WATER4CROPS

A TWIN PROJECT FOR INTEGRATING BIOTREATED WASTEWATER REUSE AND AGRO-FOOD WASTEWATER VALORIZATION WITH ENHANCED WATER USE EFFICIENCY TO SUPPORT THE GREEN ECONOMY IN EU AND INDIA

Lopez Antonio* & Lamaddalena Roberta
Consiglio Nazionale delle Ricerche
Istituto di Ricerca sulle Acque
Via F. De Blasio, 5 - 70132 Italy
**<antonio.lopez@ba.irsa.cnr.it>*

Abstract: Improving water use efficiency in face of the increased water deficit in agriculture requires a coordinated international approach with a strong commitment of all stakeholders (e.g. farmers, plant breeding industry, technology developers, etc.). The multiple issues related to water and agriculture are too often hampered by the lack of coordination and exchange of information. The treatment of water and elimination of pollutants is crucial for human health and environmental welfare. While there are number of water cleaning methods available, the potential of biotechnology based on plants, micro-organisms or biochemical processes has not been yet fully exploited.
In this context, within its 7th Framework Program, the European Commission on August 2102 co-funded with six million of euros the project "Integrating biotreated Wastewater reuse with enhanced water use efficiency to support the Green Economy in EU and India" whose acronym is Water4Crops-EU. On November 2012, according to the call, a similar but not identical twin project (acronym: Water4Crops-INDIA) was funded with more than three million of euros by the Indian Government through its Department of Biotechnology (DBT). The European project is coordinated by Dr. A. Lopez from the Water Research Institute (IRSA) of Italian National Research Council (CNR). As for the Indian coordinator he is Dr Suhas Wani from the Indian International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

The twin projects in addition to their two main objectives, i.e. -Developing innovative biotechnological Wastewater treatments for improved water recycling for agriculture and -Improving water use efficiency at field level through agronomics, plant breeding and locally adapted irrigation technologies and techniques, are both aimed at supporting the Green Economy in Europe and India. Such economy is the one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is an economy or economic development model based on sustainable development and a knowledge of ecological economics. To actually contribute to implement such an economy.

Water4Crops provides for the first time an innovative combination of several technical improvements to bridge bio treatment of Wastewater and increase water productivity with a transdisciplinary identification of agri-business opportunities and the related requirements for tailoring technological innovations.

In the following, the rationale behind the Water4Crops-EU project, its partnership, structure, strategy, objectives and expected results will be reported. Additional information and details can be found at http://www.water4crops.org

Key words: green economy, water use efficiency enhancement, Wastewater reuse, agro-food Wastewater valorisation, plants breeding.

1. INTRODUCTION

By the year 2050, the world's population is expected to dramatically increase from 7 to 9 billion. This growth is expected to be matched with an increased water demand and subsequently, increased Wastewater volume. Many regions of the world are approaching, or have already reached, the limits of their available water supplies. In water stressed regions, efforts to offset the declining surface water availability due to droughts, reduced precipitations and global warming phenomena are hampered by the rapid increase in population and water demand (Kundzewicz et al. 2007; UNDP, 2006; CIHEAM-IAMB, 2007). India has a strong emerging bio-based economy highlighted by the fact that India already completed a detailed country report presented during the Rio+20 Conference. However there are significant challenges in linking Bio-technology to the rural development and provision of crops and fibre production from the agricultural sector.

Ways to increase water productivity via Wastewater reuse, drip irrigation and nutrients recycling will be a key to the green economy, both in India and Europe. Since irrigated agriculture is the main consumer of fresh water there is a need to acquire further knowledge on how to mitigate and adapt to this serious situation. Currently, around 205 million hectares of agricultural land in developing countries are irrigated providing about 40% of crop production. Developing countries are expected to expand their irrigated area

by 40 million hectares by 2030. There are several projections of world irrigation-water demand and supply by 2025. The most accredited and reliable studies suggest that the area equipped for irrigation expands by a rate of 0.6% per annum. In parallel, the global potential irrigation-water demand will rise by 9.5% in 2021-25 (Rosegrant et al. 2002; IWMI, 2000). The challenge of irrigated agriculture is tightly related to water scarcity and droughts, hence it needs to be addressed both as an essential environmental issue and also as a precondition for sustainable economic growth [EU- COM (2007) 414].

