



## The relevance of large scale environmental research infrastructures from the point of view of Ethics: the case of EMSO

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EMSO (European Multidisciplinary Seafloor and Water Column Observatory) is a large-scale European Research Infrastructure (RI). It is a geographically distributed infrastructure composed of several deep-seafloor and water-column observatories, which will be deployed at key sites in European waters, spanning from the Arctic, through the Atlantic and Mediterranean, to the Black Sea, with the basic scientific objective of real-time, long-term monitoring of environmental processes related to the interaction between the geosphere, biosphere and hydrosphere.

EMSO is one of the environmental RIs on the ESFRI roadmap. The ESFRI Roadmap identifies new RIs of pan-European importance that correspond to the long term needs of European research communities.

EMSO will be the sub-sea segment of the EU's large-scale Earth Observation program, Copernicus (previously known as GMES - Global Monitoring for Environment and Security) and will significantly enhance the observational capabilities of European member states. An open data policy compliant with the recommendations being developed within the GEOSS initiative (Global Earth Observation System of Systems) will allow for shared use of the infrastructure and the exchange of scientific information and knowledge.

The processes that occur in the oceans have a direct impact on human societies, therefore it is crucial to improve our understanding of how they operate and interact. To encompass the breadth of these major processes, sustained and integrated observations are required that appreciate the interconnectedness of atmospheric, surface ocean, biological pump, deep-sea, and solid-Earth dynamics and that can address:

- natural and anthropogenic change;
- interactions between ecosystem services, biodiversity, biogeochemistry, physics, and climate;
- impacts of exploration and extraction of energy, minerals, and living resources;
- geo-hazard early warning capability for earthquakes, tsunamis, gas-hydrate release, and slope instability and failure;
- connecting scientific outcomes to stakeholders and policy makers, including to government decision-makers.

The development of a large research infrastructure initiatives like EMSO must continuously take into account wide-reaching environmental and socio-economic implications and objectives. For this reason, an Ethics Committee was established early in EMSO's initial Preparatory Phase with responsibility for overseeing the key ethical and social aspects of the project. These include:

- promoting inclusive science communication and data dissemination services to civil society according to Open Access principles;
- guaranteeing top quality scientific information and data as results of top quality research;
- promoting the increased adoption of eco-friendly, sustainable technologies through the dissemination of advanced scientific knowledge and best practices to the private sector and to policy makers;
- developing Education Strategies in cooperation with academia and industry aimed at informing and sensitizing the general public on the environmental and socio-economic implications and benefits of large research infrastructure initiatives such as EMSO;
- carrying out Excellent Science following strict criteria of research integrity, as expressed in the Montreal Statement (2013);
- promoting Geo-ethical awareness and innovation by spurring innovative approaches in the management of environmental aspects of large research projects;
- supporting technological Innovation by working closely in support of SMEs;

- providing a constant, qualified and authoritative one-stop-shopping Reference Point and Advisory for politicians and decision-makers.

The paper shows how Geoethics is an essential tool for guiding methodological and operational choices, and management of an European project with great impact on the environment and society.