

Role of EU and non-EU universities in achieving environmental sustainability

Anzhelika Karaeva^{1*}, Gabriela Ionescu², Lucian Ionel Cioca³, and Athanasia Tolkou⁴

¹University of Insubria, Department of Theoretical and Applied Sciences, via G.B. Vico 46, 21100 Varese, Italy

²Polytechnic University of Bucharest, Faculty of Power Engineering, Department of Power Production and Usage, Splaiul Independenței 313, București 060042, Romania

³Lucian Blaga University of Sibiu, Faculty of Engineering, Industrial Engineering and Management Department, Sibiu, Romania

⁴Aristotle University of Thessaloniki, Department of Chemistry, Thessaloniki GR, 54124, Greece

Abstract. At present, the principles of sustainable development are being implemented in almost all economy sectors whereas one of the key drivers of the transition to a new concept is higher education system also. The inclusion of special academic disciplines on sustainable development, the implementation of environmental protection measures, financial support for research in the field of environmental sciences, campuses landscape – all these stimulates the process of transition to a concept of sustainable development. In addition, higher education makes it possible to form an ecological worldview among the younger generation that is an effective tool in achieving sustainable development goals (SDGs). University graduates who understand the need to achieve the SDGs and provide environmental protection, lead an eco-friendlier lifestyle and pass on the knowledge they have gained to their children or other family members. The purpose of this study is to analyze the relationship between the involved activity of universities in the field of sustainable development and the implementation of large-scale government programs to achieve environmental sustainability. The study will examine the experience of Eu and non-EU universities and state environmental protection programs. The results obtained allow us to conclude about the correlation between educational activities in the higher education system and achievements at the state level of environmental sustainability.

1 Introduction

In 2015, the UN General Assembly adopted 17 global Sustainable Development Goals (SDGs), which became a considerable part of the development strategies of many countries around the world [1]. All the established goals can be divided into three groups: (i) goals aimed at achieving economic sustainability, (ii) goals aimed at achieving social sustainability (iii) goals aimed at achieving environmental sustainability [1].

* Corresponding author: akaraeva@uninsubria.it

Currently, the majority of states are implementing large-scale programs to achieve stated goals, especially in the field of environment protection: the high level of environmental pollution that led to the climate change stimulate the move toward a green and circular economy and environmental sustainability [2-5]. Environmental sustainability is understood as responsible interaction with the planet to maintain natural resources and avoid jeopardizing the ability for future generations to meet their needs [6, 7]. The main directions of achieving environmental sustainability are:

- development of renewable energy;
- minimizing the negative environmental impact;
- rational use of natural resources [7-10].

The introduction of the sustainable development principles and the transition to a new green direction of development requires the involvement of all elements of society, from a single individual to the largest sectors of the economy [11]. A high level of awareness of the population makes it possible to implement the necessary changes faster and encourages the introduction of principles into a person's daily life [12].

The education system plays a special role in the process of introducing the principles of sustainable development into the economies of the countries of the world [13-15]. It allows to form the right ecological worldview for new generations and accumulate intellectual capital that could become the basis for future socio-economic transformations. Higher educational institutions, being centres of research activities, have a significant impact not only on the ecological outlook of the population and the level of its awareness, but also on the speed of implementation of changes and, consequently, on the speed of achieving environmental sustainability and circular economy concepts [11,13,16]. It is possible to distinguish the following mechanisms of universities aimed at achieving environmental sustainability (fig. 1):

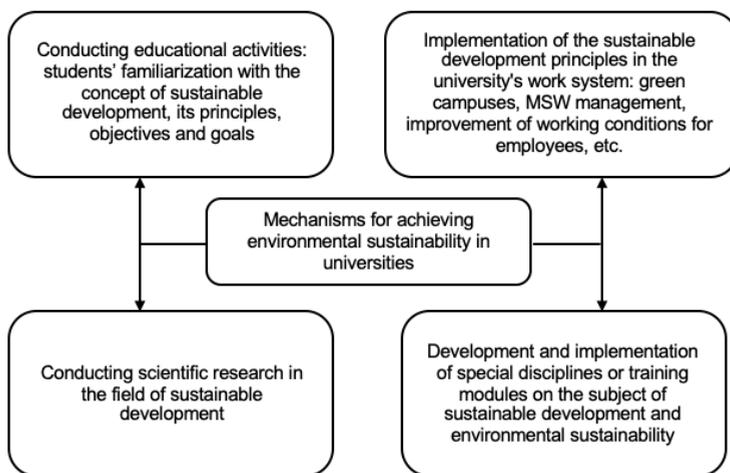


Fig. 1. Mechanisms for achieving environmental sustainability in universities (made by authors using data from: [11, 17-20]).