Climate changes will exacerbate an already critical situation. Not only Mediterranean and arid and semi-arid region will suffer higher temperature and reduced precipitation, with more severe drought periods, but also temperate and humid areas in northern Europe are expected to cope with possible increasing water scarcity (Bates, et al, 2008). Crop yields could drop sharply as temperatures rise and water becomes scarcer. Yield losses could range from 10 to 30% in many large areas of the South (EU-SEC 2007).

The huge demand for irrigation (70% of global water consumption) combined with water scarcity encourage the reuse of Wastewater as a water resource. However, the use of such resource is often linked to the problem of gastrointestinal diseases caused by using untreated Wastewater for irrigating food crops. In 2003, more than 30 % of the stomach infections in the USA were caused by this problem.

In order to cope with the imbalance between water supply and demand, we need to adopt new approaches for sustainable and efficient use of water resources, developing nonconventional water resources, adopting demand management, and integrated management of water resources, minimizing input to agriculture through precise agriculture practices, minimizing wastes, recycling and reuse natural resources in sustainable manner. However, traditional concepts to increase Wastewater re-use in irrigated agriculture are not expected to bring a breakthrough in economic developments at rural areas. According to the World Bank, the greatest challenge in the water and sanitation sector over the next two decades will be the implementation of low cost sewage treatments that will at the same time permit selective reuse of treated effluents for agricultural (or industrial purposes). The comparable high costs for treated Wastewater, its spatially restricted availability and the limited return on investment in irrigating field crops call for new approaches and combinations of products. Time has come to explore new ways for development both in Europe as in India. The European 2020 strategy, promoted under “Horizon 2020”, is intended to build a smart, sustainable and inclusive economy. In order to reach this, concrete targets are set within the next decade in areas such as innovation, energy use, employment and education to overcome the impact of the economic crisis and put Europe back on track for economic growth. The EU Common Agricultural Policy (CAP) 2020 strategy demand to foster green growth through innovation which requires adopting new technologies, developing new products, changing production processes, and supporting new patterns of demand, notably in the context of the emerging bio-economy. The Strategic Forum for International Science and Technology Cooperation (SFIC) identified India as the first partner country with which to initiate a pilot initiative on collaboration in S&T on water, biomass, energy and health. New approaches are required to exploit additional product market combinations, which address the economic challenge, the optimal use of resources and to cover the demand for water and food in an integrated way.

Treated Wastewater reuse should be not only considered as an instrument for producing alternative water resources, but also as a central source for recycling high value elements and input for integrated bio-refinery processes. Already accepted and endorsed by the public in many urban and agricultural areas, properly implemented non potable reuse projects can help communities to meet water demand and supply challenges without significant health risks. Under the broad definition of water reclamation and reuse, the sources of reclaimed water may range from industrial process waters to the tail waters of agricultural irrigation systems. The use of reclaimed water for non-potable purposes offers the potential for exploiting a “new” resource that can replace existing use of potable water sources in some sectors such as agriculture and forestry.

Climate change and increasing resources scarcity (e.g. fossil fuels) are forcing the world population to search for alternatives resources. One of the best renewable resources leading to a lower CO2 footprint nowadays is bio-fuel , energy crops biomass, biowastes and bioresidues. As a result, agriculture worldwide is becoming more intensive not only to provide the necessary food for the growing population, but also to provide biomass as resources for food, chemicals/materials and energy. Intensive agriculture with high crop yields is only possible under perfect nutrient and water management.

Water4Crops addresses the abovementioned challenges and will provide sustainable solutions through: increasing water resources supplies by developing new technologies to treat and reuse Wastewater, using the water more efficiently in irrigation through modern techniques adapted for the use of treated waste water, better management of water, land and crops and by involvement of the stakeholders in the processes leading towards a viable and stronger green economy.

2. APPROACH AND OBJECTIVES

Technologies developed in India and Europe, both in the field of bio-treatment and increased water use efficiency are basically comparable but their applications are context-specific and would require new adaptations and integration. In order to boost the bio-based economy both in Europe and India Water4Crops is based on providing a comprehensive set of individual key technologies (reflecting the highest state of the art in Europe and India), to understand the differences (at processing and application levels) and finally to identify best possible modifications which would allow a higher and combined use of technological advances *"from both at both regions"*. Water4Crops aims not at the simple further development of an individual technology, but also at understanding its added value in up-to-now less exploited fields of application (both in India and Europe).

