



Mediterranean Science, Policy, Research and Innovation Gateway

3rdEMEG Meeting – Malta, 30 September – 2 October 2015

Position paper

“A FRAME FOR A COMPREHENSIVE UNDERSTANDING OF WATER-ENERGY-FOOD NEXUS”

Recommendations by the Euro-Mediterranean Experts Group (EMEG)
(an outline of outcomes of 3rdEMEG meeting)

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Introduction

Global projections indicate that demand for freshwater, energy and food will increase significantly over the next decades under the pressure of population growth and mobility, economic development, international trade, urbanisation, diversifying diets, cultural and technological changes, and climate change (Hoff, 2011).

As demand grows, there is increasing competition for resources between water, energy, agriculture, fisheries, livestock, forestry, mining, transport and other sectors with unpredictable impacts for livelihoods and the environment (FAO, 2011).

The problem could be exacerbated by the climate change and its ecological consequences, and by fast changing socio-economic boundary conditions, including global redistributions of wealth and power, as well as changing flows of people, resources and knowledge (Schmidhuber and Tubiello, 2007; Hanjra and Qureshi, 2010).

In this context, the Water-Energy-Food Nexus has emerged as a useful concept to describe and address the complex and interrelated nature of our global resource systems, on which we depend to achieve different social, economic and environmental goals (FAOa,b, 2014).

A nexus approach can support a transition to sustainability, by reducing trade-offs and generating additional benefits that outweigh the transaction costs associated with stronger integration across sectors. Such gains should appeal to national interest and encourage governments, the private sector and civil society to engage.

The purpose of this position paper is to describe process and outcomes, leading the MedSpring Euro-Mediterranean Experts Group (EMEG) to develop a logical frame to achieve a comprehensive understanding of the complex interactions and trade-offs among selected societal challenges (water-energy-food).

Background

During the Davos Summit, The Global Risks 2011 report, issued by the World Economic Forum(WEF, 2011), brought to political attention, and for the first time, the risk correlation between the water, energy and food sectors. Later on, the interdependencies between water, energy and land resources became the focus of many global and regional conferences and meetings held in preparation for the United Nations Conference on Sustainable Development (Rio+20) held in June 2012 (UN, 2012). In particular, the Bonn 2011 Nexus Conference (held in November 2011), “The Water Energy and Food Security Nexus – Solutions for the Green Economy”, organized by the Federal Government of Germany, was a major milestone to place the nexus perspective on the international agenda (SEI, 2011).

More recently, the Bonn 2014 conference, "Sustainability in the Water-Energy-Food Nexus" (GWSP, 2014), emphasized the need for coherence of cross-sector policy efforts and cross-border cooperation for jointly improved efficiency as a successful strategy to achieve environmental sustainability.

The conference called for the following Actions:

- 1) Responsible governance of natural resources;
- 2) Broad involvement of stakeholders to collaboratively work toward sustainable development;
- 3) Need to expand financial, institutional, technical, and intellectual resources for nexus research.

MedSpring project is aligned with the ideas, the debate and the engagement on the Nexus expressed in the international fora. In fact, over the last two years MedSpring, engaging the scientific community as well as the civil society, has gained an insight into the Nexus by investigating the relationship between research and innovation and the real needs of the civil society in the frame of the three societal challenges water-food-energy.

Specifically, the main goal of the 1st EMEG Meeting (Lisbon, 2013) was to identify water, food and energy related research topics that would offer results, solutions and market opportunities contributing to sustainable development and create opportunities for new jobs in the region. The work was underpinned by the inputs of the open consultation launched before the meeting and addressed to the civil society (researchers, SMEs, NGOs, citizens... etc.) and WEB communities.

The 2nd EMEG Meeting (Sousse, 2014), aimed to identify ways and means to address (or re-address) policy and policy dialogue, particularly regarding objectives and expected impacts of water, energy and food related research, taking into account the current scenarios in Research and Innovation cooperation. This work led to the identification of objectives and expected impacts of Euro-Mediterranean R&I policy dialogue and cooperation expressed in the following cross-cutting paradigms:

“Research in water, food and energy in the Mediterranean region has cross-border dimension and can be successfully tackled only in the frame of mutual EU-MPC co-operation with participation on equal footing. Addressing the nexus among water, food and energy to satisfy human needs within the limits of natural resources, implying the development of creative integrated policy and politics.”

“Euro-Mediterranean research and innovation policy should be given a clear orientation through a process of generating joint problem awareness, and by participation of stakeholders beyond business. Euro-Mediterranean R&I policy will have to orient the prioritisation of research toward nexus problems, based on sustainability including trans-disciplinarity, integrating science in society, gender mainstreaming, stakeholders co-ownership.”

These paradigms seem to anticipate the content of the above mentioned "Call for Action" developed in the Bonn Conference later on (GWSP, 2014).

In January 2015, in Barcelona, an EU-Mediterranean Conference on R&I promoted by MedSpring was held, gathering coordinators of EU-funded project with a focus on water, energy and food. The output of the meeting¹ includes a set of recommendations for joint EU-MPC actions to face the challenges posed by the water-food-energy nexus.

¹ “Euro-Mediterranean Dialogue to Enhance Water-Energy-Food Nexus” Minutes of the Meeting organized by FP7 INCO.Net MEDSPRING, gathering 25 EU Financed Projects leaders dealing with one or more thematic topic of the Nexus. Barcelona 21-23 January 2015. www.medspring.eu

Trends and scenarios : the Nexus challenges

Our consumption of food, water and energy — directly or indirectly — impacts ecosystems and natural resources that society depends on for its survival. Recent events (e.g. extreme droughts in Australia and India, increasing of food prices, etc.) tell us that we can no longer view our food, water and energy systems in isolation. Instead, we all must understand how and where these three systems intersect — the nexus.

Water, energy and food are essential for human well-being, poverty reduction and sustainable development (FAO, 2014). Among other natural resources, energy, water and food are most needed to sustain life on earth. These three strategic resources share many comparable characteristics: billions of people without access to them; global demand for them is rapidly growing; all face resource constraints; all three are ‘global goods’ ‘involving international trade with global implications; each have different regional availability and variations in supply and demand; and all operate in heavily regulated markets (Bazillian et al., 2011).

In spite of significant progress in achieving the commitments made by the Millennium Development Goals (UN, 2014), security of water, energy and food supplies remain far from being achieved globally.

Basic services are not available to a large proportion of the world’s population; about 0.9 billion are without adequate access to water for their basic needs and for many more the water is not safe for consumption, 2.6 million lack access to safe sanitation, close to 1 billion are undernourished, and at least 1.5 billion are without access to modern forms of energy. People thereby remain deprived of their human rights and are constrained in their opportunities for development. And for many others, the system does not yet offer the conditions needed to raise their livelihoods and emerge from poverty.

EMEG experts are fully aware about the trends that a “business as usual” scenario could lead in next few years.

A rapidly rising global population and growing prosperity are putting unsustainable pressures on resources. Projections indicate that by 2050 the world population is expected to reach 9.2 billion people, with 70% of the expected global population living in cities; consequently demand for water (+55%), food (+60%) and energy (+80%) is expected to rise exponentially in the next two decades (IEA, 2010) (Figure 2).

