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**EU and UNESCO Educational Initiatives Integration
for Environmental Education
on Sustainable Water Resources Management**

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Abstract

United Nations' Sustainable Development Goals set the policy priorities for confronting the economic, social and environmental risks that our planet is facing, with equitable education and clean water and sanitation to be designated among these goals. As the main United Nations organization focusing on education, science and culture, UNESCO fully supports the implementation of the goals that lie within its respective fields of competence, such as education and natural sciences, as well as triggers frameworks and programmes such as the Education and Sustainable Development 2030 and the UNESCO's UNITWIN and Chairs towards this direction. In European Union, the well-established education programmes, i.e. the ERASMUS+ programme, play an important role on the enhancement of education systems with the perspective of sustainable development not only at the Union's level but at the global one. The specific work presents the potentiality of integrating frameworks that are supported by different international organizations and programmes for achieving the enhancement of higher education with regard to sustainable environmental management. We demonstrated the water resources management problems in three heteroclitites geographical areas of the word and the way that integrated actions of higher education institutions with the UNESCO Chair INWEB, under the umbrella of ERASMUS+ programmes, deal with the specific objectives. A key issue for the successful implementation of the programmes was the willingness of the partners to reform their educational structures and adopt innovative solutions that promote water resources sustainability.

Keywords: Higher education, water resources management, sustainable development, UNESCO Chair INWEB.

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1. Introduction

The Sustainable Development Goals (SDGs) along with their thematic targets are considered as the state-of-the-art directions framework for the sustainable development of our planet. SDGs address the global challenges that the world is facing, including those related to poverty, peace and justice, education, climate change and environmental degradation (UN, 2015). SDG 4 is dedicated to equitable quality education and promotes lifelong learning opportunities for all, with education considered as a ladder for socioeconomic mobility for escaping from poverty. According to Le Blanc (2015), the proposed goals and targets are interconnected in a form of a network since links among goals exist through targets that refer to multiple goals. Although, for example, SDG 6 is related to clean water and sanitation, improved access to water, sanitation and hygiene facilities in schools can improve health, attendance and welfare of students and teachers, and thus contribute to improved educational outcomes (UN, 2018), i.e. contributing to SDG 4.

At the same time in 2019, as the lead United Nations (UN) Educational Scientific and Cultural Organization, UNESCO initiated the Education for Sustainable Development: Towards achieving the SDGs (ESD for 2030) framework (UNESCO, 2019). The specific framework stressed the crucial role of ESD as a “*key enabler for all SDGs and a key element of quality inclusive education to build a more just and sustainable world*”. As a follow up to previous actions, ESD for 2030 maintains the five priority action areas, such as policy, whole-institution approaches, teachers, youth and community level, for ensuring coherence and complementarity with other education approaches.

Currently, in the European Union (EU) education, training, research, youth and sports are supported by the EU Erasmus+ Programme. Education and training can make a major contribution to deal with socio-economic changes, i.e. the key challenges that will appear the next few years (EU, 2013). The current programme, which will be completed in 2020, has specific objectives such as of improving learning mobility of individuals in the EU and overseas, development of joint master’s degree programs across institutions, large-scale European voluntary service events, cooperation for innovation, and the exchange of good practices (Cacchione, 2015). The programme acknowledges that well-performing education and training systems provide people with the skills required by the labour market and the economy. One advantage of ERASMUS+ is that the eligibility for cross-border education, training and research is not exclusively dedicated to the EU citizens, but various non-EU Higher Education Institutions (HEIs) could be beneficiaries.

Through its UNITWIN programme, UNESCO fosters international cooperation and networking among universities around the globe by supporting the development of UNESCO Chairs and UNITWIN cooperation programmes (UNESCO, 2017). The Chairs initiative, which was launched in 1992, focuses on the reinforcement of HEIs to bridge the knowledge gap both between developed and developing countries and between the scientific community and the society, as well

as mobilizing universities' expertise on state-to-the art policies such as the Sustainable Development Agenda 2030.

