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A contribution to the Common Euro-Mediterranean Research and Innovation Agenda (CRIA)

A document prepared by the CRIA Expert Group on behalf of the MoCo Presidency Group



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COMMON EU-MPC RESEARCH AND INNOVATION AGENDA

LOGICAL FRAME AND CROSS-CUTTING ISSUES

There is increasing evidence that the Mediterranean region as a whole is undergoing rapid social, demographic, economic, environmental and political changes, transients to long lasting changes that represent formidable challenges in the years to come. Drivers of these changes results both from natural and man-induced pressures which may have implications on the sustainability of the social models and economic development.

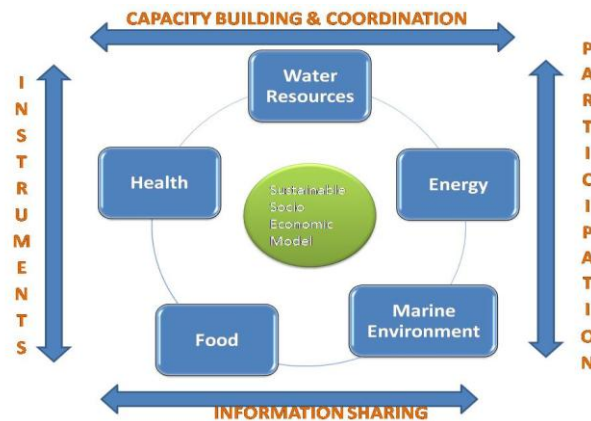
The Final Report of the Euro-Mediterranean Barcelona Conference on Research and Innovation, held in Barcelona in April 2012, highlights two aspects that cannot be emphasized enough:

- *Research and innovation (R&I) offer significant opportunities for Mediterranean countries to develop and exploit their assets for the benefit of their economies and of their peoples, especially as drivers of economic development. Increased knowledge and R&I are keys to the successful deployment of specific solutions which, in turn, may deliver economic benefits on a wider scale.*
- *The successful implementation of this ambitious strategy and the delivery of sustainable results depend on coordinated action and streamlined activities aimed at building a common innovation- and research-based culture.*

The necessary coordinated effort in R&I cannot deal with the entire set of challenges faced by the region, so a critical analysis of the importance of some key challenges and their reliability to the previous and running common regional mobilization of research resources, suggest a limited number of sectors, highly interconnected in their goals, where a common Research Agenda can be proposed as a reference frame to align different sources of financing and decision taking levels.

The five challenges proposed as a federative reference are: water resources, renewable energy, food, marine environment and health. All of them are clearly interconnected and targeting the sustainability of our social and economic models and the wellbeing of our populations. Water and energy are the basic resources to guarantee the availability of food, jobs creation and urban development. On the other hand the marine resources are common assets of all Mediterranean riparian countries and a driver for further development, while a good status of the population health and welfare is determined among other key issues by high quality food, safe water and low contamination. (See Fig.)

These social and economic challenges are also challenges for the scientific community which needs a reliable structural frame of coordination and participation, a reliable governance and financing system, common design and monitoring, and systems of exploitation of the benefits of research.



The Common Research Agenda should be based on a series of shared principles and objectives:

- Being oriented to provide scientific and technological support to address the societal challenges.
- Being informed of the holistic approach covering the whole societal challenges, in order to obtain a maximum benefit of synergetic interactions all along the innovation chain.
- Being fully co-owned and co-designed by all the parties engaged in its development and ruled through a light, efficiency oriented governance.
- Being a frame where different initiatives: national, bilateral or international, could find a source of inspiration and of benchmark for their objectives.
- Being a driver for innovation, economic development and welfare, following the sustainability principle.
- Addressing preventive and predictive actions in order to be ahead of rising risks.
- Engaging stakeholders coming from different horizons, from social organizations to industrialist interested in the exploitation of the knowledge generated in cooperative actions, and being customized, personalized, to the particular cultural, economic and social circumstances of all participating parties.
- Dealing with the high-tech (“...omics”, genomic, proteomic....) divide between the countries in order to facilitate real cooperation in equal foot.
- Favoring joint investments in human capital, research infrastructures and demonstrators as well as in innovation-based joint-ventures.

The mechanism to reach these objectives and define a way forward for actions should be:

- Be supported by participatory Forums where all interested parties could express their concerns and demands, federate their capacities and mark their common targets and priorities.

- Put innovation in the front line of the actions, as only innovative approaches could deal with the rising challenges.
- Well-structured and reactive Interconnectedness of all kind of stakeholders, especially legislators, administrators of public services, SMEs and social organizations.
- Use the existing running cooperation projects to mobilize the scientific community on the issues raised by CRIA.
- Present the challenges in a mutually coherent way, and establishing a clear understanding of the necessity of addressing their objective in a holistic way.
- Launch pilot experiences of inter-sectorial and inter-challenges character, including addressing its social dimension, as a mobilizing bottom-up experiment involving young people and beneficiary populations.

The implementation of the CRIA needs a clear engagement of financing institutions, national, regional or international, which must be informed of the main arguments to support this common endeavor, particularly the innovation component associated to the methodology of addressing the challenges and the expected benefits of addressing the challenges in terms of evolution of the social and economic frame and new jobs creation.

As mentioned above, the CRIA must be an inspiring instrument able to federate resources and shared objectives in different time horizons. However, a tool-box of instruments must be identified to facilitate the federation of wills and resources. Certainly, the inspiring driver for this federation of Instruments must be the Euro-Mediterranean Innovation and Research Space (EMIES), where all countries should find the frame for the cooperation based in the mutual benefit. Actions financed by regional, national, bi-national, and international institutions should find a place to support those initiatives inscribed in their own actions plans. Further Euro-Med initiatives such as such as the setting of the structure associated to the application of Art. 185 of the EU Treaty could also use CRIA as an inspiring background source. A coherent interaction between different European Instruments, such as the ENPI, the Horizon 2020 Program or the regional Policy, sectoral innovative strategies (SET Plan, e.g.) as well as the Mediterranean Regional Cooperation Instruments is a compulsory argument for the success of the CRIA.