All the mechanisms listed above not only increase the environmental awareness of the younger generation, but also form the concept of a so-called "green" university - a university that implements the principles of sustainable development at all levels of its functioning.

The purpose of this study is to analyse the relationship between the involved activities of universities in the field of sustainable development and the implementation of large-scale

state programs to achieve environmental sustainability. The study will examine the experience of EU universities and non-EU universities, as well as state environmental protection programs.

2 Materials and methods

The study on the relationship between the activity of universities in the field of sustainable development and the effectiveness of the state policy to achieve environmental sustainability in Italy, Russia and the U.S. included three main stages.

At the first stage, the positions of the universities of the considered countries in UI GreenMetric World University Ranking were analysed based on the results for 2021. The authors analysed:

- the total number of universities participating in the ranking;
- positions and number of universities included in the top 100 of the rating;
- criteria by which universities scored the highest number of points.

At the second stage, the authors assessed the current activities of the governments of Italy, Russia and the U.S. to achieve the sustainable development goals, in particular environmental sustainability. The authors investigated the level of green energy development, current governments' plans to reduce the negative impact of industry on the environment and priorities of state policy in the field of climate and environmental conservation.

At the third stage, the authors analysed the results obtained and made conclusions about the role of universities in achieving environmental sustainability at the state level.

3 Results and discussion

Every year, universities from different countries take part in the UI GreenMetric World University Rankings, which is one of the most credible rankings of sustainable development in universities that evaluate the commitment of universities to the ideas of sustainable development and the creation of "environmentally friendly" infrastructure [22]. The key rating criteria are setting and infrastructure (SI), energy and climate change (ECC), waste (WS), water (WT), transportation (T), education and research (ER). The weight of each criteria in the final evaluation ranges from 10% to 21%: SI – 15%, ECC – 21%, WS – 18%, WT – 10%, TR – 18%, ER – 18%. Annually a specialized questionnaire, that includes the list of indicators for each criterion, is sent to the universities participating in the rating. University specialists fill out a questionnaire according to the proposed methodology, evaluating their activities using the indicators from the list. Then they attach evidence of the university's activity in the field of sustainable development in order to avoid fraud and send them to the rating committee.

Universities in Italy, Russia and the USA are active in the field of sustainable development and annually get into the top 100 higher education institutions. Table 1 presents a comparative characteristic of the positions of the universities of the considered countries in the UI GreenMetric World University Rankings 2021.

Two U.S. universities are among the top 10 of the most sustainable universities that indicates a high level of implementation of the sustainable development principles at all levels of university activity: campus landscaping, effective waste management system, rational use of natural resources and high educational and research activity in the field of sustainable development [23]. 9 out of 33 Italian universities entered the top 100 of the rating that also indicates the high activity of universities in implementing the principles of sustainable development. The smallest number of universities in the top 100 in comparison

with the analysed countries is located in Russia - only 2 out of 54 universities were included in the top 100 of the ranking.

Table 1. Positions of Italian, Russian and U.S. universities in UI GreenMetric World University Rankings 2021 (made by authors using data from [22]).

Name of the factor	Italy	Russia	The USA
Total number of universities participating in the ranking	33	54	22
The number of universities in the top 100 of the ranking	9	2	4
Universities included in the top 100 and their position	University of Bologna (12); Polytechnic University of Turin (20); Luiss University (22) University of Turin (23); University of L'Aquila (37) University of Genoa (54); Polytechnic University of Milan (80); University of Padua (97) University of Salerno (100)	RUDN University (28) Siberian Federal University (73)	University of California, Davis (5); University of Connecticut (9); University of California San Diego (72); Washington University Saint Louis (89)

Table 2 provides information on the scores of the leading universities in Italy (University of Bologna), Russia (RUDN University) and the USA (University of California, Davis).

Table 2. Evaluation results of top-universities in 2021(made by authors using data from [21]).

Criteria	University of Bologna (Italy)	RUDN University (Russia)	University of California, Davis (the USA)
Setting and infrastructure (SI)	1200	1175	1300
Energy and climate change (ECC)	1400	1525	1650
Waste (WS)	1725	1650	1725
Water (WT)	800	850	950
Transportation (T)	1800	1650	1450
Education and research (ER)	1750	1575	1675
Total Score	8675	8425	8750

In general, all the universities under consideration scored the same scores according to the criteria SI, WS, ER, WT. That fact demonstrates a high level of development of "green" infrastructure at universities, the effectiveness of the waste management system and the availability of educational programs, courses and research on sustainable development and environmental sustainability. It should be noted that educational and research activities in this area are often conducted in such areas as climate conservation, renewable energy, waste recycling, wastewater treatment and environmental protection [23-26].