The concept of the project Water4Crops follows similar principles as the InfoDev (World Bank-hosted programme focused on building local capacity in developing countries to create and accelerate innovative technology SMEs) launch of "Climate Innovation Centers" (CIC). In a dedicated process, views and experiences of around 100 climate technology stakeholders in India had been used to prioritize amongst others: Water, Agriculture, and Bio-based technologies. By addressing the variety of experiences of key technologies from Europe and India in total, Water4Crops provides the required critical mass, both for true in-depth know how and to think completely out of the box for new product market combinations.

Water4Crops will develop an innovative modular biotechnological process dedicated to fully exploit the use of water and its content of organic carbon and nutrients (see Figure 1).

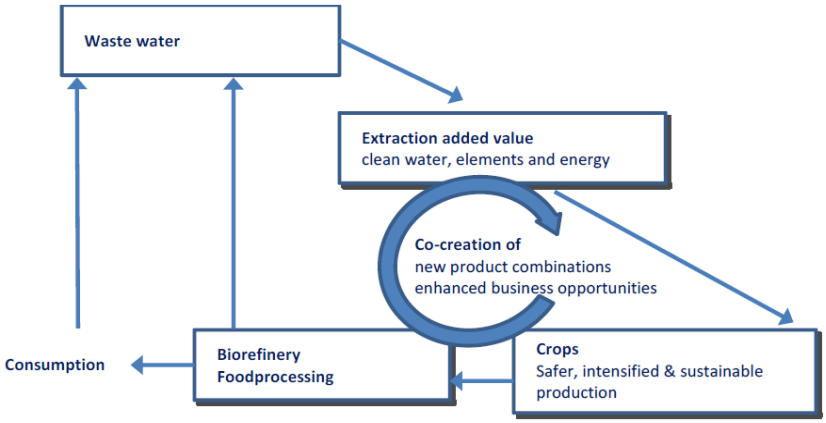

Fig. 1. The Water4Crops principle

This will lead to an innovation triangle with creation of extra added value compounds besides nutrients, water and energy as last recovery in a cascade approach. Nutrients and water will go back to the land and create opportunities to increase crop yield and to allow new crops to grow (spreading harvest periods and processing times). Finally the new crops and higher yields will allow more activities such as food processing and biorefinery. The co-creation of these new product combinations will lead to enhanced business opportunities.

Water4Crops provides for the first time an innovative combination of several technical improvements to bridge bio treatment of Wastewater and increase water productivity with a trans-disciplinary identification of agri-business opportunities and the related requirements for tailoring technological innovations. This takes into account that there is still a transition period and a co-learning process required before understanding the true potential of trans-disciplinary approaches both in the EU as well as in India. There

are still open technical questions in the field of improving the applicability of bio-treatment in Wastewater re-use for agricultural production, which need to be elaborated at laboratory scale. At the same time the support of green economy and the actual implementation of technological innovations will benefit to a large extend from a trans-disciplinary identification of new agri-business opportunities.

Water4Crops recognizes the economic challenges of rural areas in Europe as well as in India. To strengthen the identification of agribusiness opportunities, Water4Crops will focus on Wastewater treatment and reuse for agro-industries at community level. By this it will follow the processing chain from primary production to first processing levels (diary, olive manufactures, sugar factories, distilleries etc.). Moreover this focus will enable the consideration of a sufficient collection level of Wastewater(both from households as well as from processing factories/manufactures).

Combining an identification of possible solid and aquatic wastes from agricultural products processing with the innovative extraction of high valuable chemicals (e.g. phenols) and other materials for biorefinery, these products are expected to provide new market opportunities, and hence economic opportunities. The Water4Cops specific objectives are:

- Production of water apt for irrigation from Wastewater (food-processing, domestic or biorefineries) and return the nutrients as fertilizer to the land.
- Recovery of specific high added value products from the Wastewater (e.g. polyphenols), anaerobic conversion of Wastewater components into organic acids, alcohols coupled with “in situ” product recovery, production of bioplastics (Polyhydroxybutyrate) from high carbon Wastewater, and energy recovery from the final treatment.
- Development of an easy and cheap microbial monitoring method to control the irrigation water quality in terms of pathogens.
- Domestic Wastewater treatment and agricultural reuse by simplified new technologies.
- Optimized recycling and discharge of domestic Wastewater via constructed wetlands with control of heavy metal removal, developing new management of constructed wetlands in terms of improved purification capacity and suitable plants selection.
- Development of improved irrigation products, systems and strategies, coupling of irrigation systems with soil moisture control and modeling in saline conditions, and provide an accurate estimation of crop water requirements using new technologies for area based actual evaporation and soil moisture measurements.
- Modeling the impact of using poor quality water on crop and soil quality.
- Improved water use efficiency at field level through genomics and breeding;
- Development of a green economy by transdisciplinary co-creation of agri-business opportunities and water bio-treatment and evaluation and optimization of the proposed combinations of water processing from a perspective of supporting the green economy;
- Stimulate cross-fertilization and knowledge transfer between the individual work packages and activities in Europe and India;
- Disseminate the newly developed technologies, the new economical concepts and local businesses demands and exchange the experience between India and Europe on advancing the Green Economy in cooperation with EBTC (European Business and Technology Centre).