The CRIA document is based in the synthesis effort made by a group of expert (See Annex) of relevant documents elaborated in the frame of EU- and MPC experts debates and dialogue, notably the Final Report of the Euro-Mediterranean Barcelona Conference on Research and Innovation, held in Barcelona the 1-2 April 2012, the Conclusions and Recommendations of this Barcelona Conference, the Synthesis report of the Thematic Workshops of the INCO.Net MIRA Project organized to identify common Euro-Mediterranean research priorities (see <http://www.miraproject.eu>), and the Final Report of the “EuroMed 2030: Long term challenges for the Mediterranean are” prepared by a Eu and MPC group of experts on behalf of the Directorate General for Research and Innovation. Social Sciences and Humanities Directorate, EU 2011, EUR 24740, among other documents relevant to the challenged analyzed.

Fighting diseases

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1. IMPORTANCE OF THE CHALLENGE (including driving factors)

Three priority areas have been identified: **rare** diseases, non communicable diseases and infectious diseases in changing environment. These diseases have no geographic boundaries and figures are increasing, also because of demographic changes. There is a need for prevention, early and appropriate diagnosis and treatment: global R&I partnership would help better address these challenges.

Rare Diseases (RD) are a serious public health problem and represents a unique challenge in many Countries, in particular in Southern Mediterranean because of the high rate of consanguinity; RD are characterized by a low prevalence (in EU < 5:10000), are numerous (> 6-7.000), including many congenital anomalies, most of them are life-threatening or chronically debilitating. About 80% of RD has genetic origin, whereas most of the remaining are multifactorial. Due to their great number, RD can overall affect a considerable number of citizens (e.g. in Europe more than 30 million).

Non-communicable diseases (NCD): the global burden of NCD continues to grow. Heart disease, stroke, cancer, diabetes, and chronic lung disease are the world's biggest killers, causing an estimated 35 million deaths yearly -60% of all deaths globally- with 80% in low- and middle income countries. Thus, rather than being an issue for "rich countries", NCDs pose a major challenge for development. NCDs are paradigm for multifactorial diseases: prevention and treatment must cope with factors including genetic predisposition, diet, living environment, lifestyle and community factors.

Emerging and re-emerging infectious diseases (EID) are a model for health issues in a changing environment. EID are linked to modification trends related to climate, pest and wildlife ecology, animal husbandry, social structure as well as travelling of people, foods and livestock. Trends of infectious diseases (parasitic, bacterial and viral), including zoonoses, vector-borne, and food-borne outbreaks and antibiotic-resistance are currently evaluated by EU bodies such as the EU CDC and the EFSA. More than 30 new diseases have been identified in the past 30 years. EID definitely call for the "one health" paradigm, integrating an expertise network from ecology, biology, agriculture, veterinary medicine and human medicine. Efficacy and safety of new-generation vaccines must be assessed together with diagnostic tests differentiating infected from vaccinated subjects, especially in areas with close to reach disease eradication.



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Overall, to translate research into primary and secondary prevention and treatment is, indeed, a major challenge shared by all three areas.

During the last ten years achievements did concern the areas of genomics, system biology, biomedical imaging, pharmaco/toxicology and pharmaco/toxicogenomics, stem cell and organ therapy. These achievements are contributing to a better understanding of human biology, to systematic identification of known or new pathogens and non-infectious risk factors, and to improve human health. This is conducting a new era of 4P medicine: preventive, predictive, personalized and participative. MPC countries are experiencing a sort of “omics divide” due to a lack of adequate infrastructures and expertise; A strong effort still needs to be achieved in order to help MPC research into the “omics” era and to target it on priority issues for MPC countries. Thus, regional strategies must be implemented. A science-based, multi-disciplinary, design of such strategies necessitates the availability of quantitative and predictive epidemiological models as a building block for *ex ante* assessment of possible strategies. A carefully-tuned, cost-effective support of system biology can greatly strengthen the impact of epidemiological approaches on *ad hoc* topics. Moreover, risk-perception studies are needed to assess how disease surveillance and control stakeholders, including citizens, may react to prevention programs, and thus improve the efficiency of these programs. Accordingly, the implication of social sciences is essential for prevention plans in the three priority areas.

2. STATE of PLAY: Overview of relevant programmes/projects/actions.

Bilateral cooperation between EU MS and MPCs as well as some multilateral cooperation programmes have contributed to health research development in Southern Mediterranean.

However, Euro-Mediterranean cooperation on RD and NCD has been relatively limited till now. Specific international cooperation activities (SICA) for diabetes and obesity in migrant populations are starting in 2012 and impact will be evaluated in the next few years.

Communicable diseases, on the other hand, are a consolidated topic for co-operation of EU with other, less affluent world areas: there is a long history of EU-MPC collaboration as shown by initiatives funded by DG-SANCO/EAH, EuropeAid and RTD FP7 programs.

3. PRIORITY OBJECTIVES

3.1 Specific objectives: the variety of genetic, environmental, dietary, social, lifestyle and healthcare determinants of health across the Euro-Med region offers a unique opportunity for research and innovation to identify origins of diseases and new strategies of preventing them, reducing their impact and severity, as well of protecting and promoting health and well-being. At a time when some Mediterranean countries are building new social and political environments **two types of overarching objectives should be proposed for Euro-Med cooperation:** *a) to interpret health as a right*: even if this right may not be achieved immediately, it should not be put into question as an objective; *b) to define the role of*



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research in the field of health, since innovation is pivotal in the provision of know-how, equipment, technologies, procedures and policies. Euro-Med collaboration in health research should be fostered primarily where it is necessary to address the scientific challenges, or where joining efforts provides the needed resources.

3.2 Main intervention strategy

The main intervention strategy will require the creation of three governing structures:

- A policy governance structure, to take overall decision power of the collaborating strategy, including funding.
- A scientific governance structure, to define the scientific agenda, proposing actions and providing scientific evaluation of the overall strategy and of each action.
- A representation of societal stakeholders of the results of the research performed under this strategy.

3.3 Specific actions and instruments:

Health as a right: from the research standpoint, this first objective means making research that enables advancing in the provision of health care for all, especially for “vulnerable populations” and making research on the consequences of any other policy field on health.

Role of research in health: for the second objective, it is interesting to take into account that essential research capacities are at the same time essential public health capacities. Therefore, *capacity building and training* should be prioritized accordingly, so that research policy and health policy are intrinsically associated at least in a core space.

For Euro-Med collaboration, a platform should be set and a forum created to facilitate scientific personal and institutional interaction, training activities, diversified collaboration mutual assistance and institutional twinning.

