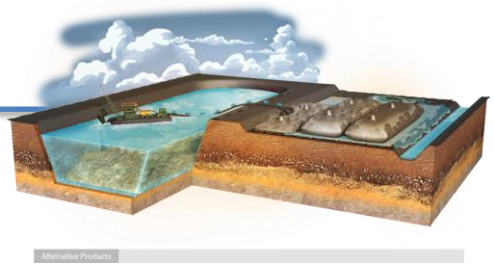


Ongoing CE activities in EU



Mappa delle attività di riuso e riciclo di sedimenti tra 500 porti analizzati in Europa (2019)

Ongoing CE activities in EU



7 Port land reclamation*

Piraeus, Oulu, Turku, Gijon, Bilbao, Dunkirk, Marseille Fos

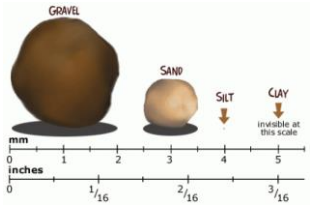
*sediments use to create emerged land in the port area

7 CE "mixed" activity (ongoing, pilot stage)

Koper, HAROPA Port (Havre-Rouen-Paris), Rijeka (Construction material pilot) Cagliari (SEDRIPORT, SEDITERRA), Olbia, Ancona, Ortona

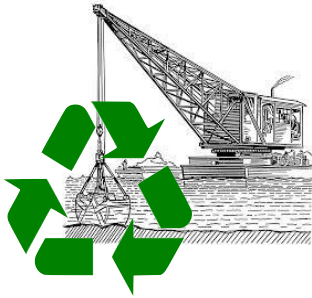
1 Operative backfilling of gravel pits

HAROPA Port



2 Operative grain size separation and CE valorisation

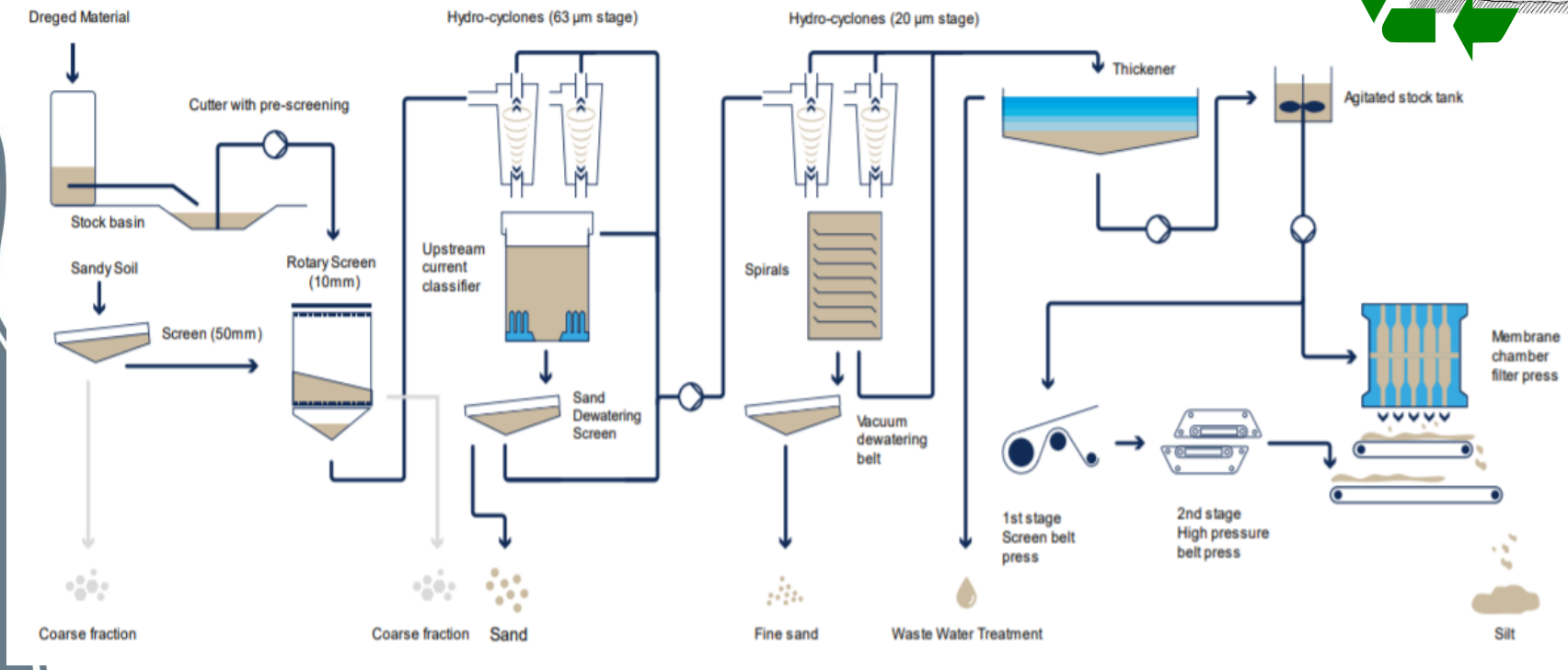
Hamburg, Anversa (AMORAS)