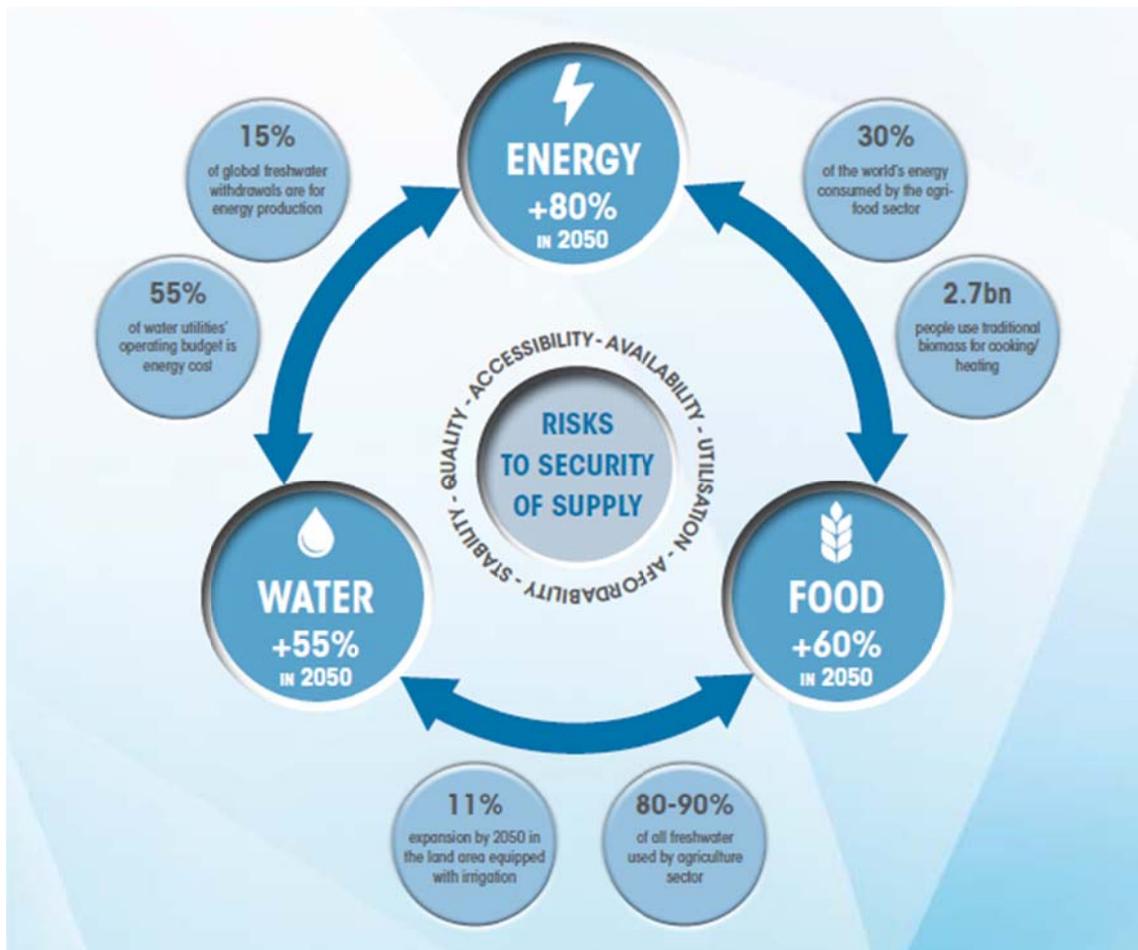


Figure 1—Projections of demand on water-energy-food sectors in 2050 (source : IRENA, 2015)

At the same time, the world is reaching, and in some cases has already exceeded, the sustainable limit of resource availability and is at risk to trespass planetary boundaries. As demand grows, there is a growing competition over natural resources. Shortages in resources could cause social and political instability, geopolitical conflict (Hamdy et al., 2014; Al-Zubari, 2014; Mohtar and Daher, 2014). and irreparable environmental damage (WEF, 2011). Climate change can amplify the relevance of interdependencies and impacts of these challenges (Sandford, 2014).

Therefore there is a need to build on more innovative solutions to achieve sustainable growth.

A new nexus oriented approach is needed to address unsustainable patterns of growth and impending resource constraints and, in doing so, promote security of access to basic services. It is an approach that better understands the inter-linkages between water, energy and food sectors as well as the influence of trade, investment and climate policies (Bonn, 2011).

Preliminary analysis outcomes

The 3rd EMEG meeting aimed to develop a Nexus approach as a new framing for the interdependence of water, energy and food (the societal challenges addressed by MedSpring project) and, through a better understanding of the synergies and trade-offs among them, identify the factors research should take into consideration to ensure that demand is met without compromising sustainability requirements.

The meeting engaged in developing a comprehensive, multi-dimensions logical frame, based on a thorough understanding of the interconnectedness of water, energy and food leading to a better Nexus analysis and how it satisfies the sustainability imperatives. The output were a set of recommendations to support the identification of priorities and guide the EC in the design of ad-hoc initiatives/calls addressing the Nexus.

In preparation to the meeting a preliminary analysis was carried out.

Based on the outputs of the first (Lisbon, 2013²) and second (Sousse, 2014³) EMEG meetings, the Meeting of the Projects Coordinators Platform (Barcelona, 2015) and a topic-related literature review⁴, a preliminary work has been carried out by the EMEG coordination team to support the third EMEG meeting.

Following the Lisbon EMEG meeting it was highlighted that research, research cooperation and the related policy dialogue in the three areas of interest- Water, Energy, Food- is affected by problems that can be grouped into 4 categories:

- NETWORKING & COMMUNICATION,
- MANAGEMENT AND INSTITUTIONAL RESPONSIBILITY,
- RESOURCES (FINANCIAL/HUMAN) & CAPACITY,
- RESPONSIVENESS TO USERS' NEEDS.

The subsequent problem analysis aimed at considering each domain specific problems under the perspective of a Nexus approach, trying to single out cross-domain problems. This operation led to the identification of what has been defined as **Main problems** requiring a sustainable set of objectives to solve them.

The same process has guided the identification of *sustainable Main objectives* that, following a *Nexus approach*, can tackle the “*main problems*”. The Main objectives identified were the basis on which to develop the EMEG discussion and work in Malta.

The preliminary analysis' outcomes are collected in Table 2 (ANNEX 1).

²The extract of the 1st Position paper on “Research results valorization” could be founded here: <http://agora.medspring.eu/en/content/emeg-position-paper>; the entire document (in .pdf) is available here: <http://agora.medspring.eu/sites/default/files/uploads/emegpositionpaper.pdf>

³The 2nd Position paper on “Policy dialogue” is available here: <http://www.medspring.eu/sites/default/files/MED-SPRING-EMEG-Position-Paper.pdf>

⁴A critical overview of external links and documents related to Nexus is available here: <http://www.medspring.eu/emeg-nexus-repository>

EMEG outcomes

The main objective of the 3rd EMEG meeting was the development of an innovative “Nexus approach” as a new framing for the interdependence of water, energy and food (the societal challenges addressed by MedSpring project) and, through a better understanding of the synergies and trade-offs among them, identify the factors research should take into consideration to ensure that demand is met without compromising sustainability requirements.