Food

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IMPORTANCE OF THE CHALLENGE

Food is a strategic issue for the prosperity and for the daily well-being of the population, and all forms of sustainable agriculture are necessary to meet the challenge of global food security. The requirements of food security and safety in the Mediterranean must be seen in a context of multiple challenges (geographical constraints including water and land scarcity, demographic growth and urbanization, climatic changes and environmental threats) and calls for more multilateral cooperation and regional solidarity among Mediterranean countries to face these challenges, as has been analyzed in the numerous studies. In the Southern Mediterranean, agriculture is one of the major socio-economic driving forces contributing more than 50% of the gross income of the region, and is the basic means for ensuring adequate food both in terms of quality and quantity. Food security in the Mediterranean is also a political concern, no longer a question of self-sufficiency but of access for populations to food, ensured through sustainable production and/or sustainable trade. In the northern Mediterranean Countries, the local production contributes largely to supplies, whereas in the southern and eastern Mediterranean countries, with the exception of Turkey, supplies are provided to a very large extent through trade and even in some cases through food aid. This is no longer sustainable and even when adequate supplies of food are available, this does not necessarily guarantee that every individual has access to food. That access depends mainly on each individual's economic and social capacity (CIHEAM, 2010). In response to a set of global socio-economic and environmental pressures (like population growth, depletion of natural resources and especially climate change), there is an increased demand for high quality food products obtained in an ecologically sustainable way, that assume a widespread view's change at individual, institutional and large-scale levels. To meet the consumers demand, the Knowledge-Based Bio-Economy (KBBE) has been defined as "transforming life sciences knowledge into new, sustainable, eco-efficient and competitive products" (EU, 2007). In a time of increased global competition, it is urgent that Europe and southern Mediterranean countries pool their resources of talent and knowledge for a better and shared future. Consequently, the bio-economy (BE) research and innovation for a smart and green growth has been identified as one of the targets in the European strategy for 2020 (EU, 2012).

STATE OF PLAY

Recent and ongoing Euro-Mediterranean cooperation aims at capturing all the innovative potential of the whole agro-food sector but also other agriculture and farm management research capacities as well as the innovative potential of SMEs, while maintaining and developing the agro-food and farming system to create transparent relationships between producers and consumers. Against this background, the future of the Mediterranean region hinges on the following essential challenges to met a more favourable food security and safety situation: *i)* sustainability component in both the ecological and the nutritional sense; *ii)* reconciliation between modernity and tradition in a region with a strong cultural identity; *iii)* local markets must be first addresses before devoting effort to the international market; *iv)* ensuring coherence between sector food safety and health policies (CIHEAM, 2008). In this regards, the BE emphasizes greater resource-efficiency, largely within an industrial perspective on global economic competitiveness, benefiting



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capital-intensive industries at higher levels of the value chain, enhancing farmers not only as commodity producers but also providers of quality food and managers of the ecosystem, and recognizing the potential of SMEs to contribute to innovation. The food sector is also an opportunity for creating more jobs and enhancing innovation.

Despite the achievements of BE in the agro-food sector, significant challenges remain to be solved for the next decades. Several Mediterranean Countries are faced with some common problems, including e.g. continued reliance on traditional technological schemes (dominance by small and medium family enterprises, with limited investment capabilities), limited local markets, weak adoption of hygienic and quality schemes, lack of appropriate facilities and laboratory equipment to carry out the required analyses, lack of appropriate programs concerning prospects for innovative processes and novel products, poor coordination between industry and teaching/research institutions, limited land and water resources for producing large food quantities, relatively high costs of required pesticides, herbicides, and fertilizers.

Mutual benefits will emerge from an increased cooperation between north and south Mediterranean, between academia and industry, between national and European initiatives, between European Programmes and activities such as Structural Funds, Horizon 2020, EU neighboring policy and the European Investment Bank. Spin-offs and technology driven SMEs are key for innovation and knowledge development in the food sector, and investing in competitive research is the only way for these enterprises to survive. One of the weaknesses of the many food SMEs is that many of them do not have the in-house technical skills to take up the results of innovation. Supporting technology transfer or stimulating SMEs to participate in “open innovation” Programmes could therefore be a way to overcome this problem.

For sustainable outputs, a more targeted research and innovation should be undertaken to cover the entire value chain via public-private partnerships. On the other hand, simulation of market demand should be developed through defined standards coupled with economic incentives and controlled by sustainability assessments based on all three pillars of sustainability: environmental, social and economic (Albrecht *et al.*, 2010).

PRIORITY OBJECTIVES

In the last ten years, several efforts have been done to identify priority objectives in the food sector, particularly in the research area. The workshop on Food and Agriculture organized in 2009 in the framework of MIRA project (FP7-INCO-CT-2007), conveying scientist and stakeholders from all the euro-Mediterranean Countries, identified several common research priorities (Annex 1). They can be summarized as follow:

- Measures to adapt the crop chains of Mediterranean products (i.e. olive, citrus) to the effect of climate change;
- Reducing post-harvest losses and contaminations;
- Improvement of access to nutritious and safe food;
- Low environmental impact for the quality improvement of Mediterranean fruits (dates, citrus, olive etc.) and vegetables productions;
- Competitiveness of agricultural products from non EU Med. countries to global market;
- Networking for data and technology exchange in the Med. Area;
- Governance and institutional aspects for sustainable development.

Other priorities has been discussed at the CIHEAM International Seminar on “*The sustainability of the food systems in the Mediterranean Area*”, held in Malta on 25-26 September 2012, regarding the sustainability of the Mediterranean diet, and food more in general:



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- Malnutrition and erosion of the Mediterranean diet heritage;
- Population growth, urbanization, globalization, socio-cultural changes and food prices;
- Water scarcity, desertification, soil erosion, and climate change;
- Biodiversity loss;
- Food losses and waste.

To achieve the priority objectives above describe, the following action are recommended:

- Competitive research to develop technology and enhance innovation in the all food chain.
- Pilot demonstrations and real case studies to substantiate competitive research in the food sector in the region (ex: water productivity shell-life of product, competitive organic farming)
- Linking research, technology driven enterprising and consumers to enhance competitive research and social innovation in the food sector.
- Increasing the sustainability of food production technology and their adaptation to different socio-economic contexts.
- Activities in support of institutional strengthening and participatory management.
- Supporting the creation of research and financial partnerships/clusters among researchers, SMEs, investors, institutions.
- Strengthening trilateral financial synergies EU-MS-MPCs to support research and innovation in the food sector.