HPA Hamburg Port Authority

METHA Approach

https://www.hamburg-port-authority.de/en/themenseiten/metha/



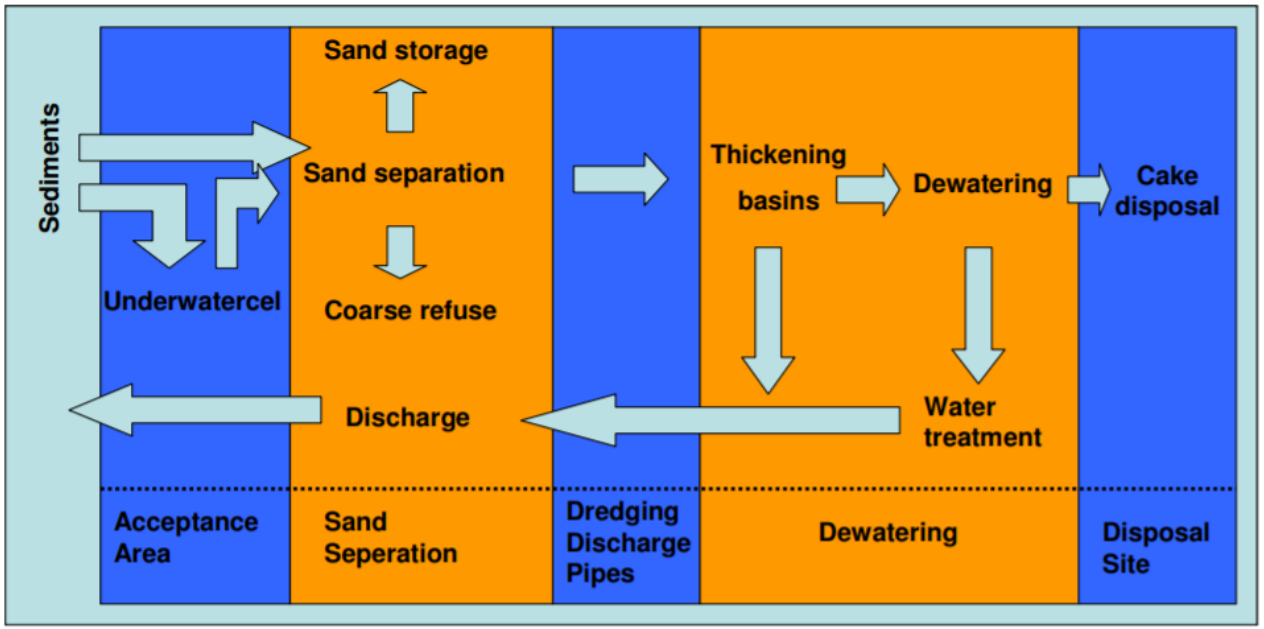
5 ANNI DI ESPERIENZA

→ **Matrici riutilizzabili**

https://sednet.org/wp-content/uploads/2019/05/H.-Roeper-and-H.-D.-Detzner-ppt.pdf