Currently there are 56 water-related Chairs in the field of water resources, with the UNESCO Chair International Network of Water-Environment Centres for the Balkans (INWEB), hereafter INWEB, at the Aristotle University of Thessaloniki in Greece to be a member of this UNESCO water family. INWEB is an international network of experts that promotes environmental awareness, training and professional education by using new media and remote learning and aims, among others, to disseminate the concept of Integrated Water Resources Management (IWRM) as an instrument of sustainable development and conflict resolution of transboundary waters (Ganoulis et al., 2014). Moreover, INWEB encourages the integration of Information Communication Technologies (ICTs) for the development and maintenance of web-based environmental databases and inventories (Ganoulis & Skoulidakis, 2013).

The aim of this work is to present the contribution of well-established educational programmes, such as the EU ERASMUS+ programme, as tools for the enhancement of environmental education, with a main emphasis on sustainable management of water resources, at higher education (HE) level. Specifically, three funded ERASMUS+ projects in which the UNESCO Chair INWEB was an active partner, are demonstrated to be successful examples of promoting ESD as well as protecting the environment. Section 2 initiates the characteristics and the necessity for environmental education at three different geographical areas in Northern Africa, South-Eastern Europe, and Northern Central Asia. In Section 3 the objectives of each educational project per geographic area are demonstrated, while in Section 4 the final outputs and achievements are presented. Finally, an overall synopsis and the benefits gained by the implementation of educational programmes in cooperation with UNESCO Chairs are provided in the last part of the paper.

2. Literature review

One of the major environmental and sustainability challenges of the 21st century is preserving and securing water resources. Lack of clean water supply and safe access to freshwater and sanitation increases the risk of economic disruption, social tension, and conflict over water resources at both regional and international levels (UNESCO, 2019). These dangers are even higher in cases where water is scarce, and effective governance is not adequately applied. The uneven allocation of water resources, both seasonally and geographically, the unequal distribution of water among the various users, e.g. industry, water supply, agriculture and environment, together with climate change magnifies the water problem. Regarding climate change, it has a significant impact on water quality and quantity, as well as on the frequency of extreme weather events (e.g. floods and droughts).

The Maghreb area, i.e. Northwest Africa, is a semi-arid to arid zone with limited water resources, facing substantial pressure on the management of its water resources and their protection. Currently, the Maghreb countries have per capita water availability of less than 1,000 m³, which is the threshold for the water-poverty

level (Oualkacha et al., 2017). It is estimated that due to climate change more than 35% of the population will live below severe water stress ($500\text{m}^3/\text{inh}/\text{yr}$) in the near future (UN-WATER & FAO, 2007). The economic development of the area highly depends on water availability, which also leads to a guarantee of the sustainable management of the environment. Being aware of the situation, the Maghreb countries engaged strategies and master plans (Oualkacha et al., 2017) adapted to the EU Water Framework Directive (WFD) to face water shortage under climate change, satisfy water demands and secure water resources sustainability. However, the efficient implementation of these policies necessitates high capacity building actions to follow-up the proposed political engagements.

At European scale, the majority of countries of the Western Balkan region are not members of the EU. The procedure of entering the EU requires that candidate countries during their pre-accession acts must make gradual progress towards transposition and implementation of the EU *acquis*, i.e. to reform, among others, their national educational and environmental legislation by following the EU legislation (articles 2 and 49 of the Treaty on European Union - Joining the EU). On their path to EU accession Serbia, Bosnia and Herzegovina, Montenegro and Kosovo have started to harmonise their legislations to converge the required frameworks. The 2016 EC Progress Report on Serbia (EC, 2016), for example, indicates that regarding education and culture “the ongoing reform of HE needs to put particular emphasis on the relevance of its study programmes” and “the unemployment rate for graduates with tertiary education remains high”. As far as the environment is concerned, the same progress report (EC, 2016) mentions that “a national strategy and action plan on water protection have yet to be adopted”, as well as “monitoring of surface water and groundwater has improved but needs further strengthening”. In Bosnia and Herzegovina’s case, the relevant EC Progress Report of 2019 (EC, 2019) demonstrates that in the education sector “achieving the objectives of the Bologna Declaration is a priority for higher education systems” while in the environmental sector “Specific plans for implementing the EU legislation on drinking water, urban waste water and flood risk management need to be adopted”.