3. PARTNERSHIP

Both Water4Crops projects bring together an Indo-European consortium of 36 organizations [14 Indian and 22 European] belonging to research institutions, universities, large industries and SMEs. Referring to the European Consortium, as shown below in Table 1, it includes 22 partners uniformly distributed from a geographical point of view.

Table 1. Water4crops-EU Consortium composition

Participant name	Short name	Country
Istituto di Ricerca Sulle Acque del Consiglio Nazionale delle Ricerche (Coordinator)	IRSA	Italy

Natural Environment Research Council - Centre for Ecology and Hydrology	NERC	United Kingdom
University of Applied Sciences Northwestern Switzerland	FHNW	Switzerland
Università di Bologna - DiSTA Università di Bologna – DICAM	UNIBO	Italy
Flemish Institute for Technological Research	VITO	Belgium
Technical University of Crete	TUC	Greece
Helmholtz Centre for Environmental Research	UFZ	Germany
Università di Catania – GESA	UNICT	Italy
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets	IRSTEA-CEMAGREF	France
Institut National de la Recherche Agronomique	INRA	France
Stichting Dienst Landbouwkundig Onderzoek	ALTERRA	The Netherlands
Consorzio di Bonifica di Secondo Grado per il Canale Emiliano Romagnolo	CER	Italy
Deutsche Gesellschaft für Internationale Zusammenarbeit	GIZ	Germany
INOFEA GmbH	INOFEA	Switzerland
SIMA-tec GmbH	SIMA-TEC	Germany
BionActis International Group SA	BIONACTIS	Switzerland
PHYTOREM S.A.	PHYTOREM	France
VITA 34 AG	VITA	Germany
Environmental Nutritional and Health Services S.A.	ENVINHEALTH	Greece
Horta srl	HORTA	Italy
S.T.E.P. Consulting GmbH	STEP	Germany
Università di Roma “La Sapienza”	UNIRM	Italy

The above Consortium includes different organisation types, namely: 5 Universities (FHNW, UNIBO, TUC, UNICT, UNIRM), 8 Research Institutes (IRSA, NERC, VITO, UFZ, IRSTEA-CEMAGREF, INRA, ALTERRA CER), 4 (agro)industrial companies (SIMA-TEC, BIONACTIS, PHYTOREM, VITA 34 AG), 3 spin off/out companies (INOFEA, HORTA, ENVINHEALTH) and 2 consultant companies (GIZ, STEP). The following complementary competences and expertizes have been integrated in the consortium:

- Development of Wastewater treatment processes dedicated to the valorisation of its organic matter (VITO, UNIBO, IRSA, TUC, UNICT, FHNW, UNIRM);
- Irrigation management, adaptation of crop to drought and to saline water and treated effluents (NERC, CER, IRSTEA-CEMAGREF, UNIBO, INRA, IRSA, UFZ) ;
- Integrated Water Resources Management and Green Economy development (ALTERRA, GIZ, IRSA).

The overall project management will enhance already existing links between the Water4Crops partners and promote new interactions within both the European and Indian Water4Crops Consortia. Such a management has been designed to enable and foster the transfer of complementary expertise among the European and Indian Water4Crops partners, as well as between both consortia partners and the members of the planned INNOVA stakeholder platform (see paragraph 4.3 below).

4. Overall STRUCTURE and STRATEGY

The overall strategy of Water4Crops is to advance individual key technologies and/or methodologies, both in Europe and in India, within the two Pillars “Biotechnological Wastewater Treatment” and “Improved Water Use Efficiency”. The work plan is based on the strong integration of two twin proposals (Water4Crops-EU and Water4Crops-INDIA) having the same structure in terms of Work Packages (see Figure 2).