Universities in Italy and the U.S. showed higher results in the UI GreenMetric World University Ranking in comparison to Russian universities. 27% and 18% of the universities in Italy and the U.S. participating in the ranking were in the top 100, among Russian universities only 4% were in the top hundred. The revealed trend might generally correlate with the level of development of green energy and the policy of transition to a new sustainable vector of development. Figure 2 shows the structure of primary energy consumption in the U.S., Italy and Russia in 2021.

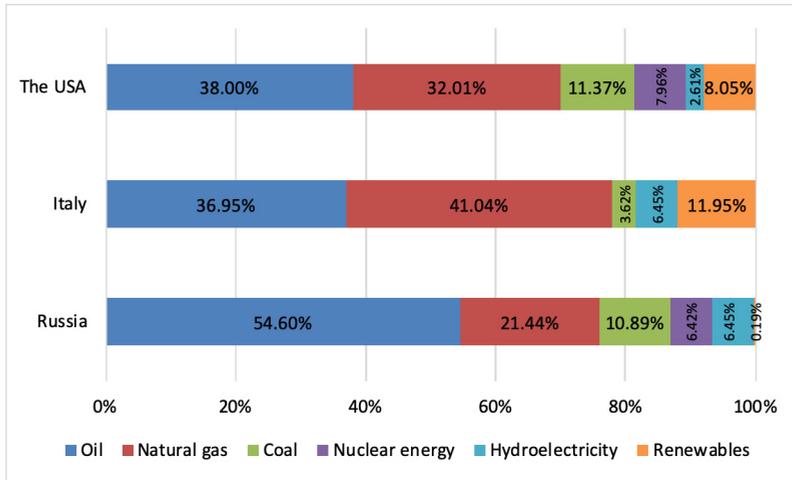


Fig. 2. Primary energy consumption by fuel in 2021, % (made by authors using data from: [27-29]).

The highest level of renewable energy development is observed in Italy – more than 18% (including hydropower). In the USA, the corresponding levels are 10.5%, in Russia less than 7%, 6.45% of which is accounted for by hydropower. This trend is primarily related to the specifics of the energy industry and the availability of natural energy resources: the U.S. and Russia have large deposits of minerals. In addition, these countries are the largest exporters of oil and natural gas in the world.

The Italian Government actively supports the transition to a green economy and the achievement of sustainable development goals, including environmental sustainability. Government initiatives and measures to support green projects are presented in Italy's recovery and resilience plan [30], in National Energy and Climate Plan (NECP) [31] and in the Italian Green Deal [32]. In addition, the Transizione 4.0 [33] plan and Eco-innovation Action Plan [34] are being implemented in Italy. Both of them outline measures of financial support for enterprises implementing projects in the field of green economy and transition to a new sustainable development vector [33,34]. According to the 2022 Country Report prepared by the European Commission, Italy is achieving the set results for the development of green energy, reducing CO₂ emissions into the atmosphere and generally demonstrates positive dynamics in the field of environmental sustainability [35].

In 2021, Russia adopted the Decree of the Government of the Russian Federation No. 1912-r dated July 14, 2021 “On the approval of the goals and main directions of sustainable (including green) development of the Russian Federation” [36]. The document identifies priority goals related to a positive impact on the environment, including (i) reduction of greenhouse gas emissions; (ii) reduction of emissions and discharges of pollutants; (iii) energy conservation and improvement of resource efficiency; (iv) conservation, protection and improvement of the environment. The development of the energy industry and the reduction of its impact on the environment are presented in the Energy Policy of the Russian Federation until 2035. The support for the development of renewable energy is

presented in the program DMP RES 2.0 [37, 38]. The Russian government supports a variety of green projects with the help of financial instruments such as subsidies, preferential rates on loans, the availability of green investments, state financing of research and development of pilot projects in the field of renewable energy, etc. However, despite the entire list of measures taken, the development of renewable energy is proceeding at a slow pace: renewable energy generation was less than 1% in 2021 [29]. In addition, in 2010, CO₂ emissions from fuel combustion amounted to 1,610 MtCO₂, in 2020 – 1,795 MtCO₂ that indicates the absence of positive dynamics within the framework of reducing greenhouse gas emissions into the atmosphere [39].