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MANAGEMENT OF MARINE ENVIRONMENT AND RESOURCES

Authors: Evangelos Papathanassiou and Rafael Rodríguez-Clemente

IMPORTANCE OF THE CHALLENGE (including driving factors)

There is increasing evidence that the Mediterranean environment is undergoing transient and/or long lasting changes. At basin scale, climatic variability impacts the physical dynamics and hydrological structure, notably the warming of surface marine waters. Mediterranean Sea is one of the richest European regional seas in terms of species diversity.

Today in Mediterranean 82 million people live in coastal cities, which will reach the 150-170 million by 2025 with sharp increase in the southern countries (Blue Plan/UNEP-MAP). In addition, over 100 million tourists visit the Mediterranean coasts during high summer season and this figure is likely to double or triple by 2025, being a strong seasonal pressure related to eutrophication. UNEP estimated that 650 million tons of sewage, 129,000 tons of mineral oil, 60,000 tons of mercury, 3,800 tons of lead and 36,000 tons of phosphates are dumped into the Mediterranean each year. In addition about 70% of the urban wastewater is discharged untreated. The sea is a major transportation route with more than 100 large tankers sailing at any time posing risk from accidental spills, illegal bunkering and tank cleaning practices. Pollution from agriculture also reaches the Mediterranean through its major river basins draining in the Mediterranean. Significant anthropogenic impact is expected in the Eastern Mediterranean from the expected exploration and exploitation of hydrocarbons in the next years. Moreover, many marine ecosystems are currently threatened by fishing activities, such as bottom trawling, gillnets and demersal and pelagic long-lines.

UNEP-MAP's Integrated Assessment of the Mediterranean Ecosystem Report (2012) identified the major anthropogenic pressures and impacts, causing degradation of the ecosystem and include: coastal development and sprawl; overfishing and destructive fishing; contamination of sediment and biota by pollution; nutrient over-enrichment; disturbance and pollution caused by maritime industries; desalination plants; invasive species spread; degradation of transitional and estuarine areas.

A well-structured Action Plan will certainly harmonize the Institutional regularity Frameworks with coherent national policies and strategies in the Mediterranean countries. In addition, a sound monitoring and control development will, provide the basis for innovative Mediterranean-wide industrial development based on shared assets, such as tourism, maritime transport, fisheries and mariculture, marine renewable energy, biotechnology and deep sea hydrocarbon exploration and exploitation, where public-private partnerships could be fully operative. New research and new partnership between public and private sectors is needed to make exploitations of these goods and services sustainable, more efficient and leading to economic growth. The sharing of continental and marine water resources and contamination data and the opening of the national data base by all or most of the Mediterranean countries is a compulsory step in order to establish a base-line description of the natural system. A common monitoring system for the Mediterranean Sea is,

therefore, an essential prerequisite. The development of new knowledge and technologies to tackle maritime issues, the reduction of pollutants and the recovery and preservation of biodiversity, offers new business opportunities in the management of marine and reclaimed waters.

STATE of PLAY

Marine Science, despite important differences of capacities between countries, has always played an integrating role and promoted the regional cooperation in the Mediterranean Sea. Important stakeholders are the Regional Commissions (e.g. CIESM and MedGOOS) and the Barcelona Convention with its protocols. The Marine Strategy Framework Directive (MSFD) provides today the basic policy frame for the EU action. Thus, series of monitoring obligations to contracting parties exist which have introduced new research needs. At the same time, series of research infrastructure development and other projects have strong Mediterranean components (e.g. EUROSION, COSCIENCE, SESAME, PEGASO, EuroSITES, EuroFLEETS, SEADATANET, GROOM JERICO, MedSEA, PERSEUS). Few projects have also been under the ESFRI initiative (e.g. EMSO, EuroARGO, and EMBRC) while others are addressing the need to provide valuable data (e.g. CoralFISH, HERMIONE, MEDISEH). Recently, the overarching ERA-NET SEAS-ERA has been established and has strong focus on the Med Sea. The ENPI Horizon 2020 Programme of de-Contamination of the Mediterranean, lead by EEA, supports an action aimed at monitoring the contamination and has as one of its main targets the extension to the whole Mediterranean Area of the Shared Environmental Information System (SEIS).

PRIORITY OBJECTIVES

Over the next decades science should provide timely and accurate information and research should, at least, focus on:

- **Implementation of MSFD**, which should be promoted and realized also by non-EU countries.
- **Coastal systems**, which must be regularly monitored as eutrophication, microbial, and emerging pollution in the coastal zone persist.
- **Scarcity and lack of reliability of data**, which are probably is one of the main issues of concern.
- **Sources of pollution and anthropogenic pressures, which** must be clearly identified.
- **Habitat mapping/habitat suitability modeling**, which, in combination with regional multi-beam bathymetry surveys, can lay the foundation for marine spatial planning.
- **Synthesis of the current findings**, which has to be used for evaluations and projections on the possible future of ecosystems.

Contributions of marine research to address these priority objectives relate to:

- **Knowledge:** Access to the latest scientific knowledge on climate change topics and its impact on natural resources. Models of climate projections. Merging R&D for national database and indicators development: robust, flexible and efficient monitoring systems, common database construction with adapted indicators development.
- **Infrastructures:** develop shared scientific infrastructures (e.g. coastal and open sea observatories) to monitor changes in the Mediterranean Sea. Need to fill the observational gaps along the southern Mediterranean areas.
- **Monitoring and Common standards:** Comprehensive revision of the different national systems in order to standardize their processes. Set a uniform data collection system with shared methodologies and common quality standards according to MSFD and UNEP/MAP Ecosystem Approach (ECAP). New measurements should address emerging needs (e.g. climate change, pollution, species migration and intrusion of alien species).



