

# The development of environmentally relevant educational activities within innovation parks: the case of Ukraine

*Mykola Petrushenko*<sup>1\*</sup>, and *Hanna Shevchenko*<sup>1</sup>

<sup>1</sup>Institute of Market Problems and Economic-Ecological Research of the National Academy of Sciences of Ukraine, Department of Economic Management of Natural Resources, Frantsuz'ky Blvd, 29, 65044 Odesa, Ukraine

**Abstract.** Combining industrial, environmental, social and scientific aspects of sustainable development in the form of innovation parks in emerging economies, inevitably leads either to the short-term functioning of too comprehensive and unviable organizational structures, or to the creation of modern platforms not only for sustainable production, but also for the greening of education. The purpose of the paper is to analyze the possibilities of developing environmentally relevant educational activities within innovation parks, on the example of industrial, scientific and technological parks in Ukraine. The research methodology: the quintuple helix model in analyzing the structure of activities within the innovation parks along the vertical “education – environment”, a comparative analysis of the concepts of Ukrainian industrial parks. The approach developed in the paper to the activation of natural and ecological activities of industrial parks in Ukraine allows identifying the level of formalization of the environmental component in their concepts, as a basis for the development of environmentally relevant education. At the conceptual level, the broad possibilities of this development depend primarily on the sufficient validity of organizational models reflecting the environmental-oriented powers of initiators, management companies and participants. At the practical level, these opportunities are partially realized in Ukrainian science parks.

## 1 Introduction

Combining industrial, environmental, social and scientific aspects of sustainable development in the form of innovation parks in emerging economies, inevitably leads either to the short-term functioning of too comprehensive and unviable organizational structures, or to the creation of modern platforms not only for sustainable production, but also for the greening of education. The relevance of the formation of innovative structures and opportunities for environmental education in them is the same for both developed economies and emerging economies. In particular, over the last decade, Ukraine has been trying to create innovation parks that do not yet have significant practical implementation,

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\* Corresponding author: [petrushenkom@gmail.com](mailto:petrushenkom@gmail.com)

but have a knowledge potential, especially in the context of implementing the sustainable development concept.

The paper [1] summarizes the relevant activities of science parks, in particular their contribution to economic and innovative development. The source [2] analyzes the role of research centers in the development of investment activities within the science park. Researchers [3] identify innovative relationships between industrial and nature parks. The source [4] reveals the features of the so-called “social innovation park” in the context of forming a concept that combines social, technological and innovative aspects of the academic entrepreneurship. The paper [5] explores the formal and informal aspects of talent management in the context of science park development. The article [6] proves the synergetic role of environmental education in the interaction between researchers and practitioners in the field of environmentally oriented activities, based on a broad generalization of the relevant literature. The article [7] reveals the features of a synergetic approach to the study of environmental conflicts. The source [8] presents a systematic review of the scientific literature on theoretical and methodological aspects of environmental policy within the concept of sustainable development. Researchers [9] also emphasize the importance of the impact of environmental education on applied areas, such as climate change and renewable energy. At the same time, the development of issues relevant to environmental education within industrial parks, especially in emerging economies, is insufficient.

The purpose of the paper is to analyze the possibilities of developing environmentally relevant educational activities within innovation parks, on the example of industrial, scientific and technological parks in Ukraine.

