

PILOT ACTION TO FOSTER SUSTAINABLE NEXUS INNOVATION & CO-DEVELOPMENT IN THE MEDITERRANEAN AND AFRICA

Authors: C. Ayache, D. Latella, C. Perakis, G. Perez, A. Soraci

SUMMARY/RATIONALE

This document provides evidence about a needed pilot action preparing the emergence of a structured and sustainable NEXUS innovation and co-development area in the Mediterranean area as well as in Africa. Co-development actions target specific marketable solutions that could – in an integrated and synergetic way as described by the NEXUS approach – be adapted to social, societal and economical needs in those geographical regions most affected by climate change and development challenges. With this respect, innovation can arise by multiple sources or multiple paths such as: thinking with a different perspective, integrating different technologies to solve integrated and co-related problems, organizing new institutions of governance, writing new narratives regarding development, integrating and using tried and tested technologies and tools in new contexts and educating citizens at the local level. Innovation is mandatory for adapting generic technologies to specific regional targets and the latter, in turn, constitute a strong driver of innovation in general. In this process, North-South as well as South-South and public-private collaborations are supposed to be proving beneficial to all parties and favour the emergence of a common regional clean-tech market, while a coordinated EU policy is an essential factor for establishing and maintaining virtuous dynamics to reach this objective. This was recognised in the recent EC communication “Accelerating Clean Energy Innovation”¹ which states, amongst actions to promote the Leveraging Europe’s global role, that ‘*the Commission will work with Member States to launch one or two joint deployment programmes in developing countries in the areas of energy efficiency and renewables, with a focus on Africa as a privileged partner...*’, those programmes being expected to ‘*couple research and innovation with capacity building in the host country*’ and to link the innovation and social innovation capacity with the change in behaviors. Also the EC communication, “The EU approach to resilience: Learning from Food Security crises”², recognizes the need that the EU Agenda for Change has to prioritise cooperation in sustainable agriculture, including the safeguarding of ecosystem services and food and nutrition security in the EU’s future long-term development assistance” spotting the strong linkage between sustainable food and ecosystem. In this regard, it is evident that sustainability can be pursued only by a strong and rigorous respect, amongst others, of the Water Framework Directive³. These policies are supported by several other studies and activities done in the last years regarding the need to get on the policy agenda the water, food and energy nexus.^{4,5}

From what’s described above, the strong interrelation between energy, food and water for a sustainable and climate resilient environment and the need for more vigorous efforts in the African landscape is clear.

FACING CHALLENGES TOGETHER

In the run-up of the Rio+20, the Bonn 2011 Nexus Conference contributed to a better understanding of the interdependencies between the water, food and energy security and highlighted the need for more systemic thinking to identify synergies and trade-offs between different sectors, interest groups and development goals. Global demands for food and energy are expected to increase by 50% and for freshwater by 30% in 2050 considering the