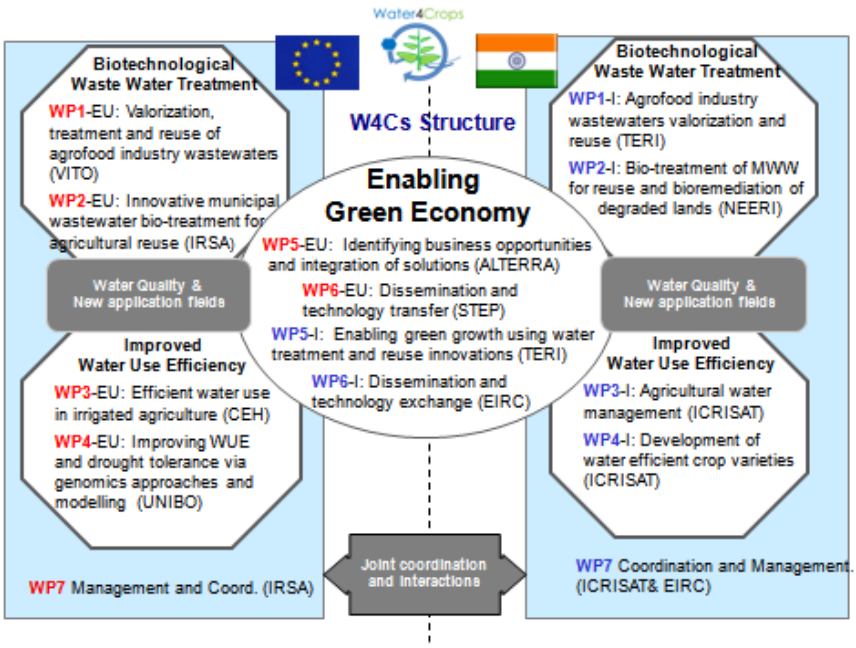

Fig. 2. Water4Crops work plan structure and its interactions between work packages (WP)

4.1 Work Packages aims

- WP1: In both the Indian and European consortia similar modular treatment technologies for the valorization, treatment and reuse of agro-industrial Wastewater will be tested, but with different effluent types, under different socio-economic and climate conditions featuring the two continents. In Europe the industrial processes will focus on olive mill Wastewater and biorefinery waters, while in India, sugar, distillery and fruit processing effluents will form the inputs. It must be pointed out that Water4Crops project aims at the development of protocols, both at EU and Indian sides, which will be tested and validated by the parallel project Consortium under its own environmental conditions. As a matter of fact, knowledge transfer among EU and Indian partners is a key project objective. In this respect, different environments are to be considered as a strategic advantage, since protocols developed by both Consortia should be as general as possible.

- WP2: This WP focuses on municipal Wastewater treatment and reuse including its nutrient components. In this WP Indian and European consortia are complementary in testing and applying both “close to nature” systems as well as biotechnological innovations. As for these latter, the European partners will focus on filtration technologies (based on membrane or cheap-cloths) and innovative periodic filters (containing aerobic granular biomass) particularly suited for decentralized applications at small communities. Referring to natural systems, the focus will be on constructed wetlands (CW) that, at least in Europe, are the most cheap, technologically simple and “close to nature” systems appropriate for treating Wastewaters coming from small settlements. Of course, Indian partners will focus on “close to nature” systems more apt the their local socio-economic features (e.g., those based on fungal and algal strains). In WP1 and WP2, the methodologies and the technologies used in Europe will not be site-specific this means that they will result valid also in India. However, if necessary and/or useful, Indian researchers will carry out some of their activities in Europe and vice versa within researchers-exchange agreement implicit in the proposal.

- WP3: There is a strong compatibility and interaction between European and Indian counterparts in the study of efficient water use in irrigated agriculture. In fact, in parallel, at two mirror-sites in India and Europe, the use of TWW (Treated Wastewater) in combination with different irrigation efficiency approaches will be tested for a number of cash-crops (maize and tomato on the EU side; maize, tomato and chickpea on the Indian side). The choice of such crops has been agreed among the partners of the twin proposals after long and thorough discussions and reflects the interests of both consortia. In WP3, also the selection and the implementation of innovative irrigation systems will be investigated.

It must be pointed out that the quality of the TWW used in this WP3 will duplicate that of the Wastewaters treated in WP1 and WP2 and this strongly links these three WPs.