Port of Antwerp

AMORAS Approach

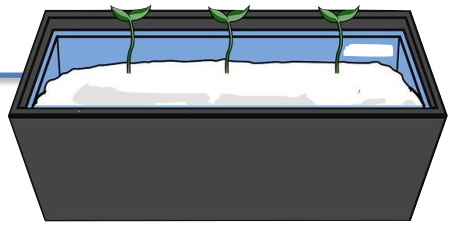


- Filler material
- Sealing layer in landfill
- Road construction
- Ceramic products

AMORAS – ANTWERP MECHANICAL DEWATERING, RECYCLING AND APPLICATION OF SEDIMENTS AN INNOVATIVE AND SUSTAINABLE SEDIMENT DISPOSAL SOLUTION FOR THE PORT OF ANTWERP –

Research and development

R&D



Soil use (co-composting, phytoremediation, techno-soils)

Cement, paving blocks and bricks from dredged sediments

Sediments mining: metals and nutrients

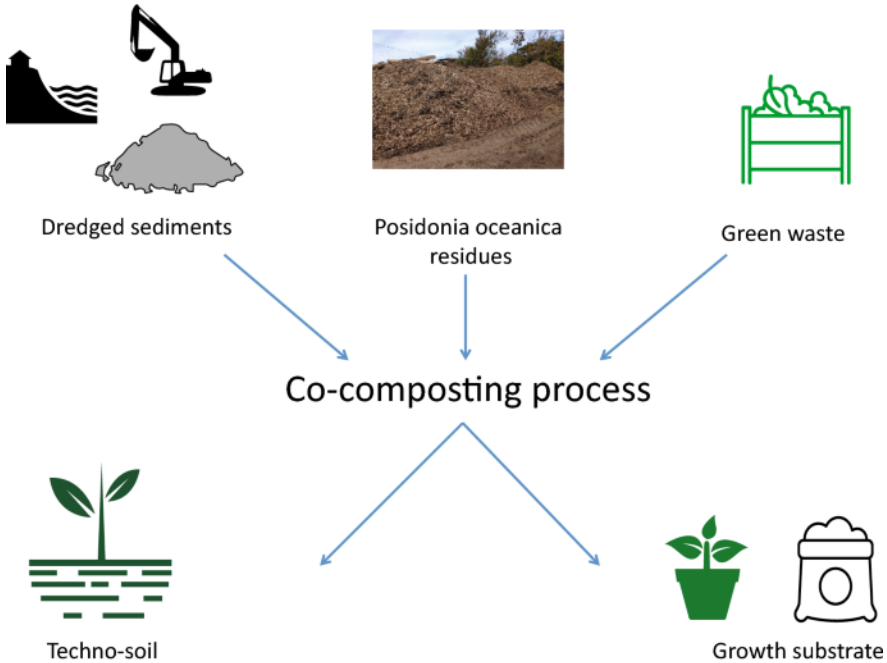
Use in other sites (off-ports), nature-based solutions, strategies and risks

https://www.deltares.nl/en/news/faster-reuse-dredged-sediment-mine-tailings-using-worms/

https://www.haropaports.com/fr/rouen/la-gestion-et-la-valorisation-des-sediments-de-dragage

Growing medium and agriculture

2 years of Phytoremediation before



Not yet admitted the presence of dredged sediments in compost substrates

Peruzzi, E., Macci, C., Doni, S., Zelari, L., & Masciandaro, G. (2020). Co-composting as a Management Strategy for Posidonia oceanica Residues and Dredged Sediments. *Waste and Biomass Valorization*, *11*(9), 4907-4919.