¹ COM(2016) 763 final, Brussels, 30.11.2016

² COM(2012) 586 final, Brussels, 03.10.2012

³ Directive 2000/60/EC

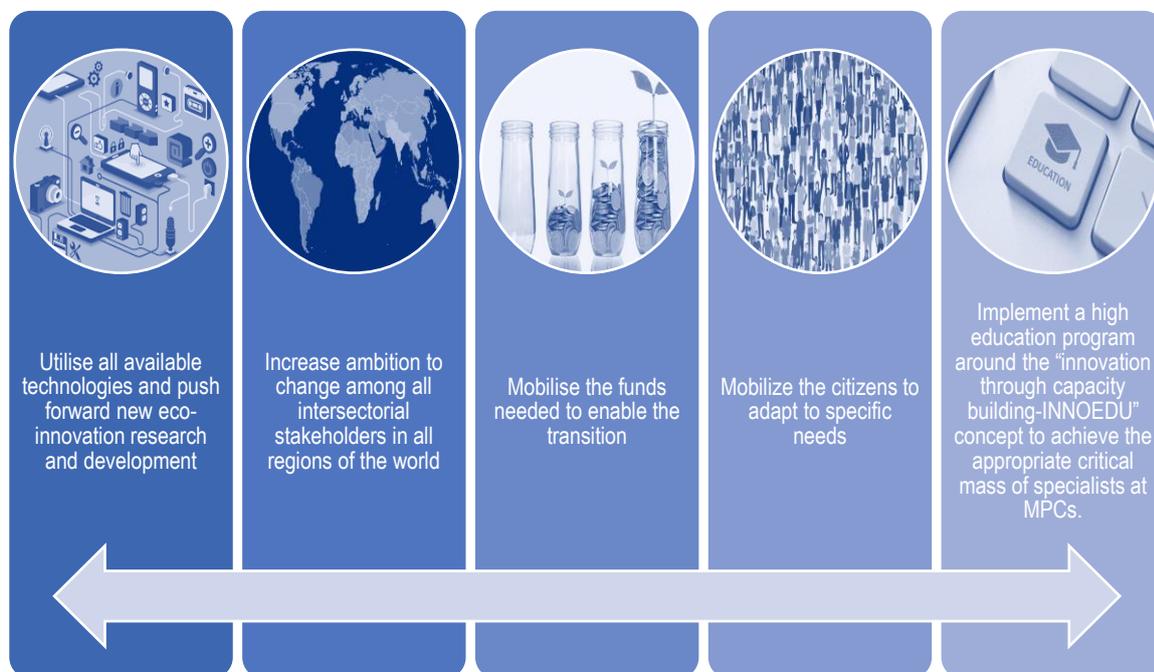
⁴ Economic and Social Commission for Western Asia - Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving Sustainable Development Goals - 2016

⁵ OECD: The Productivity-Inclusiveness Nexus C/MIN(2016)3 - 2016

year 2015 baseline.⁶ Several working groups have discussed during the last years how the trade-offs between water, energy and food affect economic growth, and how they could be addressed.

There is a clear need to move away from a “silo” approach to more integrated policy making in the areas of climate, water, energy and land-use policies. Governments have to play a key role in integrating the nexus into national strategies and policy frameworks. Yet in most governments, responsibilities for water, food and energy security are placed in separate ministries. The inter-linkages of the nexus increase the already complex task of co-ordination and co-operation among government entities⁷.

Therefore, comprehensive assessment should consider resource planning across sectors in the MPC region to capture as many interlinks and impacts as possible through modelling or trade-off of UN-SDG 2 (2.3-2.4), 6 (6.1-6.6), 7 (7.1-7.3) and consequently 12 (12.8), 15 (15.1) and 17 (17.6, 17.9, 17.16, 17.17) to capture the envisioned integration of the NEXUS. To make the next step-change in the energy, food, water nexus, countries must focus on five core objectives:



Mediterranean, both at northern (mainly EU regions) and southern sides of the rim, and sub-Saharan Africa are regions of the world where the impact of climate change is stronger, implying increased desertification and environmental modification such as sea water temperature increase. These regions also show big development needs with a strong demographic pressure and legitimate aspiration for improved life. Doing nothing may generate a threat for Europe by an increase of migration and instability in the African countries, while, collaborating on an equal footing may create a virtuous dynamics for both parties and contribute to an efficient implementation in line with COP21/22 objectives. On the other side, long-term sustainability requires acknowledging that many of the resources that support development—energy, water, land, materials—are finite and are also needed to support vital ecosystem services. Development can only be sustainable if it works within those constraints, over time, and across sectors and locations.⁸ In March 2011, the World Policy Institute, a non-partisan global think tank, and EBG Capital, an asset manager focused on alternative investments in energy, environment, and sustainability, in their report named THE WATER-ENERGY NEXUS - Adding Water to the Energy Agenda wrote “*The competition*

⁶ Leck, H, Conway, D, Bradshaw, M, and Rees, J (2015), Tracing the Water–Energy–Food Nexus: Description, Theory and Practice. *Geography Compass*, 9, 445–460.

⁷ OECD - Global Forum on Environment: New Perspectives on the Water-Energy-Food-Nexus - 2014

⁸ A Nexus Approach to the Post-2015 Agenda: Formulating Integrated Water, Energy, and Food SDGs N. Weitz, M. Nilsson, and M Davis - *SAIS Review of International Affairs*, Volume 34, Number 2, Summer-Fall 2014, pp. 37-50 (Article)

between water and energy needs represents a critical business, security, and environmental issue, but has not yet received the attention that it merits. Energy production consumes significant amounts of water; providing water, in turn, consumes energy. In a world where water scarcity is a major and growing challenge, meeting future energy needs depends on water availability –and meeting water needs depends on wise energy policy decisions. After 6 years the topic is still alive and unsolved, it is evident that the problem is not to have available just better technologies but it is necessary to adopt an integrated holistic view.