Russia and Kazakhstan, the two largest countries in Northern Central Asia, present similar problems in their education systems and environmental protection frameworks. Development of HE in these countries for decades suffered from a gap between its content and the demands of the society (Smolentseva, 2007). Strengthening links with local economies and labour-markets, implementation of competence-based, multidisciplinary, and innovative approaches are major priorities for the national HEIs in both countries. At the same time, Russia and Kazakhstan share one of the longest borders in the world (7,512.8 km) as well as the Ob river basin which is one of the largest transboundary watersheds of the world. Large parts of the basin have experienced severe exploitation and disastrous technogenic influence due to the extensive gas and oil industry in the north (Moskovchenko & Babushkin, 2017) and the high concentration of heavy industry in the south. These issues have made transboundary water contamination a most urgent problem.

In all the aforementioned case areas, the reformation of higher education could have a key role in accomplishing the objectives of sustainable development of water resources, by training university students, post graduates and professionals-experts to meet the increasing water related challenges. The proposed group of people should be trained on modern scientific approaches, integrated concepts and the latest engineering technologies for project design, system monitoring and management. Hence, the existing study programmes in these countries must undergo a diversion from a more technical orientation towards a multidisciplinary one, where holistic approaches on sustainable development are prevailing. The multidisciplinary of the water sector becomes evident by the fact that water is not only one of the seventeen SDGs, but cross-cuts almost all the other goals, such as for example SDG 1 (no poverty) SDG 4 (quality education) and SDG 13 (climate action) (UN, 2018).

3. Objectives of higher education environmental programmes

3.1. Environmental education in the Maghreb

The project entitled “Regional PhD School based on Innovative hydro-platform in water and environment to enhance Maghreb inter-research centres” aims at contributing to the water-environmental problems and related needs that are dominant in the specific area. To do so, the three participating African countries, i.e. Morocco, Algeria and Tunisia, are planning to ameliorate their HE system within the framework of the wider process of social and economic reform that is currently conducted in these countries, with the assistance of the EU project partners.

The specific project initiates new PhD courses and new advanced teaching and research methodologies through two modern approaches. Firstly, by using ITCs tools that will secure distanced accessibility to educational material. Secondly, the project proposes the development of the first common regional PhD programme among the three aforementioned African countries. The programme will follow the framework of the Bologna process aiming at improving the quality of postgraduate HE, facilitating the inter-university cooperation, and latterly at improving the background environment, i.e. modern infrastructure in terms of materials and equipment and specialised staff, for research and development purposes.

3.2. Modernization of environmental master programmes in Western Balkans

The aim of the project “Strengthening of master curricula in water resources management for the Western Balkans (WB) HEIs and stakeholders” is to improve the quality of higher education in the water resources management field, strengthen its relevance and linkage with the labour market and society and enhance the level of competences and skills of experts on water resources in the WB countries involved in the project, namely Serbia, Kosovo, Bosnia and Herzegovina and Montenegro. The answer to the previous goals is given by developing new competence-based and

enhancing existing master curricula in line with EU directives and standards, such as the Europe 2020 and the Bologna Declaration.

The project foresees to develop improved learning and teaching tools, methodologies and pedagogical approaches using best practices. The main objectives of the specific project are to i) reform existing water-related courses, ii) upgrade existing laboratories with lab courses, infrastructure, material and teaching tools, iii) train the academic staff towards the new trends on water resources management in order to provide advisory assistance to graduate students and opportunities for contract research while taking into consideration the new resources, iv) strengthen entrepreneurship skills, and v) secure quality assurance of educational programs. Specifically, the newly developed courses will be based on best practices and European principles and will enable harmonized educational and teaching methods as well as credit transfers. An issue of specific importance is the enforcement of the linkage between university studies and employment, thus the entrepreneurial thinking at all levels and directions will be promoted. Compared to the current situation where limited laboratories supporting the educational scope in the field of water resources management exist, the participant countries envisage to develop state-of-the-art laboratories which will allow students to gain hands-on experience directly transferrable to the water sector.