## **2 Methodology**

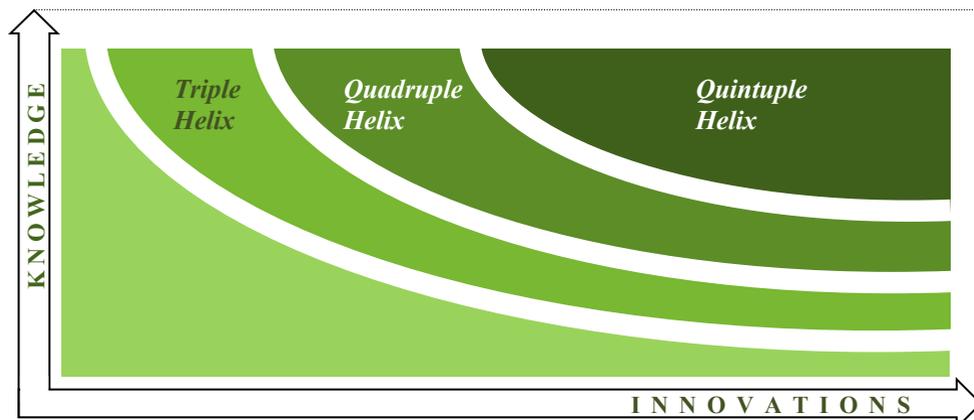
The research methodology: the quintuple helix model [10] in analyzing the structure of activities within the innovation parks along the vertical “education – environment”, a comparative analysis of the concepts of Ukrainian industrial parks, namely such components as the purpose and tasks of creation, and functionality, location and size of the land plot, requirements to participants, information on estimated total volumes of energy consumption and transport infrastructure, development plan, indicative resources (financial, material, technical, labor, natural, etc.) and expected sources of their involvement, organizational model and expected results of functioning.

## **3 Results**

The study of environmental education within innovative formations in Ukraine concerns primarily intersectoral cooperation aimed at achieving the Sustainable Development Goals 2030 [11]. In particular, we are talking about the interaction of energy and tourism [12], agriculture and tourism [13], and so on. The activities of Ukrainian industrial parks also focus mainly on agricultural activities, energy and some other industries. However, social or environmental aspects, in particular relevant to educational activities, are virtually underdeveloped.

### **3.1 Symbiosis of knowledge and innovation**

The Helix modeling explains eco-innovation development, in particular within industrial, technological or science parks: the harmony of this development is achieved in the upper right corner in the plane of “innovation – knowledge” (Figure 1).



**Fig. 1.** Helix modeling in the plane of “innovation – knowledge”. Source: developed by the authors based on [10].

Environmentally relevant educational activities, following the logic of Helix modeling, are associated with the accumulation of relevant knowledge in a symbiotic combination with sustainable innovation. This is possible at different levels of innovation park development: from additive level (greening of knowledge with insufficient development of innovations – Triple Helix) to integrated level (symbiosis of knowledge potential and sustainable innovations – Quintuple Helix).

### 3.2 Environmentally relevant assessment of industrial park concepts

The above stages of the evolution of Helix modeling and appropriate approaches to the organization of innovation can be the basis for the review and development of activities, including environmentally relevant educational activities, industrial parks in Ukraine.

According to the Law of Ukraine On Industrial Parks, Art. 15, the list of documents for inclusion of individual entrepreneurs in the Register of individual entrepreneurs, along with the application for inclusion, the decision of the initiator on the establishment of individual entrepreneurs, an extract from the State Land Cadastre, also includes the concept of industrial park [14].

The results of the comparative analysis of key elements of the Ukrainian industrial park concepts are presented in Table 1.

**Table 1.** The results of the park concept analysis: an integrated approach.

Name of the industrial park	Aim	Tasks (and principles)	Development plan	Organizational model	Expected result
Dolyna	+++*	++++*	+++*	++***	++++***
Slavuta	+++	+++	+	+	+++
Riasne-2	+++	+++	++	++	++
Korosten	+++	+++	+	++	+++
Central	+++	++++	+++	+	+++
Svema	+++	+++	++	++	+++
Solomonovo	++	++++	+++	+++	++
The first Ukrainian	+++	+++	+++	+++	++++
Bionic Hill	++++	++++	++++	++++	++++
The iPark	+++	+++	+++	+	+++

Source: evaluated by the authors based on [15].