The technologies linked to the use of resources have a universal character. Their deployment under specific climate, economical and societal conditions necessitates adaptations which are strong drivers for innovation. This constitutes an opportunity for increased and beneficial collaboration and for enhanced market activity, including job creation and upgraded people wealth. One should not just think in terms of northern technology deployed in southern markets, but rather in terms of co-development targeting a common structured area for mutual exchange of knowledge, products and services. The conditions in order to implement this concept pass by the guidance of well-educated natives. The INNOEDU program should be a key tool to accomplish this objective. This task could complement a more comprehensive education to provide for each particular country the critical mass of specialists needed for the medium/long term.

Among the numerous challenges that have to be addressed putting together existent⁹ and future “tailor made” initiatives, one retains:

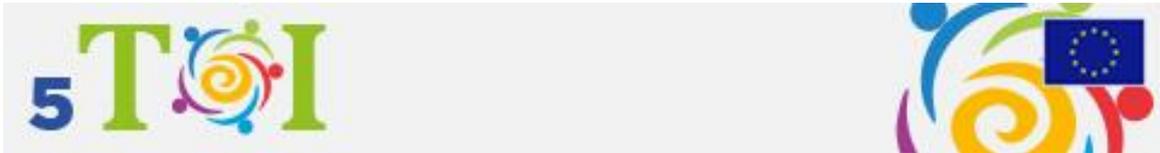
- 
Develop a shared vision about social and economic needs, environmental control and required appropriate technological solutions;
- 
Identify main action lines for innovation and market up-take, including adaptation of leap-frog strategies;
- 
Develop the human factor necessary to the emergence of a new and enlarged regional markets for sustainable exploitation of NEXUS and adaptation to Climate change;
- 
Support jointly business creation by delivering transnational services especially through a coordinated and federated network of clusters (“meta-cluster”) aggregated following a NEXUS approach and acceleration measures for innovation development;
- 
Secure financing devoted to sustainable NEXUS innovation on a public-private and transnational basis;
- 
Articulate Education and Research and Innovation efforts together with capacity building actions, especially through coordinated international, national and regional development programmes also by following a regional smart specialization focus.
- 
Sketch out the contours of regional ‘internal markets’ sharing common standards, developing common demonstration programmes and ultimately favouring joint transnational undertakings and investments.

THEMATIC FOCUS ON NEXUS FOR INNOVATION

Well-conceived regional deployment – integrated with existing initiatives⁸ and built on successful experience¹⁰ - may prove an efficient driver for innovation both as regards progress in specific energy, water and agri-food

⁹ PRIMA, ERAMEDNET, ARIM-NET. LEAP-AGRI, just to name some

¹⁰ ETRERA_2020, FP4BATIW, MARE, the R2I alliance, just to name some



technologies as in their use for specific business activities. Solving regional issues will let leading innovations and their associated enterprises in several economic sectors to emerge with ultimately, a broader impact. Therefore, it is required to perform NEXUS sustainability assessments within and across the MPC regions to address unsustainable trends in the use of natural resources by the corresponding verification across water, energy and food sectors of performance (policies, protection and conservation, legislative frameworks, incentives and finances), process (participation frameworks, sector management, roles and functions) and impact (demands, uses, threats, challenges, conflicts) indicators. Once verified, the selection of key indicators for comparative comparison among regions and within countries to assess the best practices and contribute to the comparative sustainability assessment will be required .