This work led to the identification of new Nexus objectives and possible actions to be implemented in the Euro-Mediterranean R&I policy dialogue and cooperation, which will be presented by EMEG to the EC under the form of recommendations.

About 67 experts (EMEG experts, EU officers, Clusters’ representatives, young researchers), participating to the event, were subdivided in three following groups:

- WG1. WATER vs. FOOD & ENERGY
- WG2. ENERGY vs. FOOD & WATER
- WG3. FOOD vs. WATER & ENERGY

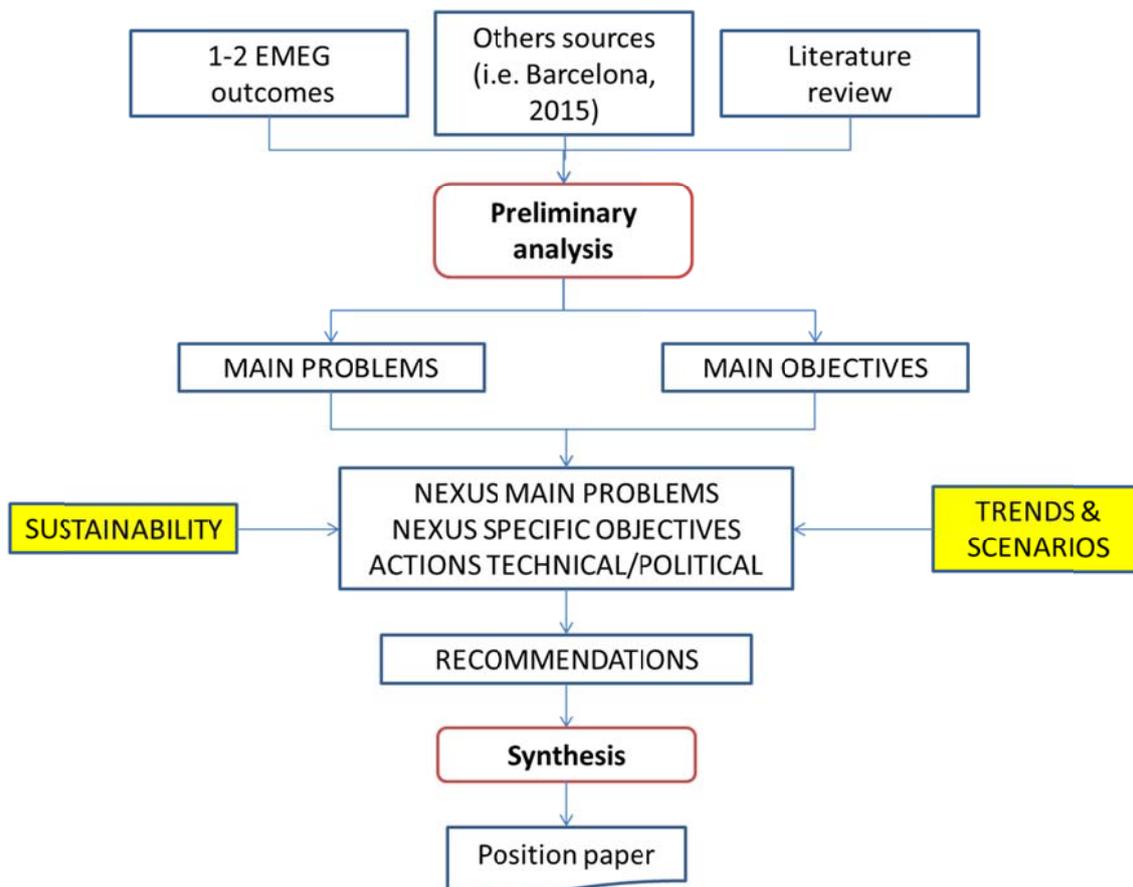


Figure 2 – Main sources, works performed and outcomes leading to the 3rd EMEG meeting Position Paper

On the basis of inputs provided by the outcomes coming from 1st and 2nd EMEG Meetings, Barcelona Conference and from other sources (see Table 2), as well as by the keynote speech, and Coordinator’s presentation, EMEG members were asked to define a number of **Nexus Main Problems** (challenges related to the above mentioned W-E-F inter-linkages) in the EU-Mediterranean area.

Moving from Specific Problems, experts were asked to identify **Nexus Specific Objectives**. Those Objectives can be considered as “policy objectives” related to a number of domains:

- Governance
- Social and cultural
- Technical/ Practical / Capacity
- Economy

The list of defined Nexus Specific Problems and Nexus Specific Objectives is summarized in Tables 3-4-5 (ANNEX 1).

This last exercise was aimed at collecting suggestions for possible **Actions** able to support the Nexus intervention logic.

EMEG experts, individually, starting from the results of the previous exercises were asked to provide suggestions for actions. These actions should be considered as possible solutions that can address both the technical and institutional level (depending on the type of objectives). Innovation and market opportunities were highlighted for each Action, when possible.

The resulting log-frames (including suggested Actions) are summarized in Tables 6-7-8 (ANNEX 1).

Following the EMEG meeting, a further elaboration of the outcomes was made. The log-frames developed into each working group were “clustered” and summarized into a synoptic table, as reported below (Table 1)

Table 1 – The Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) summarizing the Work Groups outcomes

	Nexus Main Problems	Nexus Specific Objectives	Actions (both technical and policy related)
Governance	Lack of strategies and poor policies harmonization for WEF that enable a proper implementation of the nexus approach in the region	<p>Trans-disciplinary committees should develop WEF national and regional strategies</p> <p>Participatory policy design should include socio-environmental aspects</p> <p>Nexus concepts should be integrated in all national policies</p>	<p><i>Establishing a committee of scientific experts in WEF and social sciences to map and assess available nexus strategies (at national/regional level) particularly focusing on:</i></p> <p><i>a) needs analysis</i></p> <p><i>b) mapping of stakeholders</i></p> <p><i>c) developing a comprehensive W-E-F strategy and setting a master plan (followed by implementation monitoring)</i></p>
	Lack of multi-disciplinarity and cooperation at the policy, research and management levels in each individual sector.	<p>Platforms facilitating policy, management and research cooperation in the 3 sectors (WEF) should be created.</p>	<p><i>Adopting development practices to achieve a sustainable integrated and comprehensive planning and management in the areas of water, energy and food security.</i></p> <p><i>Creating inter-sectorial committees of W-E-F experts at policy & management level for monitoring implementation of nexus approach, brokering scientific events (conferences, etc.) and promoting relevant mobility programmes.</i></p>
Social and cultural	Lack of tailored communication tools and strategies between Academia-Industrialist-Government for NEXUS	<p>Dissemination of success stories.</p>	<p><i>Enhancing best practices by: providing comprehensive description; standardizing them; adapting and replicating them in different environments.</i></p>
	Lack of awareness, inadequate communication and participation of all stakeholders, including civil society, in the challenges addressed by the nexus thinking	<p>Different stakeholders needs should be identified to better address WEF research cooperation gaps and strengths</p>	<p><i>Promoting and funding inter-sectorial deliberative spaces with clear implementation commitments by policy makers.</i></p>
		<p>Relevant stakeholders involvement in nexus related policy design and research and innovation activities should be fostered</p>	<p><i>Designing and implementing awareness campaigns especially addressed to relevant stakeholders; establishing a knowledge gateway and hub for exchange of good practices related to NEXUS adoption in policy, research and practice; supporting existing fora dealing with issues addressed by the nexus.</i></p>
	Nexus related communication should be improved	<p><i>Creating a EU-Mediterranean Network of existing public stakeholders; creating local multi-stakeholder and inclusive platforms.</i></p>	