3.3. Industry-Academia learning partnership in Northern Central Asia

The objective of the “Trans-regional environmental awareness for sustainable usage of water resources” project is to contribute to the empowerment of Russian and Kazakhstan by enhancing synergies between HE and enterprises in the field of Transboundary Water Resources Management (TWRM), particularly via enhancing the role of ‘Industry - Academia’ Learning Partnerships in addressing common educational and environmental challenges.

To achieve the goal of the project, various objectives are proposed such as the development of a trans-institutional model, which also include a specific cooperation strategy, for interaction between HEIs and enterprises in the field of TWRM. The training of academic staff from the regional universities involved within the project, and of employees in the industry is also a fundamental objective. To do so, Life Long Learning (LLL) approaches both for people and enterprises in the water and oil-gas sector are initiated within the project, and, to fulfil this objective new curricula and courses will be designed, based on the European Credit Transfer and Accumulation System (ECTS) in TWRM to train industry partners. The raise of awareness of water problems will be achieved by developing an e-learning interactive platform with educational and dissemination functions which will facilitate the close interaction of the academia and associated partners from authority bodies and enterprises.

4. Outputs and achievements

The implementation process of the ERAMSUS+ project in the Maghreb region is focused on the principal aim of the project, i.e. the creation of a common PhD programme on water environment among the participant Maghreb countries. For that purpose, the initial work was dedicated to the identification of existing postgraduate courses linked to specific tools and models that are used in water resources management, such as geographic information systems and water quality and quantity modelling software. After the enhancement of the identified courses with the latest teaching methodological advancements and their formation in accordance to the EU regulations, i.e. the identification of the competencies, courses' objectives, learning outcomes, the definition of the course's description and the teaching technics, the new courses were approved by the partner University authorities. Thereafter, the common PhD programme was based on a custom developed Hydro-Platform that facilitated distance learning and online course attendance. Apart from serving as a repository of courses material, the platform also integrated various open-source water modelling tools and was used for the training of the academia staff on new open source technologies, as well as a communication hub (web-portal) among the participants. INWEB had a crucial role in the development of teaching materials (manuals) on the use of various modelling tools.

Western Balkan's project strategy was related to higher education knowledge management, knowledge sharing, exploitation, and principles of sustainability. The achievement of the wider aim and specific objectives of the project firstly required i) the identification of WB regional issues related to water resources management and ii) the analysis of EU innovations in water policy and EU recommendations and legislation in the water sector. Prior to the development and implementation of the competence-based master curricula the partnership analysed the existing master curricula related to water resources management in both EU and WB partner countries. Moreover, the identification of the required laboratory resources in WB HEIs resulted in the equipping of several laboratories with modern equipment, software and literature units. Thereafter, the development and strengthening of new or existing master curricula in water resources management was in line with the EU legislation and standards. Also, a set of numerous novel courses were developed and implemented into the master curricula. The produced learning material consisted of learning resources such as text, recorded lectures, data sets, assignments and self-assessment - tests. Additionally, various topic-based training of WB teaching staff for acquiring new teaching and learning methods were organised and hosted by the EU partners. What is also significant, is that the development of the training material for professionals in the water sector was based on a survey that was reflecting the sector's needs in WB and similar LLL courses in EU partner countries.