One can anticipate significant progress in different sustainable NEXUS approaches to face societal challenges within the water, energy and food sectors. Below some examples of possible lines of intervention to check the corresponding sustainability assessment within the MPCs region are listed:

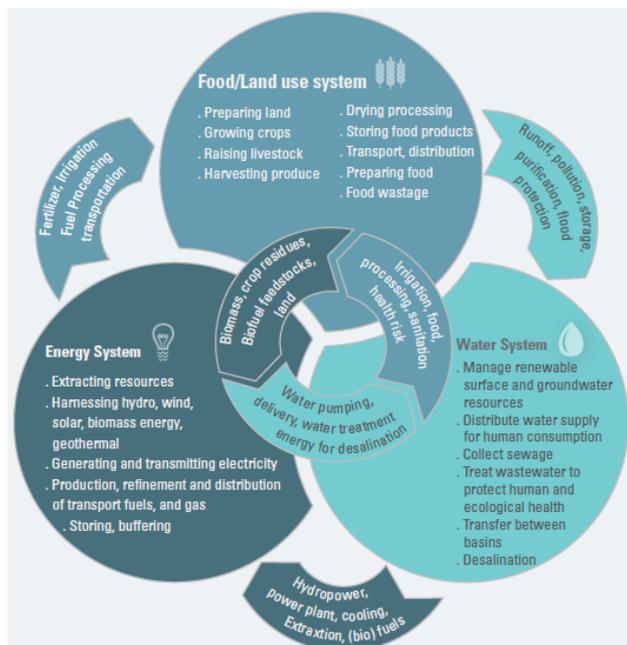
- Monitoring systems of the recharge of the aquifer layer in consequence of the introduction of new technologies
- Technologies to reduce the energy required to deliver 1m³ from water sources also by exploiting and bringing to the market the result of previous initiatives For example, Solar pumping can support the expansion of irrigation, reduce dependence on grid electricity or fossil fuel supply, mitigate local environmental impacts and reduce government subsidy burdens. Despite compelling savings promised by solar-energy water pumps, large-scale adoption is still hindered by various factors, including relatively high capital costs, inertia in adopting new technologies, establishing markets for the technology and ensuring adequate training for installers and operators. Risks are also associated with excessive water withdrawal, since operational costs of photovoltaic pumps are negligible.
- Involvement of the civil society as a strategy for the modification of intermediate and final consumer behaviour: Of utmost importance is the final use for ground water and desalinated water. High quality and high-cost water should be limited to cooking and drinking, while treated wastewater should be used for applications that do not call for high quality, such as toilet flushing and gardening.
- Shifting to more energy-efficient technologies that have a lower energy footprint, such as membrane (SWRO) rather than thermal multi-stage flash distillation desalinating (MSF) or multi-effect thermal vapour compression (MED-TVC), can reduce the energy demand of desalination. Overall, to reduce the environmental footprint, which is especially important in small-scale, off-grid applications and to enhance access to water services.
- Renewable resources, such as wind, hydropower, biomass and geothermal energy, can be used in special desalination plants known as solar cogeneration power desalting plants (SCPDP). SCPDP can be used where integrating concentrated solar power with conventional natural gas-fired power plants can be a real solution for an integrated solar combined cycle system. In overall, to bring closer to the market renewable energy desalination technologies, nowadays under incipient basic research status, especially those promising on providing thousand cubic meters per day.
- Implementation of solar PV systems in combination with Smart-Grid technologies to reduce the need of water for generating electricity in conventional thermal power plants. Also creating strategies for enabling manufacturing of PV panels locally by utilizing domestic resources, factories or technologies as much as possible (and also creating strategies for facilitating technology transfer) towards sustainable PV Power Plant manufacturing and implementation. What is more, implementation of Smart Grid technologies and its functions such as Demand-Response, will help reducing the energy usage and maximizing the utilization efficiency of energy generators.
- Develop integrated-system approaches to specific economic and consumer demands; in this context, consumer appropriation, digitalisation, open and big data, metabolic pattern concept¹¹ (what the population eats, how numerous is the population, what is the production mix, where the population lives) ... are deemed strong drivers for marketable solutions, either products or services;

11 The metabolic pattern of societies : where economists fall short. M Giampietro; Kozo Mayumi; Alevgül H Sorman. Routledge, 2012.

- Nearly Zero Waste and nearly Zero Energy in buildings and industry have a strong regional potential in relation with the structure of regional societal needs and economic activity: agro-industries, building sector, tourism, fishery, energy...
- Support integration between green houses and RES and exploitation of specific biomass and waste.