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- **Information:** Publish and share data and information; support and structure similar to the Australian Bluewater and Climate Node; Accessible repository of updated information about water challenges in the Mediterranean
- **Education and capacity building:** Use the experience of the activities in Capacity Building (CB/MEP) H2020 Sub Group (MIO-ECSDE) for scientific environment and develop adapted mechanisms and connections with other programmes for sustainable impact. Marine research institutes should develop modules for sea users (fishermen, transport-related users, etc.) and decision makers.
- **Networks:** Develop a large network of marine research centers and universities for a benchmark on best practices; Build new partnership for Programs and Projects by mixing teams and equipments.
- **Priority areas for research:** Draft targeted research programs, based on the social, economic, cultural and scientific dimensions. Elaborate biogeochemical models and create scenarios based on various emissions of agricultural, industrial or chemical pollutants and biological alterations (e.g. algal blooms or invasive species) to assess future environmental changes (including climate change). Study the impacts of emerging contaminants in coastal waters and/or organisms. Model the impact of coastal erosion and marine litter. Model the nutritional web evolution and the impact of coastal urbanization on human health, fisheries and aquaculture activities provoked by emerging contaminants. Model the changes at the basin hydrological cycles, being fundamental for the ecosystem health, caused by man-induced changes or extreme events
- **Innovation:** Foster innovation and use marine technology in connection with aquaculture (food), maritime (transport) and environmental and energy (renewable energy) sectors with know-how transfer related to the common challenges. The concept of an integrated ocean 'observatory and laboratory' for food, transport, energy and environmental monitoring could be of high priority in terms of innovation and monitoring capacity. Make use of nanotechnology to study remote and deep key areas around the basin. Mobilize public-private partnership and co-ownership of actions by all riparian countries.

The main objectives to be attained are the following:

- **Strategic planning**, by preparing an inventory of existing science and technology plans and priorities in the countries represented in the consortium, and Strategic Research Agendas (SRA) for the European Sea Basins.
- **Common monitoring systems and standards.**
- **Joint research activities**, to foster synergies at regional and pan-European level, mobilising competitive and non-competitive funds for research and innovation development through common programs and joint calls.
- **Shared Marine Research Infrastructures (MRIs) Plan**, for a better and sustainable use of the existing MRIs.
- **Human capacity building** for the development of ocean-related activities in order to improve science development and its utilization in Europe and reduce imbalances among regions.

EU – MPC SOCIETAL CHALLENGE RENEWABLE ENERGY

Authors: Ahmed Saleh – Claude Ayache

Importance of the Challenge (including driving factors):

Energy has become a very important issue for the human community worldwide; it is almost related to the development of any field in our modern life. The demand for energy is growing rapidly while traditional energy resources are exploited as never before. The development of these resources should be carefully studied and integrated with traditional energy resources to maintain the sustainability of the required energy. The development of renewable energy in the Mediterranean region requires a closer cooperation in research and innovation between the surrounding nations. More specifically, innovation that could lead to the development of common goals and the creation of new businesses that could reduce the environmental impact of the traditional energy based on fossil fuel and contribute to the economic growth of the region.

Energy can be used either directly to provide lands with power necessary for agriculture/irrigation activities or indirectly by integrating it with existing energy supply systems for food industry. The demand for fresh water tends to increase drastically due to scarcity in water resources leading to increase in demand for intensive energy desalination processes. On the other hand, the emissions produced by traditional energy resources based on hydro carbon and fossil fuel has serious consequences on the level of pollution and nations' health. On the international level, marine environment is set to play an important role in addressing future energy security problems and global warming. Globally many countries are planning to develop their marine energy resources. Offshore wind is now fully commercialized and wave and tidal energy is the next border for this sector.

The increase of energy consumption in the community creates a synergistic effect on both **societal and economical** levels, indicating the level of development and the life conditions of the population. Along with putting pressure on the infrastructure of the energy transmission in the region entailing significant investments which on the other hand contributes to the economic growth of region. Renewable energy is not only playing a very important role in the social development of the community beside creating the possibility of new jobs and new field of business that differs from the traditional energy resources, it also enhances the energy usage and creates the sustainability of energy availability. Renewable energy depending especially solar or wind is **environmentally** friendly. It does not cause any pollution, it's a green energy that improves the community environment and reduces the damage cause to the environment by using hydro carbon or fossil energy.



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On the **institutional** level, stable framework conditions to foster collaboration among all RE&EE partners (universities, research centers, industry) as well as capacity building in human resources and joint venture investments in innovation are essential to establish sustainability over the long term. Stability in regulations is crucial to accompany the energy transition which in the Mediterranean region also often represents an economical and societal transition. One anticipates that this will allow reinforcing the collaboration in Research and Innovation at a level of excellence, education and training of the human resources needed for the deployment of new technologies well adapted to Mediterranean conditions and favoring joint investment in research infrastructures as well as on technology deployment endeavors. Through funding instruments such as FP6 and FP7 the EU has constantly supported collaborative R&D projects as well as the education, training and the establishment of permanent collaborative networks. At the recent Barcelona EuroMed conference, the need for an increased support to RE&EE has been stressed out to cover all stages from research to innovation, to favor capacity building (not forgetting IP and capital aspects, including risk capital) and educating people with adapted professional skills. This increased effort could be achieved through the establishment of a formal structure able to consolidate miscellaneous contributions from EU and MS as well as from MPC. This structure should be ruled through alight, efficient governance and be articulated with both the EU SET Plan and ENPI.

On the **political** level, the usage of renewable energy requires a close collaboration not only on the national level with all the parties involved but also on the international level between the countries surrounding the Mediterranean basin to benefit from exporting energy generated in different locations to other countries across the Mediterranean.

The renewable energy is and will be a field of continuous **research and innovation** either in the production, storage or transmission of energy, currently many technical issues have to be solved to increase the efficiency of energy transmission and consumption. The generation and deployment of RE creates an important volume of business in the manufacturing of the required technology and facilities for energy production, storage and transmission, which requires long term investments joint investments in human capital and research infrastructures that can create reasonable income for producers or distributors of energy.

State of Play:

Extensive research is still needed to address areas such as energy storage, this is an important issue that has to be solved by proper means allowing the storage of generated energy (either solar or wind) before being transferred to power grids. Although the generation of the renewable energy (particularly wind) has become economically competitive, initial investments still requires more support and more financial subsidies.

A special financial attention should be given to this field in order to develop its R&D and innovation as well as the applications and construction of its power plants. Education and training of human capital to develop the renewable energy culture and usage are highly recommended and required to ensure the availability of the required skills for research and industry in this particular field. In addition, the results of pilot plants must be published and



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disseminated to other Mediterranean countries for further applications in their home native lands, exchange of information of results and working in close collaboration will have a huge impact on the development of renewable energy in the region.