In the US, the key law in the field of environmental protection and sustainable development is the National Environmental Policy Act (NEPA), adopted in 1969 [40]. The law obliges to assess the impact of federal agencies' activities on the environment. The following environmental sustainability goals also apply in the U.S.:

- Clean Water Act;
- Clean Air Act;
- Endangered Species Act;
- Insecticide, Fungicide, and Rodenticide Act;
- Lacey Act [41].

The policy of the US government to achieve environmental sustainability covers many areas of development and offers a wide range of tools to support green projects. However, according to the data presented in the United States Sustainable Development Report 2021, by 2030, the stated ambitious goals for reducing the negative impact on the environment, developing green energy and improving energy efficiency will not be achieved [42]. Despite this, the USA demonstrates relatively high rates of transition to a new sustainable vector of development: the volume of CO₂ emissions in 2021 decreased by 14.9% compared to 2010 [39].

Thus, the following conclusions could be made:

- Italy, whose universities have taken high positions in the ranking (9 universities were in the top 100), demonstrates the highest share of RES in the structure of energy consumption in comparison to Russia and the U.S. Moreover, Italy achieved most of the current objectives in the field of sustainable development [35].
- 4 U.S. universities entered the top hundred, 2 of them entered the top 10 – the highest performance among considered countries. The US policy in achieving the environmental sustainability covers various areas of its development up to 2050: the development of renewable energy, efficient water and resource consumption, reduction of greenhouse gas emissions and emissions of harmful substances, etc. However, according to the [42] the stated sustainable development goals by 2030 are not likely to be achieved due to administrative and economic barriers.
- 54 Russian universities participate in the ranking (2 of them are in the top 100), which indicates the highest academic activity in this field in comparison to Italian and American universities. Despite this fact, Russian policy in the field of sustainable development sets less ambitious goals for achieving environmental sustainability. However, the government is implementing large-scale programs to develop renewable energy, reduce the negative impact of industry on the environment [36].

Thus, Italy is the country with the largest number of universities in the top 100 of the sustainable development rating and with the most effective environmental policy in comparison with Russia and the USA. This fact may indicate the existence of a relationship between the activity of universities and current achievements in the field of sustainable development at the national level: the higher education system not only allows the formation of the necessary worldview among the younger generation, but also stimulates the development of the industry through the implementation of research projects and the

training of specialized personnel. At the same time, the number of Russian universities participating in the rating significantly exceeds the number of U.S. and Italian universities, while the current state policy in the field of environmental protection sets less ambitious goals in comparison with the considered countries and is less effective in a number of parameters. In this case, a large number of participating universities may be associated with the initial stage of the introduction of the principles of sustainable development by the higher education system at the national level, which, in consequence, may become an incentive to change the current environmental policy. The most ambiguous situation is observed in the USA: 2 universities are in the top 10 of the rating, and environmental policy covers a wide range of issues in the field of climate conservation and environmental protection. At the same time, according to [42], not all the set goals can be achieved within the set deadlines. This trend may be related to the size and developed industrial sector of the economy.

The results obtained could demonstrate that there is a relationship between the policy pursued by universities in the field of sustainable development and the pace of achievement of results in this area at the national level. Universities play an important role at the initial stage of implementing the principles of sustainable development: it is on their basis that the necessary research is most often carried out, support and incentive mechanisms are developed, and the necessary intellectual capital is formed among the younger generation [23-25, 43, 44]. Students of green universities are more aware of the need to preserve the climate and the environment and are more likely to bring the acquired understanding and values to the workplace and directly to the circle of family and acquaintances. Thus, universities play an important role in the formation of public support and initiatives to achieve environmental sustainability at national levels.

4 Conclusions

The results obtained may indicate that there is a relationship between the policy pursued by universities in the field of sustainable development and the pace of achievement of results in this area at the national level. Italy has demonstrated high results of the positions of state universities both in the UI GreenMetric World University Rankings and in achieving the set goals for environmental sustainability. The U.S. universities also showed a high level of sustainable development principles' introduction with the well-developed state environmental policy. The positions of Russian universities in the ranking partly correlate with the current situation in achieving environmental sustainability and the volume of support in this area. However, the participation of a large number of universities in the ranking may indicate a significant incentive to implement the principles of sustainable development at all state levels in the foreseeable future.

The higher education system has a role to play in the process of achieving environmental sustainability: the higher the activity of universities in the field of sustainable development and environmental conservation, the higher the pace of transition of the state to the new concept of green and sustainably economy.

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