Growing medium and agriculture

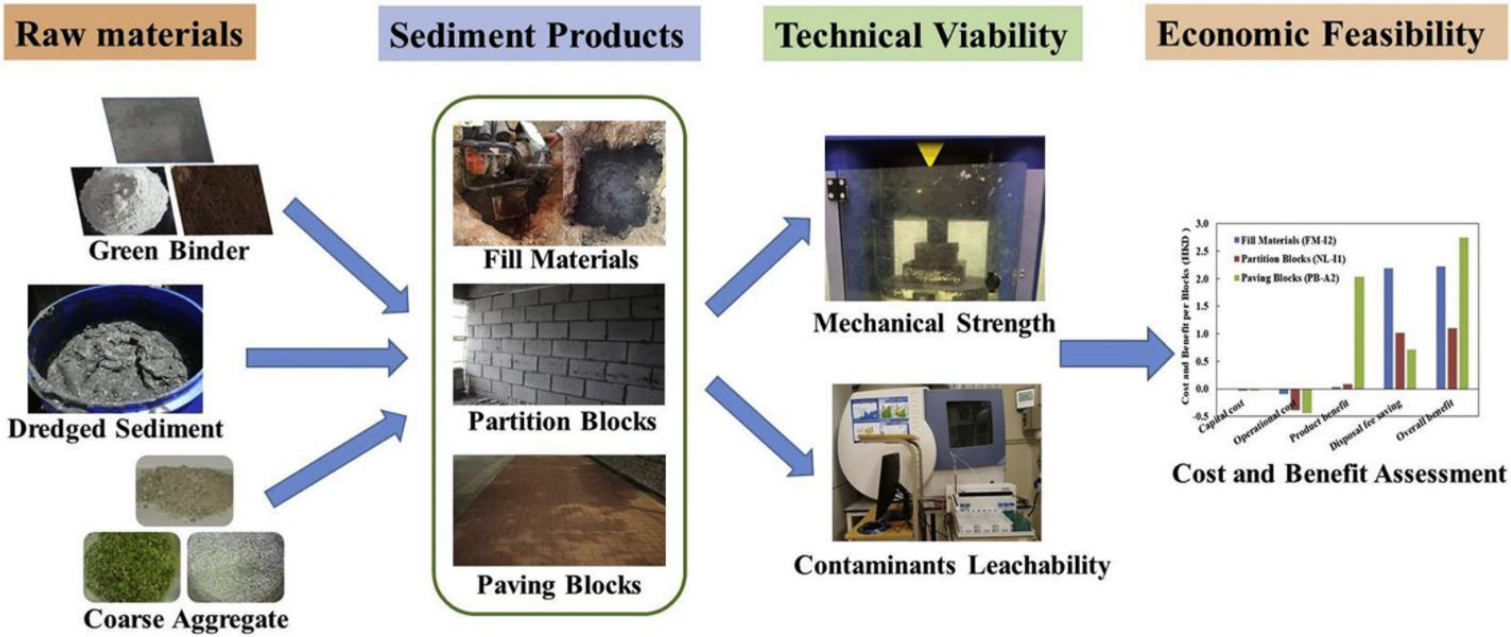
Tozzi, F., Del Bubba, M., Petrucci, W. A., Pecchioli, S., Macci, C., García, F. H., ... & Giordani, E. (2020). Use of a remediated dredged marine sediment as a substrate for food crop cultivation: Sediment characterization and assessment of fruit safety and quality **using strawberry** (Fragaria x ananassa Duch.) as model species of contamination transfer. *Chemosphere*, *238*, 124651.

Tozzi, F., Pecchioli, S., Renella, G., Melgarejo, P., Legua, P., Macci, C., ... & Lenzi, A. (2019). Remediated marine sediment as growing medium **for lettuce production**: assessment of agronomic performance and food safety in a pilot experiment. *Journal of the Science of Food and Agriculture*, *99*(13), 5624-5630.

Mattei, P., Gnesini, A., Gonnelli, C., Marraccini, C., Masciandaro, G., Macci, C., ... & Renella, G. (2018). Phytoremediated marine sediments as suitable peat-free **growing media** for production of red robin photinia (Photinia x fraseri). *Chemosphere*, *201*, 595-602.