- \*+ formalization of economic aspects, without a thorough management approach;
- ++ clear wording reflecting economic aspects;
- +++ clear wording reflecting economic and social aspects;
- ++++ clear wording reflecting economic, social and environmental aspects.
- \*\* + sufficient validity in time or space;
- ++ sufficient validity in temporal and spatial dimensions;
- +++ sufficient validity in both dimensions, taking into account the natural and ecological component in one of them;
- ++++ sufficient validity and consideration of the natural and ecological component in both dimensions.
- \*\*\* + descriptive unified model;
- ++ descriptive model with visualization of the relevant organizational structure of the park;
- +++ descriptive model with visualization of the relevant organizational structure of the park, reflecting the socially-oriented powers of the initiator and / or management company and / or participants;
- ++++ descriptive model with visualization of the relevant organizational structure of the park, reflecting the social and environmental-oriented powers of the initiator and / or management company and / or participants.
- \*\*\*\* + disclosure of general trends;
- ++ analysis of the financial-investment component;
- +++ analysis of financial-investment and socio-economic (job creation, etc.) components;
- ++++ analysis of financial-investment, socio-economic and natural-environmental components.

Thus, the provisions of the Helix model have been hardly used in the development of these concepts (except, for example, the concept of IP “Svema”, where the components of education, production and government have been classically combined in the Triple Helix model). The concepts (goals, objectives, principles) should be spelled out environmental requirements. That is, potentially the parks should be ready to perform environmentally friendly tasks.

The development of environmental education and related activities has fewer barriers within science and technology parks compared to industrial parks. However, technology parks are almost non-existent in Ukraine, and science parks do not receive sufficient investment. Although at the level of interaction between universities and business, they have the prospect of sustainable development.

### **3.3 Environmentally relevant education within the joint activities of industrial and science parks**

Materials and results of the environmental scientific projects (Table 2) are used in the educational process by Ukraine’s universities, on the basis of which science parks are based. This is a scientific and applied component of such courses as “Environmental Management”, “Environmental Economics”, “Fundamentals of Sustainable Development” and more. This approach reinforces the concept of scientific-educational institutions within the Ukrainian universities.

The integration of this experience into the field of industrial parks is based on a combination of their activities with the activities of science parks. As, for example, it is the business incubator of the IP “Svema” together with Sumy State University.

Prospects for the development of such interaction have two main directions:

**Table 2.** Environmental projects implemented by science parks of Ukraine.

Name of the science park (SP)	Name of the project	Project duration
SP of the State Ecological Academy of Postgraduate Education and Management "Chornobyl"	Ecologically safe handling of compressor pipes, equipment and materials contaminated with man-made sources of ionizing radiation of natural origin	2017
	Ecological audit services in Boyarka	2018-2020
	Determination of the impact of waste disposal sites (storage of ash slag) LLC "Euro-Reconstruction" on air pollution, soil, surface and groundwater	
SP "University Arsenal"	Reclamation of old landfills using "Volume Bioremediation" technology	2016-2025
SP DonNU-Podillya	Water resources monitoring: projects for financing from the environmental protection fund; cluster model of water resources management; analysis of the state of the tributaries of the Southern Bug, identification of critical zones, action plan to restore the ecological condition of the river	

Source: compiled by the authors based on [16].

– within eco-industrial parks such as Bionic Hill and UNIT.city [17], which provide for environmentally relevant education, at both university and business levels;

– dissemination of experience in all Ukrainian universities, where there are science parks and environmentally relevant courses are studied, namely: SP "Taras Shevchenko University of Kyiv", SP of the National University of Life and Environmental Sciences "Sustainable Nature Management and Quality of Life", SP "Kyiv Polytechnic", PS of the Odessa Polytechnic University, SP of the National Technical University "Kharkiv Polytechnic Institute", etc.

In this way, there may also be a solution to the shortage of funding: if today environmental projects are financed mainly by universities' own funds with little other investment, then in the long run attracting business will also mean raising funds.