Furthermore, the big challenge is that the Wastewater after treatment should be applicable in the new water management approaches considered in WP3 based on irrigation and related issues. Special boundary conditions for these applications will be put forward and the technological people will have to work to meet these specs. The aim of the work is to show that both systems are compatible with each other and then it will make sense to integrate them into a strongly sustainable approach leading to nutrient and water recycle and to transformation of carbon into new added value molecules.

- WP4: In the development of water efficient crop varieties both European and Indian consortia will work together in mapping and characterizing quantitative trait loci (QTL) for drought tolerant traits in maize, sorghum, pearl millet and tomato. In addition the two consortia will exchange material of these plants to conduct field trials under different conditions in both Europe and India. It's clear the link of this WP4 with WP3 as both act under the umbrella of the same Pillar "Improved Water Use Efficiency". Furthermore, a task in WP4 is specifically aimed at modeling, in a large range of climate scenarios prevalent in India and the EU, the QTL effects under the irrigation protocols and strategies identified in WP3.

- WP5: To stimulate Green Growth, the European and Indian consortia will follow an identical integrative approach. In practice, all the outputs as well as innovative technological options achieved by both consortia will be brought into contact with the demand of local stakeholders through the INNOVA platforms set in both Mirror cases. Such platforms will be mainly aimed at identifying business opportunities (technology-exchange) and integration of solutions.

- WP6: This WP will focus on the dissemination of the project results. By involving technology providers, innovators and potential stakeholders (particularly farmers), both from Europe and India, within the co-creation process in WP5, a strong facilitation and exchange of experiences and technologies will be achieved. A specific DET (Dissemination and Exploitation Team) has been set within the management structure of Water4Crops. Such a team will strongly interact with the INNOVA platform.

- WP7: The overall management of the project will be carried out by this WP. The management structure purposely designed to achieve the maximum effectiveness. It must be pointed out that some Water4Crops participants, one or more in each WP, are currently involved in National, European and/or International projects whose objectives are complementary to those of the project. Such an involvement has not been "incidental" but planned as it clearly represents an added value for Water4Crops. These partners, in fact, in addition to their tasks in Water4Crops, will be responsible for both avoiding overlapped activities and implementing complementarities and synergies with the other ongoing projects whenever appropriate and useful.

It is obvious that there are differences between the two consortia, especially with regard to the boundary conditions under which technologies are developed. However, overall a strong interaction between the two consortia has been planned and is expected, starting from similar and supplementary developments in Wastewater treatment and reuse methods to coordinated research on water use efficiency and crop varieties to full integration in the strategy of striving for Green Growth and in interactions with all involved stakeholders. As integrated project, Water4Crops targets an ambitious technology leap along the whole technology chain (WP1– WP4), from extracting high value elements, via improved detection methods, technological improvements in Wastewater treatment and precision irrigation until a consideration of genomic aspects in relation to drought tolerance.

This broad range is selected on purpose to widen the solution space for new technology combinations as much as possible. At the same time Water4Crops is fully aware that the turn of inventions to innovations requires a strong involvement of the practice and this is why Water4Crops has a significant involvement of practical SMEs. Moreover, involving established and financed marketing/technology transfer organizations (ASTER, ERVET, EBTC and more) at regional and European or international level will help to largely extend the total resources of the project and to make use of the related links to association members and practitioners in the field.

Within Water4Crops two specific tools have been strategically designed to actually integrate advanced technology developments and facilitate the planned co-creation processes, i.e.: the MIRROR sites and the INNOVA platform respectively.

4.2 The MIRROR sites

In the Mediterranean region (and other European regions) as well as in India there is a need to boost new development in rural areas. Water4Crops aims at twinning successful examples from case studies in Europe and in India. Lessons learned will help the process of boosting business development and the co-creation of new business opportunities in the field of Wastewater treatment and agricultural water use and/or reuse. This project will facilitate the co-innovation process and the identification of emerging business opportunities. Water4Crops will achieve a very intensive dissemination as the targeted businesses will be part of the innovation process.

Water4Crops will integrate several advanced technology developments. These are usually carried out selectively in laboratory locations or sparse field experiments (technology development spots) and there is a need to organize a method for their integration. Water4Crops, instead, will organize the integration of results by the set up of two mirror cases (see Figure 3).