Cement, paving blocks and bricks

MOST OF THE RECENT RESEARCH ACTIVITY IS PURSUING THIS SOLUTION

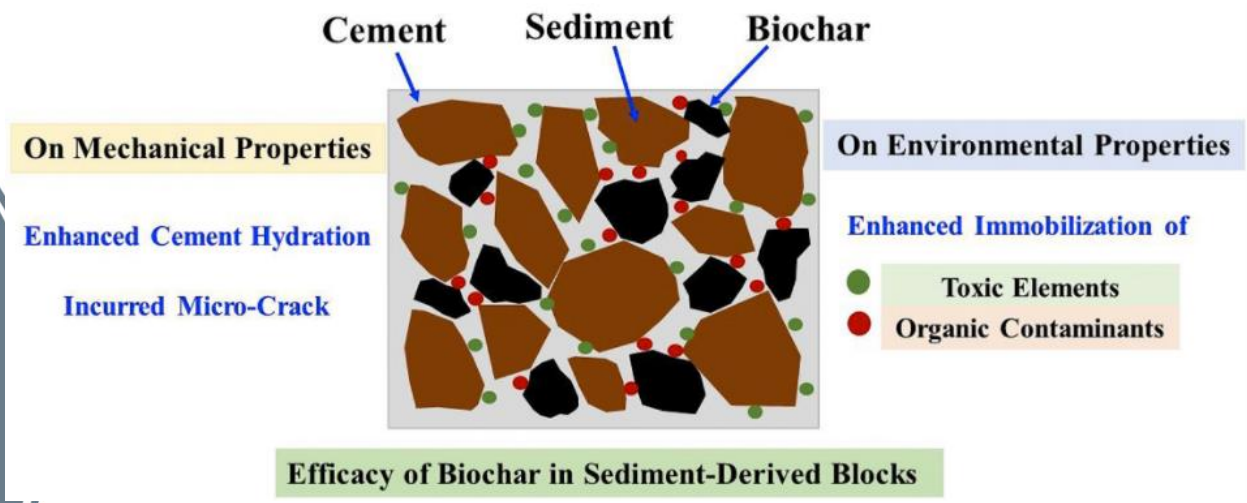


Wang, L., Chen, L., Tsang, D. C., Li, J. S., Baek, K., Hou, D., ... & Poon, C. S. (2018). Recycling dredged sediment into fill materials, partition blocks, and paving blocks: Technical and economic assessment. *Journal of Cleaner Production*, *199*, 69-76.

Cement, paving blocks and bricks

newer solutions: INORGANIC + ORGANIC fractions

Biochar incorporation had a beneficial effect on cement hydration reaction and **immobilised contaminants** and promoted environmental acceptability



Our research group is working on special biochar solutions

Wang, L., Chen, L., Tsang, D. C., Kua, H. W., Yang, J., Ok, Y. S., ... & Poon, C. S. (2019). The roles of biochar as green admixture for sediment-based construction products. *Cement and Concrete Composites*, *104*, 103348.

Metal Recovery

Concentration in Ravenna Sediments

Metal	Mean price (USD/tonne)		Max price (USD/tonne)
Ag	510,000		580,000
Co	39,000		94,000
Cu	6600	23 g/tonn	10,000
Fe	290		380
Mo	26,000		28,000
Ni	16,000	28 g/tonn	29,000
Pb	2000	17 g/tonn	2900
Sn	20,000		33,000
Zn	2200	37 g/tonn	3500

There is a monetary value in dredged materials, in terms of metal content, and that the materials can potentially be used for metal extraction. Metal extraction may also help to reduce the management costs.

Norén, A., Fedje, K. K., Strömvall, A. M., Rauch, S., & Andersson-Sköld, Y. (2020). Integrated assessment of management strategies for metal-contaminated dredged sediments–What are the best approaches for ports, marinas and waterways?. *Science of The Total Environment*, *716*, 135510.