Technical support must be provided for new projects through working groups formed by the (MED) not only on a regional level to enable different countries to study and implement new project, but also on the national level of every country supported stakeholders, legislators, administrators of public services, SMEs and social organizations. Also, Mediterranean countries (MED) must study and issue the required regulations and laws to solve problems related to the usage of renewable energy.

Priority Objectives:

- Development of the solar systems used in the generation of electric energy to improve the efficiency and the capacity of the generated power.
- Production of the energy necessary to cover the gaps and the new demand for energy consumption.
- Development of industrial investments in general and the solar systems in particular.

Specific Actions and Instruments:

- Exercise special efforts and collaboration in R&I to develop and innovate the technologies associated with Renewable Energy and Energy Efficiency.
- Encourage and support technology supplier companies' innovative practices and provide financial support and subsidize to initial investments.
- Training and development of professional skills to operate RE facilities in different countries.
- Insert a Mediterranean element into the EU Energy R&I policies
- Develop new systems for energy exchange and build environment strategies for the management of energy recourses.
- Issue laws and regulations covering energy generation and distribution in the region.

EU-MPC SOCIETAL CHALLENGE

WATER

Authors: Nicola Lamaddalena and Ayman Rabi

IMPORTANCE OF THE CHALLENGE (including driving factors)

The major problems of fresh water resources management in the region arise from the pressure to meet the increasing food and domestic water needs in urban and rural areas, industrial and energy water needs of a fast-growing population as well as from prolonged and consecutive drought events resulted from climate change. Increased cost of energy production coupled with water scarcity, deteriorated water quality and overexploitation of resources often results in deficiency in food production, increased pollution threats to both terrestrial and marine environment and leads to non-equitable access to water resources as well as water supply and sanitation services, particularly in the rural and marginal areas. Consequently, it negatively affects health and derives various types of conflicts ranging from social domestic conflicts through sectoral conflicts (agriculture, urban areas, industry, tourism as well as ecosystem), to trans-boundary conflicts.

Facing these substantial challenges to address both the needs of populations and ecosystems, particularly under conditions of climate variability and change, requires the development of creative new policies and systems of governance that are easy to adapt to changes and to the unpredictable behavior of natural systems; realistic action plans; genuine stakeholder participatory process; visionary legislation and their functional enforcement and implementation mechanisms that would improve societal shared knowledge base on these challenges and their related risks especially those related to increased water scarcity, the escalated water demand and the low reliability of supply services and infrastructures in many Mediterranean countries.

STATE of PLAY

Traditional water planning approaches in the region are still far from adopting the integrated approach where, technological, social and environmental aspects are not fully incorporated within these approaches. Moreover, developed technologies are not often tailored to the specific socio-economic context of the various Mediterranean Countries which may affect their sustainable use and increase the vulnerability of water resources. However, some changes started to be seen in the dynamics of water planning whereby more emphasis started to be given to demand management rather than the sole reliance on finding new sources of supply; a growing awareness on the importance of preventing and mitigating various types of water conflicts; a growing emphasis on incorporating ecological values into water policy; a re-emphasis on meeting basic human needs for water services; the importance of stakeholder participation; and a conscious breaking of the ties between economic growth and water use.

Although there is significant number of technical and socio-economic data and information produced mainly through European Commission as well as other donors (eg.: EU Member States) funded collaborative research and Euro-Mediterranean regional S&T dialogue and



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actions on water management issues over the past 10 years, yet, the following constraints are still facing the proper utilization of such data to ensure more rational and integrated management of resources:

1. Water management experiences throughout the Mediterranean, particularly those with potential for replication are not well documented.
2. Local experience are scattered and fragmented, often different standards are used and results are difficult to be compared, up scaled and integrated.
3. Research results are not transmitted properly to society. They are often confined within the loop of research community.
4. Water management practices are not standardized across the different Southern Mediterranean countries and they vary from country to country and from basin to basin.
5. The legislative and institutional (Governance) system in the south of the Mediterranean does not support the implementation of innovative research results or approaches.
6. Technological, managerial and policy innovation and adaptation capacities vary substantially across the basin, human resources development, gender roles in water management, sharing knowledge and consensus on the use of common sustainability indicators (economic, social, environmental, institutional) are still not adopted.

PRIORITY OBJECTIVES

- To promote competitive research on enhancing innovation in relevant water issues.
- To adopt regional approach, including building of knowledge sharing and efficient transfer mechanisms of water research results at various levels including societal level.
- To develop common monitoring mechanisms and technology sharing and to ensure water strategies/policies alignment among various countries of the basin.
- To implement capacity building including organizational reforms, institutional strengthening, science-policy interfacing, networking, participatory approach. Capacity building should target researchers as well as public, private, NGOs and water users.
- Strengthening national water governance to enhance innovation in the management of limited water resources especially in the southern part of the Basin.
- Create operational synergies with political and multi-stakeholder processes on water such as the Mediterranean Component of the EU Water Initiative.
- Research development for water multi-uses towards zero water discharge
- Linking Southern Mediterranean Countries' water strategy with the EU Water Framework Directive to improve quality of mutual EU-MPC cooperation and competitiveness in water.
- Fostering high quality but diversified partnership to promote (i) interface interaction between water specialties and other relevant sectors to enable the development of new approaches, tools and innovation; (ii) collaboration between experienced and young researchers for coaching and capacity building in cooperation.

SPECIFIC ACTIONS AND INSTRUMENTS



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- Special pre-competitive research efforts to develop innovative, cost effective, affordable and appropriate water technology.
- Pilot demonstrations and real case studies to substantiate pre-competitive research with particular regard to optimal water allocation and income generating water saving actions and multi-use solutions and alternatives at user level.
- Developing economic and technical tools that enable replication and the scale up (regionalization) of successful pilot / demonstration actions.
- Linking research, technology enterprising and water users to enhance competitive research in water use efficiency, drought and flood management, non-conventional water use, water conservation especially in agriculture, mitigation of salt intrusion in coastal groundwater and impact of desalination brine discharges to coastal environments, risk assessment and vulnerability mapping.
- Increasing the sustainability of water technology and their adaptation to different socio-economic and local natural and hydrological contexts.
- To support institutional strengthening and participatory water management.
- Supporting the creation of cooperation and financial partnerships among researchers, SMEs, investors, institutions active on water saving, water use efficiency, drought and flood management and early warnings and nonconventional water use including desalination.
- Strengthening trilateral financial synergies / co-funding (EU-MS-MPCs) in identified challenges and facilitate the engagement of Mediterranean Partner Countries in the EU Water Technology Platform (ex: Water Supply and sanitation Technology Platform).
- More research cooperation based on equal participation / co-ownership of EU and MPC researchers. In particular, a permanent ERANET type of action could be established to ensure continuity of commitments by MPC, MS and EU to face common water challenges.