Table 1 – The Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) summarizing the Work Groups outcomes (continuation)

	Nexus Main Problems	Nexus Specific Objectives	Actions (both technical and policy related)
Technical/Practical/Capacity	Lack of capacity (education, training) among policy makers and practitioners	Education and training should focus on WEF system integration promoting trans-disciplinary approaches to research to identify Nexus related solutions	<i>Developing educational programmes and materials; developing targeted and demand-driven job training; organizing events (workshops, seminars, etc.)</i>
	No observatories, reference institutions and data (i.e. statistical analysis, scenario simulations, ...) are available (or easily accessible) to relevant stakeholders	A database of WEF common areas should be created	<i>Developing a data management plan for NEXUS and creating a comprehensive database.</i>
	Insufficient scientific knowledge and innovative research on the effects of water and energy resources on food security	Scientific research and innovation activity on food security in the nexus context should be encouraged.	<i>Creating a platform gathering Universities, RD centres, public organisations, SME's, food industries, stakeholders, end users, etc., aiming to develop and share knowledge and practices, and networking in the EU-MED area.</i>
		Innovations based on scientific and socio-economic knowledge to promote business opportunities should be developed	<i>Building a strategy for managing risks, opportunities and challenges taking into account the Nexus framework in a fast-changing environment.</i>
	Insufficient scientific knowledge and innovative research on the effects of Climate change and its relation with the WEF nexus and Lack of tools and mechanisms to integrate the different aspects in water management	Research in the field of climate change adaptation and mitigation should be supported and increased (developing models that include the "climate change" factor with the other WEF factors e.g. life cycle assessment of products, ... etc.)	<i>Bridging the knowledge gap on W-E-F by developing multi-disciplinary and multi-actor research; Creating a global water knowledge hub that is relevant, visible, credible and low-cost to facilitate the work of researchers in different disciplines.</i>
Multidisciplinary RDI (national and international) in water sector to include food and energy interfaces should be developed (i.e. set up coordination platforms involving the three aspects WEF at different operational levels; develop strategies that allows Integrated Water Management and planning for the future national resources).		<i>Demonstrating water management solutions integrating E, F nexus at the real level (demonstrative pilot project sites); extending the benefits of natural water infrastructures and/or nature-based solution of water management to energy and food nexus.</i>	

Table 1 – The Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) summarizing the Work Groups outcomes (continuation)

	Nexus Main Problems	Nexus Specific Objectives	Actions (both technical and policy related)
Economy	Poor interaction between public and private sector due to insufficient funding to promote nexus approach.	Interaction between public and private sectors should be improved, including incentives for funding	<i>Creating a EU-MED platform for supranational exchange and transfer of best practices.</i>
	Lack of public/private and international organisations' partnerships to facilitate market access to nexus related new technologies .	Awareness for increasing cooperation between the public and private sectors should be improved	<i>Establishing a funding programme led by the EC promoting industry-academia/public-private cooperation in the W-E-F nexus approach.</i>
	Lack of market (and users) oriented solutions in nexus research	Identify specific markets niches where NEXUS solution can play a social and economic role.	<p><i>Developing a nexus labelling through Life Cycle Assessment approach as market criteria for products prices at MED level.</i></p> <p><i>Developing a tool (e.g. Decision Support System) to support producers/decision makers to select the most feasible solutions.</i></p> <p><i>Developing knowledge on the relation between food quality and foreign market regulations.</i></p> <p><i>Organizing one-to-one meetings between researchers and possible investors (brokerage events) to define market niches/needs and nexus approach.</i></p>

Following the above mentioned steps, the EMEG were asked to prepare **Recommendations**, both political and technical. The main recommendations have been summarized in a form of concept note that integrates both policy and technical aspects as follows:

NEXUS – NEXT GENERATION OF EXCELLENT WEF SOLUTIONS FOR SUSTAINABILITY

The current concept note summarizes the recommendations of the third EMEG meeting with the main objectives of how to employ WEF nexus to better address the societal challenges and ensure sustainability. Moreover, it emphasizes on considering the main two pillars of WEF nexus at policy and technical in an integrated manner. Without proper policies and adequate governance set up it is difficult to implement any technical solutions. In this context, the policy recommendations can be summarized as follows:

Policy recommendations

1. **Integrating the nexus concept in all relevant policies, legislation and regulations at all levels** by:
 - Promoting participatory policy design through a multilevel and participatory networks/fora;
 - Mapping and assessing existing national sectorial W-E-F policies to develop an integrated Nexus strategy including an effective implementation and monitoring plan;
 - Promoting the implementation of EURO MED strategy on NEXUS.
2. **Increase NEXUS communication and awareness among relevant stakeholders** by: multidisciplinary training and capacity building activities; dissemination of success stories, initiatives, good practices and innovative technologies; including Nexus related principles and concepts in educational system; creating a EU-MED platform (based on the MEDSPRING EMEG + additional players) for trans-boundary exchange and transfer of best practices.
3. **Increasing funding for multidisciplinary** and integrated research projects and initiatives and promoting cooperation between public and private sectors through financing and incentive schemes.

Once proper policies and common understanding on nexus aspects is established, it will be easier to move to the actions that is needed to support the actual realization of nexus on the ground and will help implement these policies. The main technical recommendations can be summarized as follows:

Technical Recommendations

To better articulate the technical recommendations, it was important to organize them in a sequential interrelated steps as follows:

STEP 1:

Understanding the current state of and interconnection among WEF nexus through DATA COLLECTION, STORAGE AND ANALYSIS, MODELLING

- Conduct survey about available data, identification of gaps, create a new database (nexus database of WEF relevant data)

- Develop data management plan for NEXUS including data collection, IT model and platforms
- Assessing the risks, opportunities and challenges taking into account the Nexus framework in a moving world (dynamic, multidisciplinary)
- Bridging the knowledge gap on WEF by concentrated multi-disciplinary research; create a global water knowledge hub that is relevant, visible, credible and low-cost to facilitate the work of researchers in different disciplines.

Analysis on WEF data availability, aimed to identify gaps (or redundancies), creating a ICT open-access, dynamic, interactive platform and database, to facilitate multi-disciplinary research, to assess risk, opportunities and challenges in sustainable resources management.