A Ravenna intanto…..

certimac
certificazione materiali per costruzioni
ENEA CNR

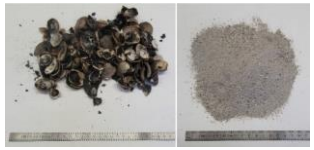
Integrazione in prodotti da costruzione per economia circolare

Esempi di scarti e possibili reimpieghi

SCARTO DA MITILICOLTURA

PROBLEMATICHE

-Componente organica
-Fortemente degradabile
-Contenuto di cloruri



Conchiglie calcinate prima e dopo macinazione

PROCEDURE

-Caratterizzazione
-Lavaggio
-Calcinazione
-Macinazione
-Vagliatura e selezione

POSSIBILI IMPIEGHI

SEDIMENTI MARINI

PROBLEMATICHE

-Differente composizione
-**Contenuto di cloruri**
-Contenuto di argilla
-Presenza di impurità e contaminanti
-Presenza di metalli pesanti
-Presenza di idrocarburi
-Presenza di batteri

PROCEDURE

-Caratterizzazione
-Trattamenti termici
-Trattamenti chimici
-Vagliatura e selezione

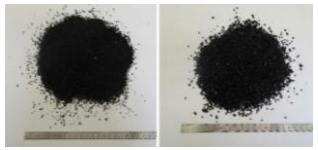
POSSIBILI IMPIEGHI

-Prodotti da costruzione
-Prodotti ceramici
-Produzione di cemento
-Impiego in malte e conglomerati
-Opere civili

PNEUMATICI ESAUSTI

PROBLEMATICHE

-Composizione variabile
-Presenza di impurità
-Presenza di oli
-Scarsa adesione

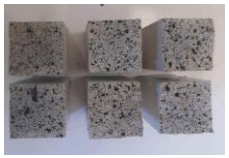


Pneumatici macinati

PROCEDURE

-Caratterizzazione
-Lavaggio
-Macinazione
-Vagliatura e selezione

POSSIBILI IMPIEGHI



Massetti sostenibili

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certificazione materiali per costruzioni
ENEA CNR

Integrazione in prodotti da costruzione per economia circolare

Esempi di scarti e possibili reimpieghi

SCORIA NERA DI FONDERIA

PROBLEMATICHE

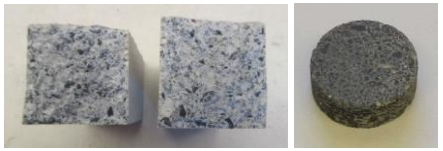
-Presenza di metalli pesanti
-Peso elevato
-Composizione variabile

Scorie frammentate

PROCEDURE

-Caratterizzazione
-Vagliatura e selezione

POSSIBILI IMPIEGHI



Malte ad elevata resistenza
Massetti ad alta conducibilità termica

COMPOSITI IN VETRORESINA

PROBLEMATICHE

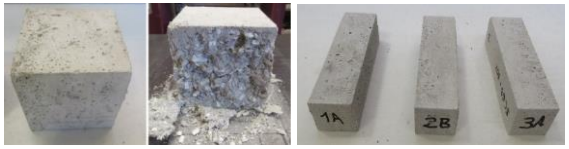
-Composizione variabile
-Resina + fibra
-Differenti pezzature
-Componente organica
-Volatilità

Diverse tipologie e pezzature

PROCEDURE

-Caratterizzazione
-Macinazione
-Vagliatura e selezione

POSSIBILI IMPIEGHI



Betoncini e calcestruzzi sostenibili

Altri scarti:

