



**THE FIRST INTERNATIONAL DOCTORAL STUDIES IN SUSTAINABLE
DEVELOPMENT AT UNIVERSITY OF MONTENEGRO
REPORT ON FIRST YEAR IMPLEMENTATION**

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ABSTRACT

The First Doctoral Program in Sustainable Development was established in Montenegro under the leadership of the University of Montenegro in the academic year of 2021/2022.

The Program is an outcome achieved over the period of a four-year Erasmus + “598465-EPP-1-2018-1-ME-EPPKA2-CBHE-SP” project, which was maintained by 16 partners in 6 countries. This interdisciplinary program focuses on natural, technical and biomedical sciences, which are very relevant today in the modern world, as they are important for sustainability of nature and living beings at the present stage of civilization development.

The article outlines the importance and requirements of modern doctoral education for sustainable development, as well as focuses on the vision of the Program, curriculum structure, early experiences, feedback and the lessons learned. The Program has already had a wide impact on different aspects of the sustainable development of Montenegro and the Mediterranean Region by training leaders, experts and managers to combat the contemporary challenges, shaping culture and habits, improving the visibility and international recognition of the PhD education in Montenegro and other five countries-participants of the project.

The project has also substantially boosted the cooperation of academic and non-academic sectors, created the possibility for scientific diaspora contribution and reintegration, as well as offered many other major and minor changes.

1. INTRODUCTION

We live in a world full of challenges that have become even more intense in the last few years. In 2019 when COVID-19 struck us out of nowhere, we saw that everything we believed firmly had melted down. It has become of crucial importance to adapt, evolve, and modify. We had to change our daily routine, our habits, our usual perspective, and even our paradigm of the world and of life itself. And this is not the first warning that we got. Crucial problems for humanity began much earlier: climate changes, water shortages, drought, hunger, extreme weather, wars, floods, and wildfires kept reminding us that action needed to be done [1]. All of these challenges and other consequences of irrational human behavior that have been affecting all continents and all the living things and nature in the previous decade have made some of the humans stop and think: Where is this leading us? What is the world going to look like if we continue at the same pace? Can we become victims of nuclear war very soon? Development is often driven by one particular need, without fully considering wider future impacts. We are already seeing the damage this kind of approach can cause, from large-scale financial crises caused by irresponsible banking to changes in the global climate resulting from our dependence on fossil fuel-based energy sources. The human population is expected to reach 10 billion by 2100. Such an increase entails an increase in needs and, as a result, more individual consumption. A need for long-term solution was desperately necessary. The concept of sustainable development arose as an urgent necessity. Even with the latest war in Ukraine, sustainable development cannot only be viewed as a climate, economic or sociological aspect. We must refine the subject of „Sustainable development“ with „Sustainable development and peace“.

Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In other words, it is about exploiting the planet's resources in moderation, without exceeding its capacity for natural renewal. One of the most comprehensive definitions of sustainable development is "when you give more than you take", but we would add "when you give more than you take and you constantly think about the consequences of your behavior", because your behavior, whether social, professional or political, can cause crises that can destroy even the most orderly societies, e.g. corruption, health disasters, nationalism, wars, etc... The focus of sustainable development is far broader than just the environment.

In 2015, the United Nations set out the Sustainable Development Goals, a series of common goals to protect the planet and guarantee social well-being. The Sustainable Development Goals, also known as the Global Goals, seek to reconcile economic growth, environmental balance, and social progress, ensuring that all people have the same opportunities and can lead a better life without compromising the planet: End poverty, Zero hunger, Good health and well-being, Quality education, Gender equality, Clean water and sanitation, Affordable and clean energy, Decent work and economic growth, Industry, innovation and infrastructure, Reduced inequalities, Sustainable cities and communities, Responsible consumption and production, Climate Action, Life below water, Life on land, Peace, Justice and strong institutions, Partnerships for the goals [2].