STEP 2

DEMONSTRATIONS AND PILOTS

- Highlighting and evaluating the best practices and document them.
- Standardizing the best practice.
- Demonstration of water management solutions integrating E, F nexus at the real level
- Develop a system to be used as a showcase to be replicated
- Applied examples are needed to convince the market of the benefits of the Nexus approach and its sustainability

Collecting, standardizing and evaluating the best practices and/or smart solutions (i.e. smart farms in the rural world, how to extend the benefits of natural water infrastructures and/or nature-based solution of water management to energy and food nexus,); to develop a system to be used as a showcase of water management solutions integrating E, F nexus at the real level (i.e. reed beds, water treatment, solar pumping stations, etc.), to be replicated by relevant actors and/or to be considered as prototypes to convince market of the Nexus approach benefits and its sustainability.

STEP 3

MARKET ORIENTED RESEARCH

- Investigation and deep analysis concerning virtual water to give the water the appropriate cost
- Developing a nexus labeling through LCA approach as market criteria for products prices at MED level.
- To develop a tool (DSS) to support producers/decision makers to select the most feasible solutions.
- Up scaling and replicating the high positive impact smart solutions

Support innovation project run by industry and academia (multi-stakeholders) to bridge the gap between research and societal needs. Project can target to WEF labeling, nexus smart greenhouses, WEF semi-arid biomass and soil management.

Support business creation in the MED area (co-production, co-generation, co-ownership, ...) on WEF products and services solutions

Developing a NEXUS-oriented labeling system (also using LCA approach, virtual water, ...) as market criteria for products prices at MED level.

Organize EU-Mediterranean brokerage events aimed to create research/SMEs-public/private partnerships on the marketable aspects of WEF nexus.

STEP 4

CAPACITY BUILDING - MULTILEVEL AWARENESS RAISING

- Developing the curricula to integrate NEXUS concept in Higher Education and Research Centers missions
- Integration of NEXUS concept in Higher Education curricula and Research Centers missions

To develop tools for new WEF skills (a new generation of “game changer” professional profiles), including Med Master as well as capacity building targeting decision makers, also using pilot cases (see step 2) and/or brokerage events aimed to create research-public/private partnerships on the marketable aspects of WEF nexus.

Conclusions

Adopting the nexus approach in a large-scale, system-wide manner may be challenging because we have a limited knowledge of how food, water and energy systems operate and interact.

A nexus approach provides more flexibility to confront complex challenges like natural resource depletion and climate change adaptation. Change can only happen if policy makers, enterprises/industries and consumers alike better understand these interconnections.

The existing knowledge gap in the W-E-F nexus needs to be bridged by concentrated active research to identify:

- **Inter-dependencies (Data and Analysis)** - In order to assess and analyse Nexus interactions, we need accurate, pertinent and timely data. In some cases there is a huge accumulation of data in all the sectors, but they are not or under-utilized due to a mismanagement and lack of coordination of the existing and planned observing systems around the world. At the same time, we need to support the development of new systems, tools and services. This will help to fill data gaps and to provide key data to decision-makers.
- **Current and future challenges (Scenario development)** - The cross-sectorial nature of the Water-Energy-Food Nexus indicates a need to create a shared understanding of the interrelations between water, energy and food as well as the underlying drivers. This can best be done through scenarios. A constant attention about the priorities in the Mediterranean, considering the market's today stand and future trends, should be paid.
- **Opportunities (Response options)** – Sometimes science and technological solutions to face the nexus challenges already exist; actions need to be triggered by developing policies. Often, separate bodies are in charge of different aspects that appear difficult to integrate into a unified policy frame. The working area should refer to a) the planning and implementation of new policies, regulations and incentives, capacity development and training, and technical interventions; and b) the process of evaluating and revising already existing policies and strategies.
- **Appropriate and effective governance, institutional, and organizational frameworks (Stakeholders dialogue)** - The stakeholder dialogue is a continuous process that brings together the different working areas through a participatory process of engaging with all relevant stakeholders and experts. The dialogues have to be designed for a specific context – regional, national, local or basin level – and problem, e.g. to evaluate a national policy on water, energy and food systems.

A regional approach should be considered through the Nexus, giving emphasis on “South-to-South” diversification, introducing innovation (e.g. ICT, biotechnologies and social innovation) that does not come into conflict with other aspects as human development, education and gender aspects.

Government policy, both at national and international level, must set the stage by improving data monitoring and gathering programs, overcoming the logic of isolated resource management and understanding how the water-energy-food systems and processes overlap through reports and studies.

The above mentioned steps must be combined with sensible policies and regulations that encourage cooperation between individual citizens, research bodies, governments and industry so that all decisions should be sustainable and legitimate. Improve consensus among different sectors (Research, Policy and Society) and stakeholders appears to be the best way to achieve a form of public ownership of knowledge about nexus.

Nexus should not just be another suit for multidisciplinary approach. As proved by several examples of “good practices” this already exists in many instances, especially at local scale. We rather have to focus on other issues related to common socio-economic interests where common stakes may prove impacting positively policy makers’ decision.

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ANNEX 1

Table 2 – Preliminary analysis outcomes: draft list of Main Problems and Specific Objectives.

Table 3 - Nexus Main Problems and Specific Objectives, for each group – WG1 – WATER vs. ENERGY & FOOD

Table 4 - Nexus Main Problems and Specific Objectives, for each group – WG2 – FOOD vs. ENERGY & WATER

Table 5 - Nexus Main Problems and Specific Objectives, for each group – WG3 – ENERGY vs. WATER & FOOD

Table 6 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (WATER vs FOOD&ENERGY)

Table 7 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (FOOD vs WATER&ENERGY)

Table 8 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (ENERGY vs FOOD&WATER)

Table 2 - Draft list of Main Problems and Specific Objectives, identified during the first two EMEG Meetings (Lisbon, 2013; Sousse, 2014), in the course of the MedSpring Meeting of the Project Coordinators Platform (Barcelona, 2015) as well as coming from the literature review.