STRUCTURAL ISSUES

Authors: Juliane Brach and Jejel Ezzine

IMPORTANCE OF THE STRUCTURAL CHALLENGE

In relation to the thematic societal challenges presented in the first part, the EU Member States and the Mediterranean Partner Countries are currently also facing substantial structural issues. These include horizontal issues such as strengthening innovation, coping and understanding change in science and society, increased efficiency through a higher degree of coordination of programs and funding instruments, as well as through a shared vision and concerted strategy for building competence in research and innovation. Because of their horizontal and cross-cutting nature, these structural issues need to be jointly addressed in order to improve the performance of the research and innovation systems as well as regional cooperation in all five abovementioned thematic societal challenges, and beyond.

The historical events in the Mediterranean countries and the economic challenges are affecting large parts of the population and are especially impacting on the future perspectives of the younger generations in the entire Southern Mediterranean region. These developments call for a renewed, and yet more focused, innovative and highly ambitious cooperation among the Members of the European Union and the Mediterranean Partner Countries. Increasingly people on the northern (European), southern (North African) and Eastern (Middle Easter/Levant) shores of the Mediterranean Basin, see themselves confronted with similar structural societal challenges such as limited degree of innovation, economic stagnation, and related consequences such as high rates of unemployment and millions of missing jobs.

The Final Report of the Barcelona Conference (p. 4) highlights two aspects that cannot be emphasized enough: First, *Research and innovation (R&I) offer significant opportunities for Mediterranean countries to develop and exploit their assets for the benefit of their economies and of their peoples as increased knowledge and R&I are keys to the successful deployment.* And second, *the successful implementation of this ambitious strategy and the delivery of sustainable results depend on coordinated action and streamlined activities aimed at building a common innovation- and research-based culture.*

STATE of PLAY

Over time, European Member States have succeeded to integrate and link research within and beyond the borders of the European Union and have become a hub for innovation and academic excellence. Although EU member states were not equally successful in internalizing these achievements and transforming research into business and economic prospect, on average the EU is a very interesting and experienced partner, especially in research.

Until now, the research and innovation divide across the Mediterranean is substantial and the gap with respect to the average quality and quantity of research and research institutes is striking. Once the leading region in academic research and entrepreneurial innovation, today, the southern Mediterranean shores host only a very small number of internationally recognized centers of excellence. And the degree of academic and economic interaction within



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these countries is very limited. This lack of concerted articulation of interest is one of the key factors that impede a clear cut and tailor-made regional EU-Med cooperation based on innovation and research.

The main difficulty with respect to the present Structural Issues related to the societal challenges, is to frame the proposed structures within a well established, accepted and proven framework. This analytical framework is nothing but the National Innovation System concept. A promising approach has been presented, and discussed at the Barcelona Conference i.e., the Euro-Mediterranean Innovation Eco-System (EMIES).

Indeed, during the past decade or so, and within the framework of the ERA concept, the EU-MED cooperation has achieved sensible results. To further the ongoing collaboration and produce mutually beneficial impacts three cooperation principles are to be observed: (i) partnership, (ii) co-design and (iii) co-ownership.

Moreover, and in order to accelerate the innovation-led development in the present and near terms, as well as prepare for the future, the S&T levers of cooperation have to be built simultaneously. As such working towards EMIES, requires several activities, both at the EU, MPC and regional levels. At the EU level: (i) Initiate work on supranational EMIES by building on past EC/EU experiences, (ii) Identify and map the EU RISs, existing and potential ones, and identify best practices, and potential causes of failures for future policies design and streamlining, and (iii) Align, as much as possible, ERA's and other ongoing programs at all three spatial levels, i.e., national, regional and EU-Med. 2) At the MPCs level: (i) Benchmark the National Innovation Systems (NIS) of the MPC countries, and help identify new promising industry/service niches, (ii) identify R&D priorities, missing policies, and S&T policies/managerial capacity building in coherence with the new framework, and (iii) accelerate the convergence of MPCs to ERA and the European Higher Education Area, especially the Bologna process, with emphasis on educational and R&D institutional governance and autonomy, e.g., universities.

PRIORITY OBJECTIVES

Given the urgency of societal, structural and economic issues, future and sustainable EU-MPC cooperation needs to be much more efficient and as effectively as possible. At the same time it needs to target a much shorter timeframe for strategies, projects, or initiatives to deliver results.

- Harmonizing and coordination of existing cooperation, instruments and funding schemes on the side of the European Union, both within EUCOM, and with respect to EUCOM and EU member states, in order to reduce redundancy and render instruments more effectively.
- Clearly communicate the difference between research/innovation support action (such as administrative and/or capacity building support activities), networking activities (people and institutional exchange) and support of actual research/innovation projects. This will help MPC to better formulate their demand for support and address the right measures.
- To increase the relevance of research for society cooperation at a research level, MPC researchers and research institutions must at a large scale focus more on applied research and on marketable output than in the past. At the same time, there needs to be a strong focus on internationally competitive academic excellence, in order to be interesting and frequented as collaboration partners within the ERA. This requires to make choices, and to choose priorities.



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- The lack of coordinated action among the MPC is a major hampering factor for substantial progress in EU-MPC science, research and innovation cooperation and for materializing the societal benefits from research through marketable innovation and competence. Working towards an establishment of a regional MPC innovation and research strategy possibly with the aim to create an MPC innovation system should be a top priority of EU-MPC cooperation. And yet, a successful EU-MPC cooperation will in future even more than in the past, depend crucially on a regular dialog and concerted formulation of demand and priority areas among MPC countries.
- With respect to the formulation and establishment of a EU-MED regional innovation system such as for example the EMIES, the role of MoCo should be strengthened and used as to be the overarching and horizontal oversight, monitoring and coordination instrument.