2. DOCTORAL EDUCATION AND SUSTAINABLE DEVELOPMENT

With more attention to growing problems of sustainability, more awareness began to rise. Since the originality of the research and new solutions are at the heart of doctoral education, sustainable development became an interesting and attractive topic for Ph.D. studies. In the beginning, such programs were more developed as a response to environmental protection and climate change, but today they increasingly include interdisciplinary aspects of development, involving the social, natural, engineering, and health sciences. The first International Doctoral Program in English "Sustainable Development", hosted at the University of Montenegro, has started to operate as a direct outcome of the MARDS project in the 2021/2022 academic year. Fifteen (15) students were selected, in high competition to join the first generation. In Albania, the project consortium is on track to introduce a similar program at the Shkoder University, the first in Northern Albania, which will be of great importance not only for Albania, but also for cross-border cooperation.

The Ph.D. in Sustainable Development should include a set of rigorous core requirements in the social and natural sciences designed to provide a deep understanding of the interaction between natural and social systems and provides students with the flexibility to pursue in-depth research in a broad variety of critical policy areas. It's due to the unique combination of diverse skills and deep insight into the most challenging problems of future human welfare that more and more students choose this field for their doctoral programs.

After having obtained a Ph.D. in Sustainable Development, graduates can pursue academic careers in interdisciplinary graduate and undergraduate programs with a focus on policy and the environment as well as in the more traditional social science disciplines. This degree is also suitable for students interested in a variety of non-academic career paths, including leadership roles in government ministries throughout the world, creating environmental and sustainable development policy for NGOs, in international institutions such as the IMF and the World Bank, or private firms engaged in environmental and development projects.

Sustainable development courses focus on the global goals and long-term actions that can be taken to protect nature against harmful, unsustainable activities. As a sustainability consultant, one can assess projects and offer improvement suggestions and recommendations for limiting any damaging impact on the environment. Additionally, sustainability experts also analyze aspects related to economic growth, as this is the main factor behind unsustainable practices. It allows brilliant minds to come up with revolutionary solutions to environmental problems.

Another purpose of Sustainable development studies is to concretize science and to convert research into tangible work that is of greater use for the economy and industry. It focuses on technological and natural sciences but through a sustainable approach. The essence and the core lie in continuous progress, smart use of resources, sustainability in thinking, planning, and performing, and in perspectives that go beyond man alone and transcend whole generations; intellectual, spiritual, and not only material *Perpetuum mobile*, *Perpetuum mobile* of ideas. This idea has also originated from the need to enable researchers to work in the field and real sector, and to encourage them to give a contribution to both science and the system, to get them prepared

for work in companies and a more competitive labor market. Holders of this degree can be expected to be able to promote, within academic and professional contexts, technological, social and cultural advancement in a knowledge-based society.

The way we approach development affects everyone. The impacts of our decisions as a society have very real consequences for people's lives. Poor planning of communities, for example, reduces the quality of life for the people who live in them. Sustainable development provides an approach to making better decisions on the issues that affect everyone's lives. For instance, by incorporating health plans into the planning of new communities, we can ensure that residents have easy access to healthcare and leisure facilities. The last time that a hospital was built in Montenegro was 47 years ago. The current pandemic has best shown the importance of a strong health system and infrastructure in times of crisis, and all the deficiencies that management and planning without a vision can cause. Montenegro is now experiencing many challenges with the constant price increase of foodstuff, building materials, and many other products and services, due to trends in the world market. It relies completely on imports, without its own production and industry that were shut down in the last 30 years. By encouraging more sustainable agriculture, food production, and supply chains, we can ensure that Montenegro has enough food and other vital supplies for the long-term future.

The financial, health, and energetic crises we are experiencing today are consequences of bad decisions and policies undergone 20 and 30 years ago. They indicate the need for wiser management and a multidimensional approach. We need to make the right moves now so that our future and the future of our children reflect the prudence, humanity, and selfless action of our epoch, proactive vision, and smart resource management- whether human, natural or technological.

Also, we mustn't lose track and let machines take over the system, we have to preserve humaneness, and keep a man as the main protagonist, with his brains, emotions, and spirit woven into everything he plans, designs, and constructs, and leaves as a legacy.

It is of crucial importance to raise awareness about sustainable development, to put this idea into the educational system, and to teach children from an early age about the benefits and risks that human actions can bring. They need to think sustainably, a reality like the one we are living in requires a change in reasoning, a complete shift of paradigm to maintain life on the Earth as acceptable and meaningful.