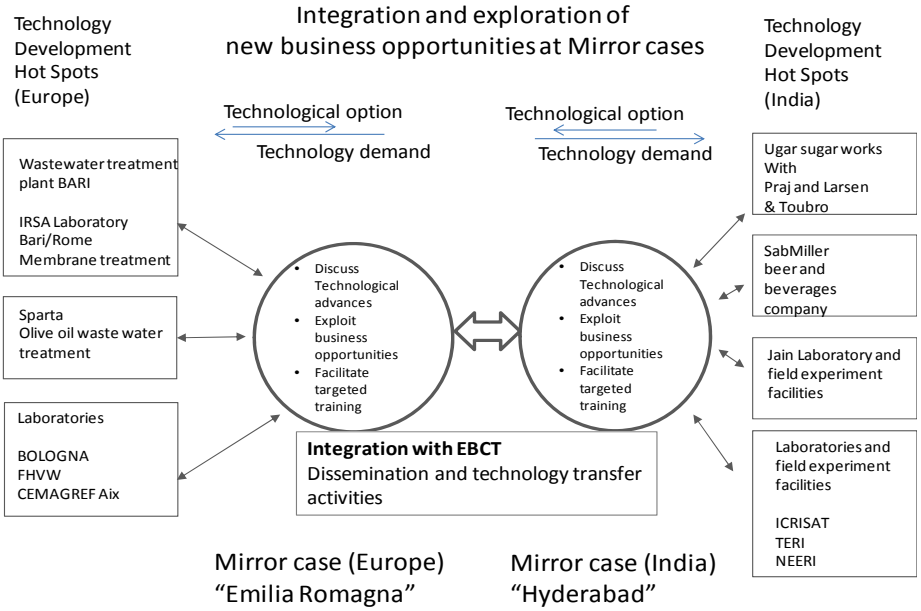

Fig. 3. Concept of the mirror cases aiming at integrating the technological research results, the identification of business opportunities in the sense of Europe2020 and Green Economy, as well as the close exchange of experience between Europe and India.

The Mirror cases will act as "reflectors", 1st) reflecting businesses point of view/demands to the technology developers, 2nd) reflecting achievements from individual technology development to the identification of new solutions and new local business opportunities, 3rd) mirroring the experience gained in India and in Europe.

The mirror cases will be set at the Emilia Romagna region (Italy) and at the greater Hyderabad region (Andra Pradesh State, India). Both regions offer potential for excellent application of technology development research in increasing/diversifying agricultural production.

The Region Emilia Romagna is one of the most fertile and productive agricultural region in Italy. It offers a region of available irrigation infrastructure, intensive agricultural production and a consolidated network to promote agricultural production. The region, and the nearby location of the Bologna University labs and the actual involvement of the Consorzio di bonifica per il Canale Emiliano Romagnolo (CER) make the region predestined for arranging co-creation activities and events. Within the greater Hyderabad region ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) has large experience with agribusiness development, empowering farmers as basis for co-creation processes. The experimental fields of ICRISAT and the cooperation with local farmers make the region predestined to elaborate more applications from the technology hotspots.

4.3 The INNOVA stakeholder platform

The central tool for the co-creation process will be the by Water4Crops developed INNOVA stakeholder platform.

The INNOVA platform will be the main tool to facilitate the co-creation process. The platform will consist of key stakeholders along the KENGI (Knowledge, Enterprises, Non-Governmental and Governmental Institutions) groups with specific involvement of innovative key stakeholders from the main areas: i) technology production, ii) technology use, and iii) marketing/retailing. This composition of the INNOVA platform enables a strong interaction of tacit and explicit knowledge and the highest degree of "out of the box thinking" capacity. In addition, cascades of flash-think meetings with smaller subgroups within the INNOVA platform will be conducted. The subsequent co-creation process will include the benchmarking of ideas by Governmental and Financial Evaluators to ensure a true transdisciplinary approach. At each mirror case, one INNOVA co-creation platform will be established. Figure 4 shows the targeted composition of the platform whose members will continue to be recruited across the entire course of the project.