THE WAY FORWARD

The Mediterranean governance of the R&I cooperation is not only limited by financial constraints but by the recognition of several gaps in the development of research and innovation capacities. The structural unbalance between Research and Innovation (National or EU) Systems limits the capacity of absorption of the cooperation support policies which would be primarily based on financing principles. Gaps also concern the rhythm of evolution of Research and Innovation, as Europe is engaged in a world competition on Research and Innovation around Great Societal Challenges. H2020 addresses this point through programmes integration on a large scale, while MPCs can benefit substantially from smaller and regionally bounded initiatives. A sustainable approach to overcome these gaps in a single Mediterranean regional approach should fully recognize differences and be based on co-ownership for structuring further R&I cooperation within the Mediterranean. Then, common initiatives should be taken in a comprehensive way, consolidating existing EuroMed experiences through a broader platform approach.

Taking into account the structural aspects, an innovative approach to link the different common EU-MPC basic challenges described above is proposed, based on identifying federative polyhedral challenges with facets corresponding to several basic challenges, taking into account that water and energy, affect all federative approach in the Mediterranean environment. Two different topics, as overarching activities to merge competences and motivate emerging sectors, were identified as crosscutting challenges affecting the five outliner earlier CRIA social challenges:

- **Wellbeing of people**
- **Efficient use of resources (material and human resources).**

In the framework of these topics, flagship projects or initiatives in the Mediterranean should tackle socio-economic problems in the region in a holistic approach. Taking into account the concrete thematic recommendations for actions that formed the conclusions of the Euro-Mediterranean Conference on Research and Innovation of Barcelona in April 2012, and the specific topics and actions recommended for the Societal Challenges described in the previous sections, they need to be accompanied by *coordinated action and streamlined activities aimed at building a common innovation- and research-based culture*, with full co-design and co-ownership. In particular the recommendations can be formulated as a basket of integrated and coordinated actions:

Wellbeing of people

Clustering of research priorities of the Food, Health, Water, Energy, and Marine Environment Societal Challenges, that are mutually affected:

- Application of the “one health” paradigm, and promoting a strong partnership between health research Institutions supported by a common health research policy.
- Research directed at water multi-uses towards zero water discharge.



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- Linking Southern Mediterranean Countries' water strategy with the EU Water Framework Directive to improve quality of mutual EU-MPC cooperation and innovation and competitiveness in the water sector.
- Develop new systems for maximizing the use of RE, facilitate energy exchange and build environment strategies for the saving of energy in face of a growing public and industrial demand.
- Overcoming Malnutrition (obesity or deficient nutrition).
- Sustainability of food production technologies and adaptation to different socio-economic contexts.
- Modeling the nutritional web evolution and the impact of coastal urbanization on human health, fisheries and aquaculture activities provoked by emerging contaminants.

Efficient use of resources (material and human resources).

Clustering of research priorities of the Water, Food, Marine Environment and Renewables Energies Societal Challenges, considering material (including soils), human and cultural resources.

- Encourage the use of Renewable Energy and Energy Efficiency criteria, together with new systems for energy exchange, as building blocks for the management of energy resources. Insert a Mediterranean dimension into the EU Energy R&I policies
- Develop a monitoring and control system of the Mediterranean Sea to support innovative Mediterranean-wide industrial development based on shared assets, such as tourism, maritime transport, fisheries and mariculture, marine renewable energy, biotechnology and deep sea hydrocarbon exploration and exploitation.
- Tackling biodiversity loss, water scarcity and handling of water waste, desertification, soil erosion, food losses and the impact of climate change on the use of natural resources
- Research on optimal water allocation and minimum energy use and income generating water saving actions and multi-use solutions. Enhance competitive research in water use efficiency, drought and flood management, non-conventional water use, water conservation especially in agriculture, mitigation of salt intrusion in coastal groundwater and impact of desalination brine discharges to coastal environments, risk assessment and vulnerability mapping.
- New research and new partnership between public and private sectors is needed to make exploitations of these goods and services sustainable, more efficient and leading to economic growth.



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In addition, the matching of scientific competences, by linking several cross-cutting concrete actions dealing with political, socio-economic and innovation actions are needed to obtain the desired benefits of the two federative actions:

- The alignment of legislation dealing with the handling of the challenges and creating optimal and sustainable conditions for joint investments in innovation.
- The agreement on the use of common standards in the description of the variables affecting the challenges, a common system of data acquisition must also be agreed as well as rules for sharing data and guarantees of transparency between the collaborating parties.
- Create/boost shared/common infrastructure and services in some reference places and reference centers. Ex: promoting a sort of EUROSTAT in the Mediterranean could be a good option as a concrete proposal – EUROMEDSTAT
- Promote capacity building in human resources, demands of the innovation system (IPR, Technology Share, valorization, etc.) and infrastructures for research as well as for the deployment of new technologies. Launch a concrete program of support to young entrepreneurs
- Channel talent toward innovative and to the adaptation of existing technologies (high, low, medium) to the local needs., including engagement or participation of private enterprises.

The common governance of the cooperation should be established as a federative body. This platform-based structure will address different levels including initiatives towards the convergence in the National Research and Innovation Systems, recognition of shared instruments for multi-lateral cooperation (like ERANET, Mobility, Research Infrastructures Programmes, Educational Programmes), as well as the financing and mobilization of resources. This should be consolidated in a formal single vision document for R&I Mediterranean cooperation and its development, a definition of the roadmap for establishing the common governance structure (which could be articulated with Art 185) and the development of specific programmes for R&I cooperation and a implementation plan focused on market and society deliverables.

LIST OF MEMBERS OF THE EXPERT GROUP

Surname	Name	Country	Societal challenge
Claude	Ayache	France	Renewable Energies
Ahmed	Saleh	Egypt	Renewable Energies
Ayman	Rabi	Palestine	Water
Chiara	Morini	Italy	Food
Domenica	Taruscio	Italy	Fighting Diseases
Sonia	Abdelhak	Tunisia	Fighting Diseases
Claudio	Bogliotti	Italy	Food
Juliane	Brach	Germany	Structural Issues
Jelal	Ezzine	Tunisia	Structural Issues
Evangelos	Papathanassiou	Greece	Marine Environment
Rafael	Rodríguez	Spain	Expert Group Coordinator/ Marine Environment
Claudio	Bogliotti	Italy	Water
Nicola	LaMaddalena	Italy	Food
Maroun	El-Moujabber	Lebanon	Food