All these potential action lines can be summarised by a need to focus on innovation in the NEXUS system targeting final uses either for industry and agriculture, or households. In such a context, NEXUS seems a key concept as it induces adapting a series of transdisciplinary technologies to dedicated demand.

The Water-energy-food system



Source: <http://www.se4all.org/sites/default/files/1/2015/03/1.-Mohinder.pdf>

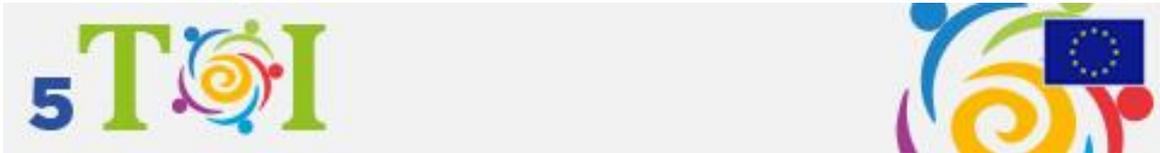
The innovation process is engaged along above lines with relevant national and international plans for developing sustainable technologies with specific targets at given horizons. This trend benefits from significant enhancement in technical education and corresponding professional skills as well as from an improving industrial basis. However, technical education alone cannot stimulate all the component of the innovation process without business education and a cultural environment able to understand the role of innovation.

Euro-Mediterranean Networking was developed over the two last decades establishing reliable links at transnational as well as inter-sectoral levels. However, the feeling is that we are still far from a real shared innovation space where the potential of the region to promote new solutions based on the integration of systems and technologies is appropriately exploited. In the meanwhile, developing new business and satisfying people's needs urges accelerating, enlarging and structuring further the process.

There is the need to open the scenario thinking around a NEXUS approach by shared and joint deployment programmes to develop sustainably at right scale over the next budgetary period, beyond 2020. Until 2020, a pilot action should strongly help to establish a structured frame to reinforce efforts and experiment new synergy formulas.

HOW TO AFFORD THE NEW SCENARIO: PILOT ACTION FOR CO-DEVELOPMENT OF SUSTAINABLE NEXUS INNOVATIONS

A pilot action, integrated and complementary with the ongoing initiatives such PRIMA, should cover the end of H2020 R&I EU programme (Work Programme 2018-2020) or it should be foreseen in the 9th Framework Programme. It should prepare the floor for the launch of an integrating programme to meet the 2030, 2040 and 2050 engagements. The Pilot action should favour the matching of the different national and international related



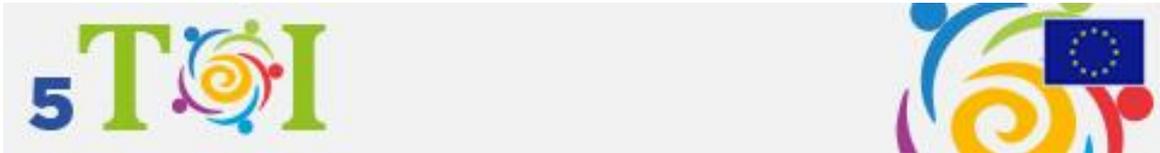
programmes and help matching the investments to the real needs of economic development and people's wealth. The action should have a strong focus on the several forms of innovations with market and society as mandatory targets. Human factor is another strong dimension needed to meet the objectives of the transition in this demanding world region. Furthermore, in order to ensure the sustainability of the action in its three standard dimensions (financial, environmental, social), it is of the utmost importance that the societal impact dimension becomes a driver in all the phases of the project cycle (from programming to evaluation). This will require to embed a mandatory socio-economic dimension in all the design activities as well as including the socio-economic impact as an evaluation criterion.

The Pilot action should develop along five missions:

- 1) Consolidating a structured organisation of actors: governance organizations, finance and micro finance actors, intermediate organization, business innovation centre and technology transfer organization, civil society, researchers
- 2) Co-developing and maintaining knowledge platform concerning sustainable innovations and their adaptation to regional needs in strong alignment with the current initiatives sponsored by international organization: EU, UNIDO, World Bank,
- 3) Planning and Implementation of a high education program to develop the concept of "innovation through capacity building" (INNOEDU) including tech-to-business curriculum, to achieve the appropriate critical mass of specialists at MPCs.
- 4) Co-conducting demonstration experimental joint activities concerning investment, clean-tech market organisation and business creation, also by facilitating the access to the existing research and testing infrastructure available in Africa and Europe to the world. Building synergies from other regions of the world to have lessons to learn and sharing of best practices
- 5) Prepare the establishment of a sustained Regional Integrating NEXUS programme, including the form of its legal status. Involve the innovation players and enablers to stimulate the adoption of a NEXUS Agenda for applied innovations.