In short, the participants of this program should be leaders in the implementation of strategies and measures of sustainable development in Montenegro and the Region.

3. MARDS PROJECT AS AN EXAMPLE OF GOOD PRACTICE IN PH.D. EDUCATION IN SUSTAINABLE DEVELOPMENT

The MARDS Project “Reforming doctoral studies in Montenegro and Albania – good practice paradigm” (No. 598465-EPP-1-2018-1-ME-EPPKA2-CBHE-SP), from ERASMUS+ funding scheme, track capacity building in higher education, and addresses one of the most acute problems in Montenegrin and Albanian education systems, the doctoral studies. Its main objective was to reconstruct those systems in line with Salzburg Principles and establish sustainable and modern Pilot Joint Doctoral Schools between two friendly neighboring partner countries that will serve as an example of “good practice” for the Western Balkan Region, in order to improve and establish sustainable capacities in the field of doctoral studies in these two countries. When we started the project we had no idea that it would be, as its name reminds us, “an example of good practice” in doctoral education in these two Western Balkan countries [3].

It is a 180ECTS doctoral program, with the structure given in Fig. 1. The new structural elements in relation to the existing Ph.D. programs at the University of Montenegro are marked in yellow.

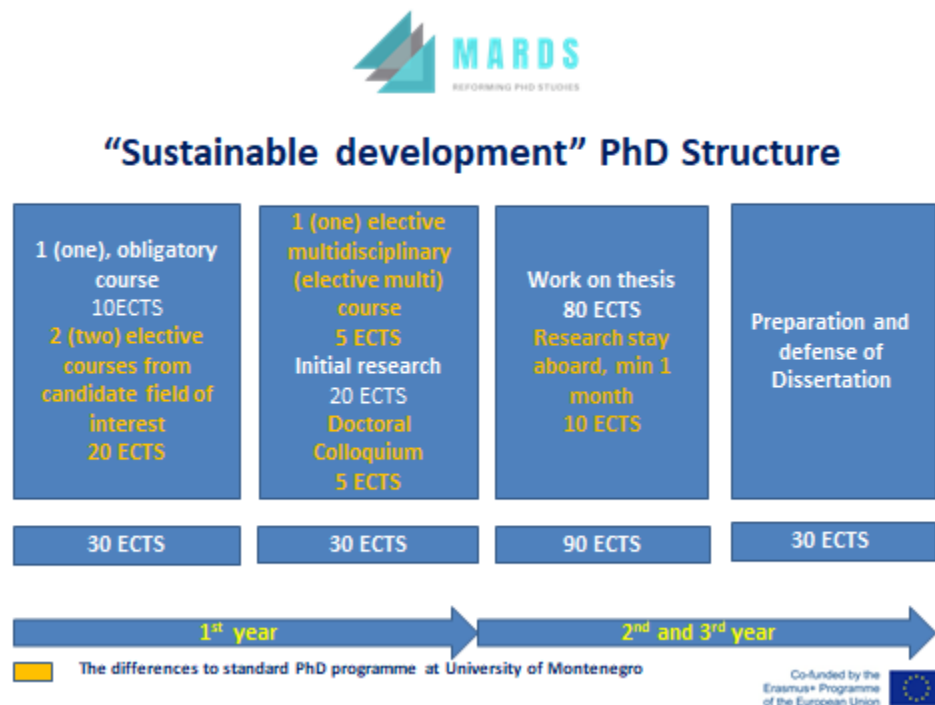


Figure 1: Structure of MARDS Ph.D. Program

Student starts from the 1st semester, where he needs to pass three courses, one obligatory and two elective ones. The obligatory course is „Methodology of science and research work“, while two electives are courses from the group of 25 courses, Table 1. For example, a student who is coming from the field of electrical engineering, subfield electronics, telecommunications, and computers, prefers the courses under numbers #2,#4,#5, #13, and #20. It chooses two of them, similar to other professions. In 2nd semester, the student chooses one course from position #27 to #29. Those courses are related to soft skills, verbal and research communication as well as management in

high technologies. Additionally, in this semester (2nd), together with a mentor, the student works on Initial Thesis Research and preparation for the Doctoral Colloquium.