Main Problems	Main Objectives
<ul style="list-style-type: none"> • Deficit of involvement of stakeholders (e.g. policy makers, industry, civil society, end users, decision makers, private sector) in Joint Mediterranean strategy in the nexus. • Lack of initiatives/actions tailored to local needs in current Joint EU and MPCs programs, integrating gender needs, mainstreaming and SMEs. • Weak interaction between academia, industry/SMEs and final users. • Use of inappropriate communication methods, media and languages to disseminate research results. 	<ul style="list-style-type: none"> • Promoting participative policies design, taking into account socio-environmental aspects, ensuring inclusion of different stakeholders at various stages. • To increase the level of social awareness to fuel a Nexus thinking and to establish a multi-stakeholder dialogue involving the civil society, the private sector, decision-makers, etc. • Empowering civil society and resource users, (to bring local needs into the research focus)
<ul style="list-style-type: none"> • Migration caused by shortage and unsustainable management of resources • Insufficient focus of the employment market on supporting green jobs 	<ul style="list-style-type: none"> • Creating regional clusters of research organizations and institutions • Building regional co-ownership of resources management • To promote cooperation between public and private sector to improve the relationship between Nexus knowledge, market needs and employment opportunities in the framework of sustainability.
<ul style="list-style-type: none"> • Scientific evidence on nexus-related problems not being appropriately translated into political terms linked to poor awareness of decision makers. • Insufficient access to information and low communication flow among MS-MPC and EU as well as low participation of MPCs in Platforms and policy setting instruments. Poor engagement of mid-level policy makers. 	<ul style="list-style-type: none"> • Improving the links between scientific world and policy makers, developing common knowledge and continuous policy dialogue • Enhancing co-ownership by ensuring more participation of MPCs representatives and thematic experts in decision making and programme definition • To promote integration of different policy domains. • Construct medium- to long-term Research Agendas focused on a few challenges of common interest.
<ul style="list-style-type: none"> • Discontinuity of funding, discrepancies in budget allocations between North/South Mediterranean Countries. • Lack of integrated financial support to the whole research cycle. • SMEs limited use (insufficient demand) of research results 	<ul style="list-style-type: none"> • Ensuring durable funding mechanisms and equal budget allocation adopting also flexible administrative and financial procedures combined with capacity building actions for MPCs administrators.
<ul style="list-style-type: none"> • Poor management of natural resources 	<ul style="list-style-type: none"> • Promoting resources efficiency in sustainable agriculture under Mediterranean climate conditions.

Main Problems	Main Objectives
<ul style="list-style-type: none"> • Lack of enabling institutional environment (complex bureaucracy, insufficient decentralisation) • Insufficient degree of cooperation at regional level for tackling common challenges 	<ul style="list-style-type: none"> • Identifying regional priorities for improving research and capacity building, addressing specific local needs, to foster long term cooperation between EU and MPCs. • Strengthening the Mediterranean region towards project co-design in the management and use of resources always considering market demands and social trends.
<ul style="list-style-type: none"> • Unsustainable practices in water management • High level of food (and virtual water) waste “from fork to table” • Too much energy produced is still “oil-based” or is not clean/renewable • Intensive industrial livestock production and inadequate grazing and water withdrawal contribute to widespread degradation and pollution of water and land resources. 	<ul style="list-style-type: none"> • Managing water resources under scarcity, pollution and uncertainty. • Improving agricultural water use efficiency. • Promoting non-conventional water treatment and reuse. • Reduce waste and minimize losses along the food production chain by changing mind-set and incentivizing technology in supporting reuse.

Table 3 - Nexus Main Problems and Specific Objectives, for each group – WG1 – WATER vs. ENERGY & FOOD

Nexus Main Problems	Nexus Specific Objectives
1. Lack of strategies and poor policies harmonization for WEF that enable a proper implementation of the nexus approach in the region	Develop WEF national and regional strategies through trans-disciplinary committees
2. Scattered authorities responsible for the water, food and energy sectors at country level (as well as at regional level)	
3. Poor dissemination of information about success stories (traditional know-how, project, good practices)	Addressing WEF gaps and strengths (SWOT) if available and identify different stakeholders needs (stakeholders analysis)
4. Lack of awareness and poor understanding of the W-E-F nexus (nexus illiteracy) by different actors (policy makers, industry and market, academia, civil society) which affected the acceptance and the proper adoption of the nexus approach.	
6. Lack of capacity (education, training) among policy makers and practitioners	Identifying specific crossing areas and educating/training people for system integration within cross disciplinary themes for nexus solution
7. No observatories, reference institutions and data (i.e. statistical analysis, scenario simulations, ...) are available (or easily accessible) to relevant stakeholders	Formation of a database of common areas for the WEF
8. Urbanization as well as migration from rural areas would affect the implementation of the nexus	Setting up socio-economic policies in order to maintain rural population
9. Climate change and its relation with the WEF nexus are not enough studied	a) Supporting and increasing the research in the field of climate change adaptation and mitigation. b) Developing models that include the "climate change" factor with the other WEF factors e.g. life cycle assessment of products, ...etc.

Nexus Main Problems	Nexus Specific Objectives
10. No or limited investment in the applied research to make low cost technologies in WEF sector	a) Collaboration across ministries in charge of WEF at different levels of government and international cooperation for common strategy of investment. b) Promote financing and incentive schemes for innovative SMEs to develop appropriate near-market solutions through risk-sharing mechanisms. c) Balance different development goals by managing trade-offs and exploring opportunities for synergies in light of growing resources.
11. Lack of tools and mechanisms to integrate the different aspects in water management	a) Promote multidisciplinary RDI (national and international) in water sector to include food and energy interfaces. b) Set up coordination platforms involving the three aspects WEF at different operational levels. c) Develop strategies that allows Integrated Water Management (IWM) and planning for the future national resources.
12. Lack of market (and users) oriented solutions in nexus research	a) Identify specific markets niches where NEXUS solution can play a social and economic role. b) Evaluate market areas within the Mediterranean region. c) Disseminate/share results toward public and private investment at the MED level.

Table 4 - Nexus Main Problems and Specific Objectives, for each group – WG2 – FOOD vs. ENERGY & WATER

Nexus Main Problems	Nexus Specific Objectives
1. Inappropriateness of current policies and governance in the EU-Med food sector to achieve food security by uptaking the nexus approach and addressing nexus-related challenges	Promoting participatory policy design taking into account socio-environmental aspects Integrating the nexus concepts in all national policies
	Improving governance models and arrangements for achieving broader participation in the nexus arena
2. Insufficient scientific knowledge and innovative research on the effects of water and energy resources on food security	Encouraging scientific research and innovation activity on food security in the nexus context
	Developing appropriate innovations based on scientific and socio-economic knowledge to promote business opportunities
3. Lack of awareness, inadequate communication and participation of all stakeholders, including civil society, in the challenges addressed by the nexus thinking	To increase awareness of relevant stakeholders about nexus approach
	Improving communication methods and media regarding the nexus paradigm
	Fostering involvement and participation of relevant stakeholders in nexus related policy design and research and innovation activities

Table 5 - Nexus Main Problems and Specific Objectives, for each group – WG3 – ENERGY vs. WATER & FOOD

Nexus Main Problems	Nexus Specific Objectives
1. Lack of strategic policy formulation and governance towards the nexus.	Formulate strategic and coherent policies and implement appropriate governance structures towards the Nexus
2. Poor interaction between public and private sector due to insufficient funding to promote nexus approach.	Improving interaction between public and private sectors including incentives for funding
3. Fragmentation of international cooperation	Increase the number of integrated “nexus” projects under international funding schemes
4. Lack of multi-disciplinarity and cooperation at the policy, research and management levels in each individual sector.	Create platforms of cooperation among the three sectors in the policy, management and research levels.
6. Lack of public/private and international organisations’ partnerships to facilitate market access to nexus related new technologies .	Increase the awareness for the necessity for cooperation among the public and private sectors
7. Governance and citizens’ involvement with a gender consideration. Importance of cross-sectorial involvement of all stakeholders and need for adequate funding.	Promote citizens’ and stakeholders’ engagement for efficient governance, including securing adequate funding for relevant actions, ensuring gender
8. Lack of communication awareness and ICT models about Nexus	To identify Key parameters and connexions in Nexus
	Provide and analyse understandable integrated solutions
9. Lack of capacity building and educational tools about Nexus	Provide knowledge to society
10. Absence of success stories and showcases about Nexus	Valorisation of nexus initiatives and tools
	Development of optimised real nexus systems
11. Lack of national/ EURO MED trans-disciplinary cooperation among the researchers of the different domains for NEXUS	Establishment of MEDSPRING as a permanent platform to sustain NEXUS innovation.
Need to harmonize EURO MED strategy on NEXUS	Promote the implementation of EURO MED strategy on NEXUS
12. Lack of tailored communication tools and strategies between Academia-Industrialist-Government for NEXUS	Dissemination of success stories.