1) ***The structured organisation of actors***

The ***structured organisation of actors*** should capitalise on past experience especially that relating to EC projects launched in the context of R&I collaboration within South Neighbouring or African policies. One can mention here, 5TOI_4EWAS, MEDSPRING, ERANETMED, EUROSUNMED, the Energy, water and food related



R2Is projects and other projects of the R2I's Alliance. It should also help and prepare the dialogue between EU, MS and regional concerned countries as well as with International organisations for prioritising R&I agenda and investment programmes. It should help to establish synergy between often disconnected regional initiatives. It will also serve as an inter-sectoral, public-private platform between higher education, research, industry and funding bodies to enable and support such collaboration for high compatibility within the region.

This role to integrate the several existing platforms can't be covered by any of the current ongoing initiatives (most of them have a different focus and target not so strongly related to innovation) Coordination and integration among different initiatives is a must. It is necessary to establish synergies and increase the expected outcomes. Coordination is key to valorise the efforts already done and to avoid replication and duplication of work.

2) **Co-developing and maintaining knowledge platform**

Co-developing and maintaining knowledge platform is part of the capacity building activity. It will help R&I actors to evolve in an optimal way with their enterprises. Innovation roadmaps bridging between technological development and specific regional needs will be a key part (see above section on thematic focus). NEXUS technologies market analysis will also be part of the platform either to assess the dynamics and potential of existing markets as well as emerging ones. A Modelling and prospective activity could also be considered in this context. There it seems profitable to connect African with Euro-Med actions as the former can benefit from the experience gained by the latter for two decades now.

3) **INNOEDU**

Creation of a joint EU-MPC high education program based on the concept "innovation through capacity building" (INNOEDU). Such Program should include tech-to-business curriculum, to achieve the appropriate critical mass of specialists at MPCs. The program should include the following characteristics:

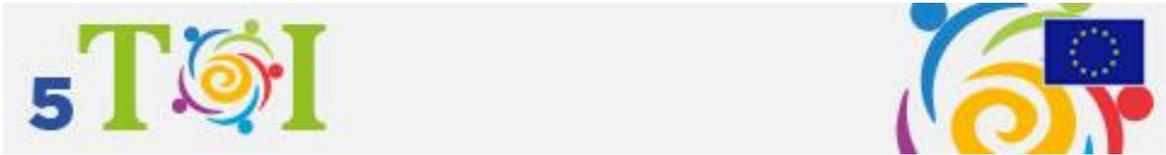
Creation of a task force with EU and MPC specialists in high education and business development to plan jointly the INNOEDU Program.

Selection of EU and MPC high education centres to cover the demand of specialists at the different MPC countries. The MPC centres could provide the selected graduate students and the EU centres could take care of the specialized postgraduate high education during a minimum period of two years for a Master Degree or a maximum of three years for a PhD Degree.

The specialised high education should include business development training that will be validated with the inclusion of a specific business plan in the final respective thesis defence.

the INNOEDU Program should be co-funded by the EC and the respective MPC government. The participants should be subjected to specific condition: a) to report his/her progress yearly as a condition to continue the formation plan and b) to accomplish for the final defence of her thesis (Master or PhD) at the end of the formation period, assure the return back to the home country at the end of the period in order to contribute to the specialised innovation process of the country.