In case of the Northern Central Siberia ERASMUS+ project, an important asset was the creation, at the beginning of the project, of Interdisciplinary Working Groups (IWGs) that included staff from academic and non-academic partners and facilitated the project activities and the development of specific methodologies and roadmaps for the partnership (academia and employees/enterprises) interaction, such as

evaluating the policy context, problems and solutions for TWRM, conceptualizing and implementing the “Industry - Academia’ Learning Partnership model and identifying the requirements for creating new ECTS-based courses. EU partners, as well INWEB, contributed in enhancing the knowledge potential of the HEIs’ staff in TWRM by providing a series of lectures and organizing workshops and visits to their host institutions. Moreover, they assisted on the up-dating of the partners’ curricula covering issues on the diversity of water ecosystems, water pollution, valuing of water resources, water monitoring and water governance and management. All courses and modules were ECTS-based created and what is of particular importance is that they were commonly agreed with partners from the industry sector. Finally, aiming at the accessibility of the created material, an e-learning platform for HEIs, enterprises and authorities, was developed to ensure wide access to resources and to provide a forum for public debate on water issues. This platform also facilitated the communication links between all relevant stakeholders. It is believed that the successful implementation of the project enforced partnerships of HE with water industry enterprises and oil-gas industry and improved the awareness on the integrity of ecosystems in the river Ob Basin via sustainable water resources management.

5. Conclusions

Three ERASMUS+ projects were implemented in the Maghreb, Western Balkans and Northern Central Asia aiming at reforming the HE of the participant institutions through the integration of sustainable water resources management concepts. In all case studies, the UNESCO Chair INWEB was actively involved as an EU project partner, with both UNESCO’s and EU’s policies, strategies and frameworks to be disseminated by the Chair. The identified water related problems were addressed by the enhancement of the existing curricula with courses-modules related to integrated water resources management. Incorporating ICTs as indispensable educational tools, perceiving the value of water for various uses and users and investigating policy and water governance issues were among the amendments that were adopted by the HEIs. An additional important output during the implementation process of the projects was the connection between academia and the business sector. For that purpose LLL courses were developed and directed to employees who wanted to obtain up-to-date knowledge. In parallel, a performed market analysis on the business water sector demands was taken into consideration for the formation of the new curricula in order to increase future university students’ employability.

The dual role of UNESCO Chairs, i.e. active university structures and “ambassadors” of modern and innovative policies formed within UNESCO by disseminating modern policy decisions, establishing new teaching initiatives, generating innovation through research and contributing to the enrichment of existing university programmes, proved to play an important role at the promotion of the SDGs. At the same time, EU’s environmental policy has a pivotal role into all EU sectoral policies with a view to promoting sustainable development in relation with third countries. The Water Framework Directive, for example, is a state-of-the-art and globally accepted framework for the protection and sound use of the water

resources, with numerous non-EU countries ready to integrate it in their legislation. The aforementioned ERASMUS+ projects are characteristic examples of the effort made to enhance national water management with regard to the WFD. A further development of the current research would be the qualitative and quantitative evaluation of the three projects implementation progress in the near future used to identify their operationality, advantages and potential bottlenecks.

The major upcoming challenges on water resources management are closely related with climate change and extreme events, pressure on the environment due to population growth and rapid urbanization, unsustainable consumption and inequitable allocation of the resources. The 2030 Agenda for Sustainable Development, i.e. the SDGs and the various targets are considered the key mechanism for confronting with the aforementioned challenges, while other policies such as the EU Adaptation Strategy to climate change are bound to contribute towards this direction. UNESCO Chairs already have a direct involvement on the achievement of the Goals (Bergnam et al. 2018), but nevertheless there is space for further and deeper engagements.

To sum up, education and particularly higher education is the link between knowledge and relevant quality skills and competences for employability, innovation and active citizenship. The links between different sustainable goals were also studied in the scientific literature (Fonseca et al., 2020). The interwoven nature of water is reflected in global socioeconomic development that could potentially causesocioeconomic imbalance. The solution of regional water problems should take into account local idiosyncrasies, but at the same time they ought to be anchored in broader and long-term strategies and action plans. In any case, education has an important role to bridge regionalities with international perspectives fostering the sustainable development of our world.

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