Table 6 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (WATER vs FOOD&ENERGY)

	Nexus Main Problems	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
Governance	Lack of strategies and poor policies harmonization for WEF that enable a proper implementation of the nexus approach in the region	Develop WEF national and regional strategies through trans-disciplinary committees		1) Map and assess available nexus strategies (at national/regional level), 2) establish a committee 3) to develop (using a participatory approach) the WEF strategy and 4) set a master plan, 5) monitoring the implementation of the plan
	Scattered strategies from the authorities responsible for the water, food and energy sectors at country level as well as at regional level		Formulation of multi-sectorial and adopt development practices capable of achieving integrating and comprehensive planning and management in the areas of water, energy and food security for current and future generations	
Social and cultural	Poor dissemination of information about success stories (traditional know-how, project, good practices)	Addressing WEF gaps and strengths (SWOT) if available and identify different stakeholders needs (stakeholders analysis)	1) identify, promote and share knowledge of success stories, WEF pilot projects, initiatives, good practices and innovative technologies.	1) Establish clusters to implement multi-disciplinary awareness WEF-based trainings for different actors;
	Lack of awareness and poor understanding of the W-E-F nexus (nexus illiteracy) by different actors (policy makers, industry and market, academia, civil society) which affected the acceptance and the proper adoption of the nexus approach.			1) Working with stakeholders at different levels to improve public sector-led governance, planning and information through training, education and dialogue. 2) Establish national frameworks that encourage empowerment, mainstreaming gender issues, research, information and education.
	Urbanization as well as migration from rural areas would affect the implementation of the nexus		Setting up socio-economic policies (e.g. incentives for young farmer) in order to maintain rural population	

	Nexus Main Problems	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
Technical/ Practical / Capacity	Lack of capacity (education, training) among policy makers and practitioners	Identifying specific crossing areas and educating/training people for system integration within cross disciplinary themes for nexus solution		1) To introduce WEF and Sustainable Development concepts in the educational system (basic/high education)
	No observatories, reference institutions and data (i.e. statistical analysis, scenario simulations, ...) are available (or easily accessible) to relevant stakeholders	Formation of a database of common areas for the WEF	1) Conduct survey about available data, identification of gaps, create a new database (nexus database of WEF relevant data)	
	Climate change and its relation with the WEF nexus are not enough studied	a) Supporting and increasing the research in the field of climate change adaptation and mitigation. b) Developing models that include the "climate change" factor with the other WEF factors e.g. life cycle assessment of products, ...etc.	1) Bridging the knowledge gap on WEF by concentrated multi-disciplinary research among the institutions and organizations involved in WEF development; 2) Create a global water knowledge hub that is relevant, visible, credible and low-cost to facilitate the work of researchers in different disciplines.	
	Lack of tools and mechanisms to integrate the different aspects in water management	a) Promote multidisciplinary RDI (national and international) in water sector to include food and energy interfaces. b) Set up coordination platforms involving the three aspects WEF at different operational levels. c) Develop strategies that allows Integrated Water Management (IWM) and planning for the future national resources.	1) Demonstration of water management solutions integrating E, F nexus at the real level (demonstrative pilot project sites); 2) to extend the benefits of natural water infrastructures and/or nature-based solution of water management to energy and food nexus	
Economy	No or limited investment in the applied research to make low cost technologies in WEF sector	a) Collaboration across ministries in charge of WEF at different levels of government and international cooperation for common strategy of investment. b) Promote financing and incentive schemes for innovative SMEs to develop appropriate near-market solutions through risk-sharing mechanisms. c) Balance different development goals by managing trade-offs and exploring opportunities for		1) One-to-one meetings between researchers and possible investors (brokerage events) to define market niches/needs and nexus approach

Nexus Main Problems	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
	synergies in light of growing resources.		
Lack of market (and users) oriented solutions in nexus research	a) Identify specific markets niches where NEXUS solution can play a social and economic role. b) Evaluate market areas within the Mediterranean region. c) Disseminate/share results toward public and private investment at the MED level.	1) Developing a nexus labeling through LCA approach as market criteria for products prices at MED level. 2) Investigation and deep analysis concerning virtual water to give the water the appropriate cost. 3) To develop a tool (DSS) to support producers/decision makers to select the most feasible solutions.	1) To better understand the relation of food quality in relation to foreign market regulations. 2) Organize One-to-one meetings between researchers and possible investors (brokerage events) to define market niches/needs and nexus approach.

Table 7 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (FOOD vs WATER&ENERGY)

	Nexus Main Problems	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
Governance	Inappropriateness of current policies and governance in the EU-Med food sector to achieve food security by uptaking the nexus approach and addressing nexus-related challenges	Promoting participatory policy design taking into account socio-environmental aspects		1) <i>Build a stakeholder platform to promote a multilevel participatory policy design; 2) Development of a framework to explore challenges and barriers to achieve appropriate policies</i>
		Integrating the nexus concepts in all national policies		
Technical/Practical/Capacity	Insufficient scientific knowledge and innovative research on the effects of water and energy resources on food security	Improving governance models and arrangements for achieving broader participation in the nexus arena		1) <i>Understanding on the existing legislation in relation to food security nexus at national and EU-MED level – identifying existing gaps and make recommendations for improvements</i> 2) <i>Provide T&E on food security nexus concept for potential stakeholders</i>
		Encouraging scientific research and innovation activity on food security in the nexus context		1) <i>Creation of a Platform formed by Universities, RD centers, public org., SME's, food industries, stakeholders, end users, etc., with a view to develop and share knowledge, appropriate methods and networking in EU-MED</i>
and	Lack of awareness, inadequate communication and participation of all stakeholders, including civil society, in the	Developing appropriate innovations based on scientific and socio-economic knowledge to promote business opportunities		1) <i>Build a strategy for exploring and anticipating the risks, opportunities and challenges taking into account the Nexus framework in a moving world, Clustering funders, industry, researchers</i>
		To increase awareness of relevant stakeholders about nexus approach	1) <i>Training and Capacity building activities addressed to planners and researchers dealing with NEXUS</i>	