Doctoral Colloquium is the conference/symposium, where students have to present their research results (see example www.doc-me.com). It is an event important for their professional development and provides a unique opportunity to receive in-depth feedback on their (ongoing) research from fellow Ph.D. students, leading academicians and researchers, as well as from non-academic sector representatives. Additionally, the Colloquium provides students with a unique opportunity to master the methodology of presenting a scientific paper or research proposal to target groups and stakeholders. 2022 Symposium that took place in Kotor, Montenegro, from 22-24 October, and had 26 registered contributions from 6 Western Balkan countries, which is an impressive success for the first issue.

During 2nd and 3rd years, students are working with their supervisors on the thesis, mainly on implementing the research hypothesis and publishing selected results. During 2nd year students must spend one month at minimum in an institution abroad, compatible with the thesis research topic. In the end, the thesis should meet all quality standards, pass the appropriate procedure, and be publicly defended and accessible via the university electronic repository.

Table 1. The structure of MARDS Ph.D. Program. The elective courses may change from year to year.

#	Course	ECTS	Status	Holding Institution
1	Methodology of science and research work	10	obligatory	Indiana University Bloomington
2	Remote sensing	10	elective	Univ. Maribor
3	Power system control and protection	10	elective	Univ. Maribor
4	Human-computer interaction in the media	10	elective	Univ. Maribor
5	Intelligent data analysis	10	elective	Univ. Maribor
6	Distributed data storage systems	10	elective	Univ. Maribor

7	Mining unstructured data and natural language processing	10	elective	Univ. Maribor
8	Contemporary building materials	10	elective	University of Montenegro
9	Experimental analysis of structures	10	elective	University of Montenegro
10	Risk management in civil engineering	10	elective	University of Montenegro
11	The energy efficiency of buildings	10	elective	University of Montenegro
12	Selected topics in electrical machines	10	elective	University of Montenegro
13	IoT ecosystems	10	elective	University of Montenegro
14	Power analyses in HVAC systems	10	elective	University of Montenegro
15	Metal complexes and their application	10	elective	University of Montenegro
16	Environmental chemistry	10	elective	University of Montenegro
17	Ecology and environment	10	elective	University of Montenegro
18	Ecology and biodiversity of aquatic ecosystems	10	elective	University of Montenegro
19	Biological processes in the environment - selected chapters	10	elective	University of Montenegro
20	Precision agriculture	10	elective	University of Montenegro
21	Ships' alternative fuels and propulsion	10	elective	University of Montenegro

22	Reliability-based maintenance	10	elective	University of Montenegro
23	Modeling the supply chain	10	elective	University of Montenegro
24	Continuities in the city building	10	elective	University of Montenegro
25	Energy and environmental refurbishment of buildings	10	elective	University of Montenegro
26	Design and Nature	10	elective	University of Montenegro
27	Science communication and writing	5	elective multi	UniversityDonjaGorica
28	Advanced entrepreneurship	5	elective multi	University DonjaGorica
29	Technological entrepreneurship	5	elective multi	University of Montenegro

LESSONS LEARNED

Today, we can say that the visionary idea of the MARDS project has become a reality. It spread to the Western Balkan Region. The University of Montenegro became even more recognizable in doctoral education thanks to the MARDS project. In addition, the MARDS project contributed to the improvement of other policies and measures in doctoral education in Montenegro, e.g. at the University of Montenegro, the tuition fee for doctoral studies has been reduced to symbolic €250 per semester.

The MARDS program attracted most of the students enrolled in Ph.D. studies (16 studies programs) at the University of Montenegro in the 2021/2022 academic year. As many as 15 students out of a total of 93 are enrolled in this program (16%). At the end of the academic year, all enrolled students mastered the defined curriculum with more than 75 % of success. All of them

defended their colloquium works within Doctoral Symposium and were awarded 5 ECTS. The students were very proactive in mobility, their research stays at a partner institution, and 83% spent that stay, mainly at the University of Maribor. 46% of them defended Initial research on thesis.