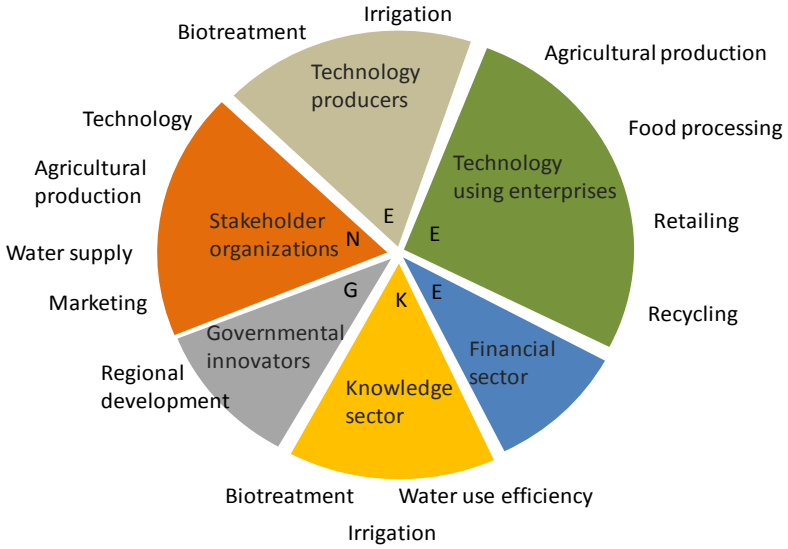

Fig. 4. Targeted composition of the INNOVA co-creation platform

Critical for a research project is a careful selection of knowledge broking institutions and the identification of pro-active business developers. The actual composition of the INNOVA platform will be made by a selected group of stakeholder organizations together with the specific involvement of organizations representative of local farmers and small farmers communities, enterprises in the (bio)-technology sector, the SMEs involved in the project and the involved research parties.

5. EXPECTED RESULTS

Water4Crops will develop innovative technologies for Wastewater treatment and water use efficiency in irrigated agriculture both for Europe as well as for India. Innovation is considered as turning inventions into practice. The participation of industries is essential to provide and apply technologies in new application areas and to identify relevant new business opportunities as a central tool to bring a market oriented innovation and to stimulate the jobs creation of in rural areas of Europe and India. This will help to achieve not only strong integration between research and practice, but also an increased utilization of results. In this way Water4Crops will contribute to a clear environmental and economic benefit optimizing the use of water in agriculture including water saving. Demonstrating jointly the potential turn of rural areas under economic pressure into highly prosperous regions will prove the lead role of Europe and India in stimulating Green Economy and help to step up the EU-India collaboration under such scope and scale. The main points are:

- Research and development activities will provide solutions for sustainable processes and products as well as for preventing and cleaning-up pollution. Is addressed by elaborating the entire value chain form Wastewater treatment, abstracting added value elements from waste water, identifying ways to intensify the bio-production and bio-refineries , and the co-development of new business opportunities

- Develop applications for Wastewater treatments and leading to a greater integration of research actors and activities from across the European Union and the candidate countries. The development of modular processes, operating in cascade and dedicated to the treatment, valorization and reuse of Wastewaters, will lead to new applications in decentralized units or industrial parks linked to the production of new bio-products.

- Provide a clear environmental and economic benefit optimising the use of water in agriculture and water saving. The project will integrate the valorization of Wastewater with effective solutions for an improved efficiency of water use in agriculture Options to start with are the biotechnological production of biopolymers (e.g. PHAs) which can be employed as films in irrigation systems dedicated to optimize the water consumption for irrigation. Other similar combinations will be elaborated within the INNOVA platforms.

- Participation of industry, including SMEs, will contribute to bring a market oriented innovation in this field in order to address the social dimension of the project. The project consortium includes key SMEs in particular in the field of bio-treatment and improving water use-efficiencies. Furthermore, the active involvement of further stakeholders within the INNOVA platforms will exploit the innovation capacity outside of the project. The joint and coordinated identification of new business opportunities within the INNOVA platforms will strengthen the commercialization, creating of jobs and social welfare. Integrating Wastewater treatment with new application opportunities will help to intensify the use of environmental technology.

- A wide co-ordination of research activities in the topic area between the EU and India, which are both major players in these fields, will contribute to step up the EU-India collaboration in scope and scale. The setup of mirror cases both in Europe and in India will provide the operational platform to exchange experience. The mutual participation of researchers from India and Europe in the INNOVA sessions enables the best use of common experience towards an “out-of the box thinking” and identification of new business opportunities.

Both Europe and India face the challenge of severe societal and economic transformation at rural areas. Water4Crops will specify new opportunities by considering the potential of rural / urban interfaces. Together with the co-creation of new opportunities of technology application and new bio-products, this will help to create job opportunities at rural areas. Information sessions with stakeholders from the cohesion and structural funds as well as with related instruments in India will be organized, particularly for organizations representative of local farmers and small farmers communities, to stimulate the up-scaling approach presented and to intensify the economic development further.

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