Nexus Main Problems	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
challenges addressed by the nexus thinking	Improving communication methods and media regarding the nexus paradigm		1) <i>Designing and implementing awareness campaigns addressed especially to relevant stakeholders,</i> 2) <i>Establishment of a knowledge gateway and hub for exchange of good practices related to NEXUS adoption in policy, research and practice,</i> 3) <i>Supporting existing forums, conferences dealing with issues addressed by the nexus</i>
	Fostering involvement and participation of relevant stakeholders in nexus related policy design and research and innovation activities		1) <i>Creation of EU-MED Network of existing public stakeholders and Creation of territorial/local multi-stakeholder and inclusive platforms/forums involving relevant stakeholder</i>

Table 8 – Log-frame (Nexus Main Problems-Specific Objectives-Suggested Actions) (ENERGY vs FOOD&WATER)

	Nexus Main Problems- Policy	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
Governance	Lack of strategic policy formulation and governance towards the nexus.	Formulate strategic and coherent policies and implement appropriate governance structures towards the Nexus		1) Commission an integrated group of scientific experts in W-E-F + social sciences with a) a needs analysis (demand for a paradigm shift towards the nexus) and b) a mapping of stakeholders for a nexus related shift of paradigm and a roadmap of necessary action.
	Lack of national/ EURO MED trans-disciplinary cooperation among the researchers of the different domains for NEXUS	Establishment of MEDSPRING as a permanent platform to sustain NEXUS innovation.		1) To launch network from MEDSPRING members to sustain Nexus Innovation and extend cooperation
	Need to harmonize EURO MED strategy on NEXUS	Promote the implementation of EURO MED strategy on NEXUS		1) Elaborate an inclusive work plan to promote the strategy on NEXUS
	Lack of multi-disciplinarity and cooperation at the policy, research and management levels in each individual sector.	Create platforms of cooperation among the three sectors in the policy, management and research levels.		1) Create inter-sectorial committees at policy & management level made up by specialists in WEF that make sure that the nexus approach is applied 2) Broker scientific events (conferences etc.) and promote relevant mobility programs
	Fragmentation of international cooperation	Increase the number of integrated “nexus” projects under international funding schemes		1) Establish a permanent dialogue platform of public and private partners for the agenda setting of the validation of research results with the goal of sustainable and inclusive problem solutions
Social and cultural	Lack of tailored communication tools and strategies between Academia-Industrialist-Government for NEXUS	Dissemination of success stories.	1) Highlighting and evaluating the best practices and document them 2) Standardizing the best practice 3) Adapting and replicating to a specific environment	

	Nexus Main Problems- Policy	Nexus Specific Objectives	Technical Actions	Institutional/Governance Actions
	Governance and citizens' involvement with a gender consideration. Importance of cross-sectorial involvement of all stakeholders and need for adequate funding.	Promote citizens' and stakeholders' engagement for efficient governance, including securing adequate funding for relevant actions, ensuring gender		1) Promote and fund inter-sectorial deliberative spaces with clear implementation commitments by policy makers; 2) Upgrade the institutional framework to implement the output of the above stakeholder involvement processes
Technical/practical/capacity	Lack of communication awareness and ICT models about Nexus	To identify Key parameters and connexions in Nexus Provide and analyze understandable integrated solutions	1) Develop data management plan for NEXUS including data collection, IT model and platforms	
	Lack of capacity building and educational tools about Nexus	Provide knowledge to society	1) Develop educational program and materials; 2) Develop on job training tailored to end users; 3) Organize seminars, workshops, etc...	
	Absence of success stories and showcases about Nexus	Valorization of nexus initiatives and tools	1) Develop a system to be used as a showcase to be imitated	
		Development of optimized real nexus systems		
Economy	Poor interaction between public and private sector due to insufficient funding to promote nexus approach.	Improving interaction between public and private sectors including incentives for funding		1) Create a EU-MED platform (based on the MEDSPRING EMEG + additional players) for supranational exchange and transfer of best practices
	Lack of public/private and international organizations' partnerships to facilitate market access to nexus related new technologies .	Increase the awareness for the necessity for cooperation among the public and private sectors	1) Fund a pilot project to showcase the benefits of the nexus approach from a market point of view.	1) Establish a funding programme led by the EC promoting industry-academia/public-private cooperation in the WEF nexus approach.

ANNEX 2

List of Euro-Mediterranean Experts Group members

First Name	Last Name	Institution	Country
Amr Farouk	Abdel Khalik	Academy of Scientific Research and Technology - Egypt	Egypt
Majd	Al Naber	Higher Council for Science and Technology Jordan	Jordan
Halil Ibrahim	Atabay	TUBITAK	Turkey
Claude	Ayache	KIC-INNOENERGY	France
Rita	Baraldi	CNR	Italy
Carine	Baroudi Barakat	ENTOTOX PUBLIC HEALTH SARL 2000	Lebanon
Soukeina	Bouraoui	CENTER ARAB WOMEN FOR TRAINING AND RESEARCH	Tunisia
Latifa	Bousselmi	CERTE - Centre des Recherches et Technologies de l'Energie	Tunisia
Adriana	Bruggeman	Cyprus Institute	Cyprus
Anabela	Carvalho	FCT - FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA Portugal	Portugal
Eduardo	Cuoco	IFOAM	Italy
Khuloud J. Khayyat	Dajani	Al Quds University	Palestine
Khaled	Djelouah	CIHEAM - IAMB	Algeria
Hamid	El Bilali	CIHEAM - IAMB	Morocco
Rasha	El-kholy	Faculty of Engineering/Heliopolis University; SEKEM	Egypt
Yuval	Eshdat	Agricultural Research Organization, Volcani Center, IL	Israel
Anna	Fumarola	Fondacion Mujeres por Africa	Italy
Nestor	Fylaktos	The Cyprus Institute	Cyprus
Mauro	Gamboni	IBBR-CNR Institute of Bioscience and Bioresources	Italy
Ian	Gauci Borda	Malta Council for Science and Technology	Malta
Ahmed	Ghrabi	CERTE - Centre des Recherches et Technologies de l'Energie	Tunisia
Victor Manuel	Goncalves Silva	FCT - FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA Portugal	Portugal
Joan	Grimalt	Spanish Council for Scientific Research (CSIC)	Spain
Amen Allah	Guizani	CERTE - Centre des Recherches et Technologies de l'Energie	Tunisia
Imad	Ibrik	An-Najah National University/ Energy Research Centre Nablus-West Bank-Palestine	Palestine
Ahmed Torky	Jailany	Faculty of Agriculture, Dept. of Agricultural Engineering - Alexandria University	Egypt
Moez	Jebara	MESRST	Tunisia
Maria	João Fernandes	FCT - FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA Portugal	Portugal
Rafik	Karaman	Al Quds University	Palestine
Abdel-Wahab	Kassem	Alexandria University (AU)	Egypt
Sifeddine	Labed	Ministry of Post and Information and Communication Technologies Algeria	Algeria
Nicola	Lamaddalena	CIHEAM - IAMB	Italy
Christian	Leduc	Institut de Recherche pour le Développement (IRD)	France
Eduardo	Maldonado	FCT - FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA Portugal	Portugal
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