

Advances technological platforms for sea monitoring and forecasting: RAISE project

Giulia Dapuetto¹, Francesco Misurale², Beatrice Maddalena Scotto³, Marco Faimali⁴, Elisa Costa⁵, Chiara Gambardella⁶, Simone Marini⁷, Paolo Povero⁸, Antonio Novellino⁹

¹ ETT S.p.A., Via Albareto 21, 16153 Genoa, Italy / Department of Earth, Environment and Life Science, University of Genoa, Corso Europa 26, 16132 Genoa, Italy, giulia.dapuetto@grupposcai.it

² ETT S.p.A., Via Albareto 21, 16153 Genoa, Italy, francesco.misurale@grupposcai.it

³ ETT S.p.A., Via Albareto 21, 16153 Genoa, Italy / Department of Civil, Chemical and Environmental Engineering, University of Genoa, Via Montallegro 1, 16145 Genoa, Italy, beatrice.scotto@grupposcai.it

⁴ Institute of Anthropic Impacts and Sustainability in Marine Environment, National Research Council (IAS-CNR), Via De Marini 16, 16149 Genoa, Italy, marco.faimali@cnr.it

⁵ Institute of Anthropic Impacts and Sustainability in Marine Environment, National Research Council (IAS-CNR), Via De Marini 16, 16149 Genoa, Italy, elisa.costa@ias.cnr.it

⁶ Institute of Anthropic Impacts and Sustainability in Marine Environment, National Research Council (IAS-CNR), Via De Marini 16, 16149 Genoa, Italy, chiara.gambardella@ias.cnr.it

⁷ Institute of Marine Sciences, National Research Council (ISMAR-CNR), Forte Santa Teresa, 19032, La Spezia, Italy, simone.marini@sp.ismar.cnr.it

⁸ Department of Earth, Environment and Life Science, University of Genoa, Corso Europa 26, 16132 Genoa, Italy, povero@unige.it

⁹ ETT S.p.A., Via Albareto 21, 16153 Genoa, Italy, antonio.novellino@grupposcai.it

Abstract – *The Italian RAISE project is dedicated to the development of innovation ecosystems in AI and robotics in Liguria. Specifically, Spoke 3 focuses on sustainable environmental technologies that integrate cutting-edge technologies, cost-effective devices, AI, and contributions from citizen science. The cohesive ecosystems harmonise these efforts, using local testing to reinforce strengths, address weaknesses, and promote innovation guided by ethical design principles, with the aim of generating significant economic and social benefits.*

Keywords - *Cost-effective devices, Intelligent Marine observing systems, Citizen science, Data management, FAIR principle*

I. INTRODUCTION

RAISE (Robotics and Artificial Intelligence for Socio-economic Empowerment) is an Italian project founded by the Ministry of University and Research as part of the National Investment Recovery and Resilience Plan for the period 2022-2025. RAISE aims to create and strengthen innovation ecosystems based on the scientific and technological domains of artificial intelligence and robotics. The innovation ecosystems focus on areas of technological specialisation in line with the industrial and research vocations of the reference area, promoting and strengthening collaboration between the research system, the production system and local institutions. The Liguria Region (Italy) has been chosen as test market for innovation ecosystems because of its scientific, technological and economic characteristics. RAISE's ambition is to subsequently project at a national and international level.

RAISE is organised according to the Hub & Spoke governance system and is divided into five themes: Spoke 1) accessible and inclusive urban environments and services; Spoke 2) personal and remote healthcare; Spoke 3) environmental protection and care; Spoke 4) smart and sustainable ports; Spoke 5) knowledge and technologies transfer.

II. ENVIRONMENTAL CARING AND PROTECTION

RAISE Spoke 3 “Sustainable environmental caring and protection technologies, towards a Zero Emission Environment” aims to establish an innovation ecosystem to enhance strategies and methodologies for environmental monitoring, focusing on environmental scenarios representative for the Ligurian territory. The potential of robotics and AI are exploited to implement a process capable of modifying the current approach to environmental monitoring, which, although using high technology, suffers from the operational decoupling of monitoring systems. The main challenge of Spoke 3 is to change this paradigm thanks to the development of innovative robotic systems managed by AI capable of coupling and synergising timely punctual and widespread monitoring. This will increase the efficiency of data collection

Martech 2024.
Marine Technology Workshop
06, 07th June. Palma, Balearic Islnds, Spain

and their diffusion, duration and the energy savings of the monitoring missions and the quality and timing of the various forecasting systems (early warning systems) dedicated to the safeguarding and continuous monitoring of the aquatic, terrestrial and aerial sectors of our territory. In particular, there are vertical projects that address specific problems with the aim of developing specific products, by using cutting-edge technologies, cost-effective devices, AI and citizen science.

Within the Spoke 3 there is a specific project on the development of advanced technology platforms for sea monitoring and forecasting. The objective of this project is to develop of a new monitoring system that integrates and combines punctual monitoring with widespread monitoring. To achieve this, hardware and software modules are being developed that integrate traditional in situ measurements with adaptive monitoring managed by solutions based on artificial intelligence. The outcome of this project are 12 products for monitoring, forecasting and warning systems associated with noise, organic composites, gelatinous zooplankton, necton, satellite monitoring, adaptive sampling, waves, precipitation, etc. The products will be integrated to realise a distributed space/time monitoring system based on AI-guided robots with innovative sensors and adaptive monitoring strategies.

Another Spoke 3 project is the development of innovative technologically assisted citizen science systems. The project develops new scientifically validated workflows for managing and processing of data from participatory sources and actions: technologically assisted activities applied to environmental monitoring in order to collect valuable scientific data and maximise community involvement. The project includes the initial identification of: 1) the most relevant environmental variables that could be of scientific interest in the field of environmental protection and monitoring in relation to the UN SDGs; 2) the appropriate tools and sensors already used or applicable to citizen science campaigns for critical environmental parameters. Finally, the project plans to make use of the information collected in the field in order to define the stakeholders and plan/promote the citizen science campaign.

III. CONCLUSIONS

The innovation ecosystem that RAISE will enable will strengthen environmental monitoring strategies and methodologies. This will help to consolidate RAISE's position as a pioneering project in the European data management landscape. The data produced within RAISE will be managed by the backend infrastructure, currently under development. The data infrastructure will be fully compliant with European standards and the FAIR principle, improving its efficiency, accessibility and security. The interoperable environment will facilitate collaboration and data exchange with other platforms and services in the European context (e.g., EMODnet, Copernicus). The system will also facilitate the dissemination of results to the scientific community, industrial associations, and citizens. This work will provide an opportunity to present the first results of this implementation.