Vetro riciclato

Gusci d'uovo

Polverino ceramico

PAST

FUTURE

AUTORITA' DI SISTEMA PORTUALE
DEL MARE ADRIATICO CENTRO SETTENTRIONALE

Il porto di Ravenna

Progetti LIFE conclusi nel 2013

Caratterizzazione dei sedimenti e setacciatura

Caratterizzazione geochimica ed estrazione Silicio

PROGETTO HUB PORTUALE

PORTO DI RAVENNA

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Competenze locali

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

CARATTERIZZAZIONE GEOCHIMICA E FITOESTRAZIONE
https://bigea.unibo.it/it/ricerca/gruppi-di-ricerca/geochimica-dell-ambiente-superficiale
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ECOCOMPETIVILITA' E LCA
https://centri.unibo.it/cirsa/en/research/environmental-management-research-group-emrg

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certimac certificazione materiali per costruzioni ENEA CNR

Sviluppo di miscele innovative e sostenibili cemento e materie prime seconde
Ing. Simone Bandini s.bandini@certimac.it

RETE ALTA TECNOLOGIA EMILIA-ROMAGNA HIGH TECHNOLOGY NETWORK
TECNOPOLO RAVENNA

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RegioneEmilia-Romagna

Katia Ferrari
katia.ferrari@greentech.clust-er.it

LOOP·Ports Circular Economy Network of Ports

12 CONSUMO E PRODUZIONE RESPONSABILI
13 AGIRE PER IL CLIMA
11 CITTÀ E COMUNITÀ SOSTENIBILI

LINK ed EVENTI

The European project SMOCS (Sustainable Management of Contaminated Sediments):
"…seems to be a lack of an established forum for exchanging knowledge and experience on circularity of contaminated dredged sediments…"

SedNet

A Working Group dedicated on CE for dredged sediments

5th meeting WG Sediments in Circular Economy

WGCE5 will be held as a videoconference on 2020 November 5th, 9 to 16 hrs UK time (10 to 17 hrs for most others)

LINK ed EVENTI

19-20 November 2020

CORSO DI FORMAZIONE PER LE AUTORITÀ PORTUALI ITALIANE

"Circular economy in the maritime sector: how to close the loop and build capacity?"

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Ore 14.00 – 17.00

LINK FOR PARTICIPATION https://www.loop-ports.eu/2020/10/corso-di-formazione-per-le-autorita-portuali-italiane/

Info: tcampisi@cifla.it

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LINK ed EVENTI

Open for registration. Link: https://www.loop-ports.eu/2020/09/loop-ports-final-conference

Relevant ongoing projects

LIFE SURE

https://www.interreg2seas.eu/en/usar

1) demonstrating an innovative dredging technology that does not cause any resuspension, release and pose risks to environmental and human health and
2) developing treatment techniques that make it possible the beneficial use of dredged sediments and
3) developing cost-effective techniques for recovery of valuables such as nitrogen, phosphorus and different metals such as copper, zinc and lead.

Interreg 2 Seas Mers Zeeën USAR
European Regional Development Fund

https://www.interreg2seas.eu/en/usar

1) Inventory catalogue of possible uses of sediment as a resource and conditions, potential, limitations for use
2) Recycling strategies for partner territories based on local potential for uses of sediment
3) Pilot tests to validate new uses of sediment on different sites
4) "Operational Sediment Management System" – ICT tool for water managers to make business cases and management decisions for recycling of sediment

Relevant ongoing projects

SURICATES - Sediment Uses as Resources In Circular And Territorial EconomieS

Interreg North-West Europe SURICATES

https://www.nweurope.eu/projects/project-search/suricates-sediment-uses-as-resources-in-circular-and-territorial-economies/#tab-3

The project aim is to increase sediment reuse for erosion and flood protection. We will provide authorities, port and waterway managers and erosion experts with new large scale solutions for sediment reuse in NWE ports, waterways and coastlines.

Relevant closed projects

CEAMaS Civil Engineering Applications for Marine Sediments

http://ceamas.sediments.fr/

PRISMA

Promoting Integrated Sediment Management

https://www.broads-authority.gov.uk/looking-after/projects/prisma

setarms

Sustainable **E**nvironmental **T**reatment and **R**euse of **M**arine **S**ediment

https://www.setarms.org/en/

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