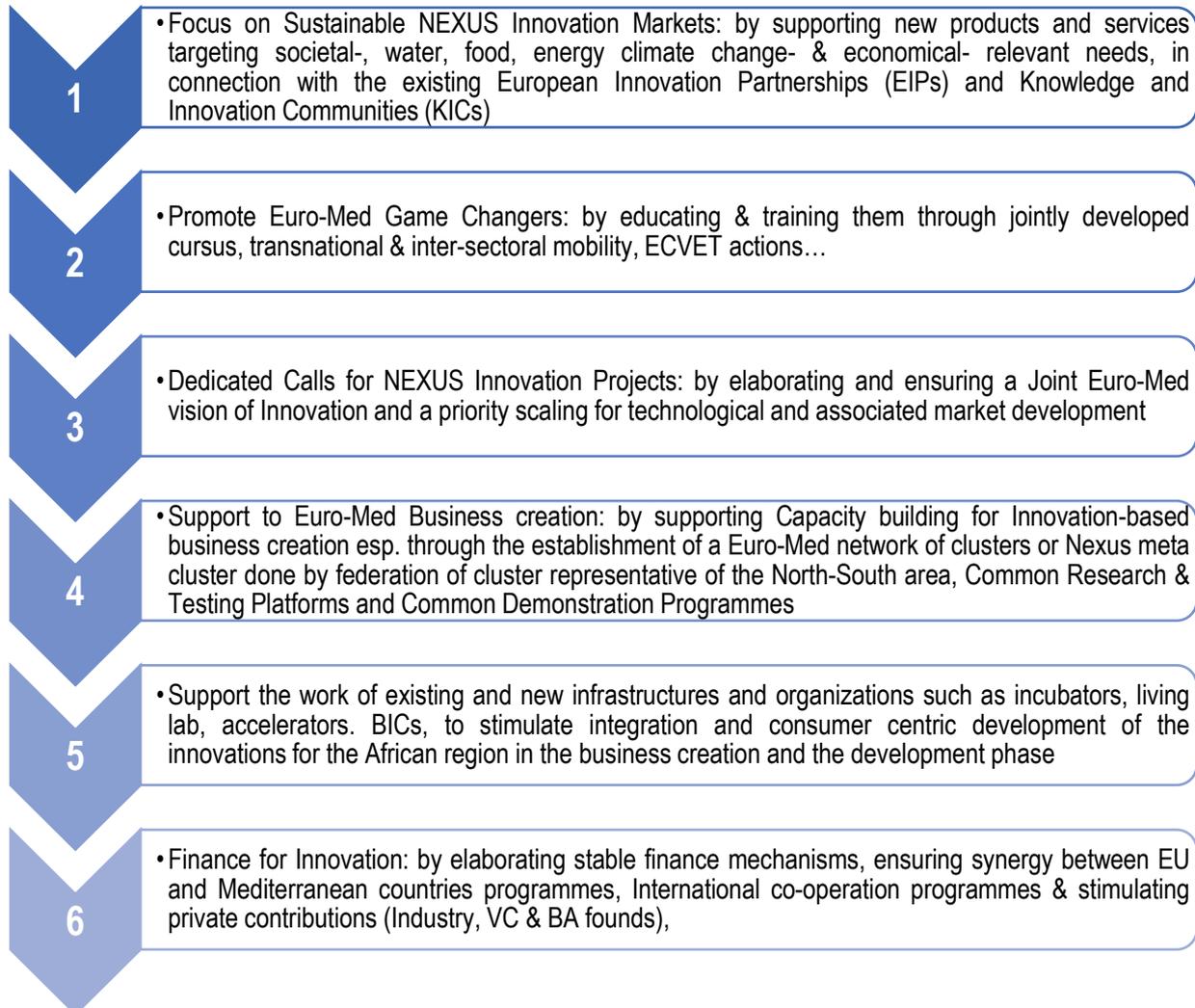
The duration of INNOEDU should be planned for a period of ten years and its objective is to provide such education for an average of two thousand students per year to result in a period of ten to fifteen years on a critical mass of



twenty thousand high education specialists with the potential to provide a remarkable change to the innovation and technical level of the MPCs to a more balanced cooperation with the EU

4) *Experimental joint activities*

Experimental joint activities should be conducted along Five Action lines strongly aligned with operational concern and impact. They will help to prioritise and scale needs for establishing a full Integrating programme beyond 2020.



5) **Regional Integrating NEXUS programme,**

A macroregional innovation programme targeted on the NEXUS approach and designed following the example of other successful macro regional programmes such as the Danube region programme could be the right tool to stimulate innovation and social economic development in the EU-MED African Regions. The programme should define the coordination and organization structures and the several pillars around which to draw the development strategy.