In 2nd generation at University of Montenegro, 10 students were accepted and they attend classes

The Program shows the following advantages, inter alia:

- Introduces a new model of doctoral education at the Ph.D. level, where students' progress is continuously monitored and they are provided with opportunities for intensive training, team work, and quality research.
- Students have easier access to mobility, publication of scientific results, international cooperation, and international mentors.
- Students have the possibility of mastering soft skills and professional competencies (communication, writing, entrepreneurship, management, design, etc.)
- The research progress of the attendees as well as all info are available via an online platform.
- Great opportunities for Long Life Learning and continuous education. Almost 100% of students are employed in different sectors.

The program also showed several weaknesses in the organization and implementation of doctoral studies, the most significant are:

- The criteria for admission of students is based exclusively on success during the MSc studies, without an interview or entrance exam. In this way, it is possible to eliminate better students who come from stronger schools.
- The infrastructure for monitoring students' work/progress is modest and lacks professional staff and hardware/software infrastructure, as well as spatial capacities for teaching (rooms and laboratories) [4].
- It is very difficult to find teachers who offer modern courses, and even more difficult to find mentors, for a wide range of disciplines that are studied.
- The support of the external environment of society, economy, and services is symbolic, in terms of scholarships and offering conditions for practical work.
- The labor market is still not aware of the need to hire as many PhDs as possible outside the academic and research sector.

MARDS PH.D. PROGRAM IN LIGHT OF INTERNATIONAL COOPERATION AND SUPPORT

The MARDS is a “de facto and de jure” international program. It originated from an international project, conducted in English by international institutions and professors, including international students. Circa 36 % of the enrolled students of the first generation completed their previous level of education at one of the foreign universities. Some of them returned to Montenegro to continue their studies and professional development. About 50% of professors and supervisors were from foreign universities. About 40% of all authors, at Symposium, were out of Montenegro. The Program offers opportunities for the scientific diaspora of Montenegro and the wider Western Balkan.

- To continue their education on the Ph.D. level in their homeland.
- To return and to reintegrate.
- To help as supervisors or to provide scientific hosting to homeland students.
- To establish cooperation in professional and other fields.
- To transfer know-how and good practice examples to the homeland.

ACKNOWLEDGMENT

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MARDS

REFORMING DOCTORAL STUDIES IN MONTENEGRO AND
ALBANIA – GOOD PRACTICE PARADIGM

Grant: 598465-EPP-1-2018-1-ME-EPPKA2-CBHE-SP

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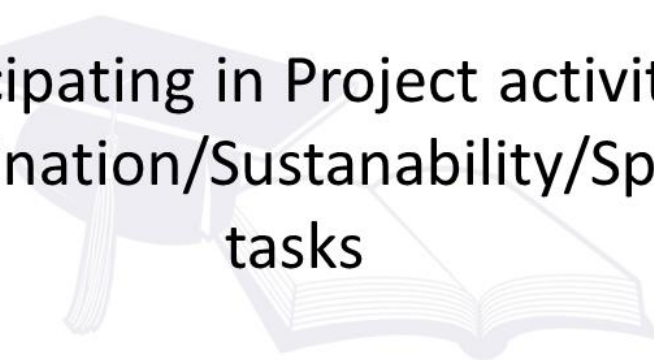
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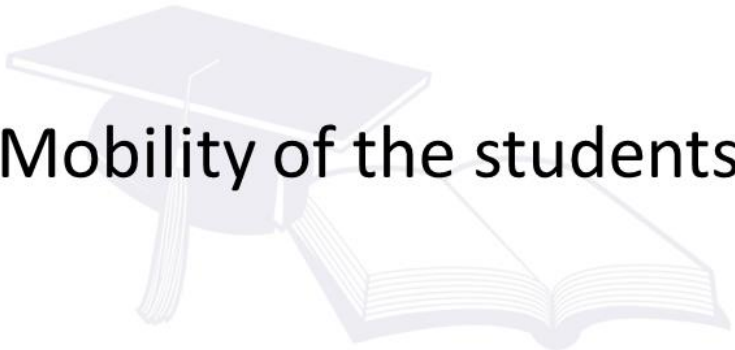
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