## 4 Conclusions

The approach developed in the paper to the activation of natural and ecological activities of industrial parks in Ukraine allows identifying the level of formalization of the environmental component in their concepts, as a basis for the development of environmentally relevant education. At the conceptual level, the broad possibilities of this development depend primarily on the sufficient validity of organizational models reflecting the environmental-oriented powers of initiators, management companies and participants. At the practical level, these opportunities are partially realized in Ukrainian science parks. The paper proposes the integration of ecologically relevant education in two directions: by creating eco-industrial parks with an educational component and disseminating the experience of implementing the results of environmental projects in the educational process of universities on the basis of which science parks are created.

The research is part of the National Academy of Science of Ukraine's research projects: "Inclusion of the experience economy in the nature management" (No. 0119U000229), "Investment and innovation policy dominants of national economy's nature management" (No. 0120U100160).

## References

1. L. Lecluyse, M. Knockaert, A. Spithoven, The contribution of science parks: a literature review and future research agenda. *J Technol Transf.* 44, 559-595, <https://doi.org/10.1007/s10961-018-09712-x> (2019)
2. F. Lamperti, R. Mavilia, S. Castellini, The role of Science Parks: a puzzle of growth, innovation and R&D investments. *J Technol Transf.* 42, 158-183, <https://doi.org/10.1007/s10961-015-9455-2> (2017)
3. M.M. Petrusenko, H. M. Shevchenko, N. O. Vernydub, O. V. Kravchenko, N. V. Ovcharova, The forming of industrial and national natural parks networks in Ukraine based on the principles for responsible investment. Financial and credit activity: problems of theory and practice. 31(4), 221-229, <https://doi.org/10.18371/fcaptp.v4i31.190880> (2019)
4. Lundström, C. Zhou, Promoting innovation based on social sciences and technologies: the prospect of a social innovation park. *Innovation: the European Journal of Social Science Research.* 24(1-2), 133-149, <https://doi.org/10.1080/13511610.2011.583864> (2011)
5. H. Löffsten, M. Klofsten, E. Cadorn, Science parks and talent attraction management: university students as a strategic resource for innovation and entrepreneurship. *European Planning Studies.* 28(12), 2465-2488, <https://doi.org/10.1080/09654313.2020.1722986> (2020)
6. N. M. Ardoin, A.W. Bowers, E. Gaillard, Environmental education outcomes for conservation: a systematic review. *Biological Conservation.* 241, 108224, <https://doi.org/10.1016/j.biocon.2019.108224> (2020)
7. O.V. Prokopenko, M.M. Petrusenko, Systems-synergetic thinking to the environmental conflicts management at the territorial level. *Marketing and Management of Innovations.* 1, 254-266, <https://mmi.fem.sumdu.edu.ua/journals/2013/1/254-266> (2013, accessed 10 Apr 2021)
8. K. Aikens, M. McKenzie, P. Vaughter, Environmental and sustainability education policy research: a systematic review of methodological and thematic trends. *Environmental Education Research,* 22(3), 333-359, <https://doi.org/10.1080/13504622.2015.1135418> (2016)
9. S.N. Jorgenson, J. C. Stephens, B. White, Environmental education in transition: a critical review of recent research on climate change and energy education. *The Journal of Environmental Education.* 50(3), 160-171, <https://doi.org/10.1080/00958964.2019.1604478> (2019)
10. E.G. Carayannis, D. F. J. Campbell, Developed democracies versus emerging autocracies: arts, democracy, and innovation in Quadruple Helix innovation systems. *J Inn Entrepreneurship.* 3(12), <https://doi.org/10.1186/s13731-014-0012-2> (2014)
11. Sustainable Development Goals Ukraine / Voluntary National Review, [https://sustainabledevelopment.un.org/content/documents/26295VNR\\_2020\\_Ukraine\\_Report.pdf](https://sustainabledevelopment.un.org/content/documents/26295VNR_2020_Ukraine_Report.pdf) (2020, accessed 10 Apr 2021)
12. H. Shevchenko, M. Petrusenko, A symbiosis between renewable energy and tourism: The case of Dnipro region in Ukraine. *E3S Web Conf.* 234, 00087, <https://doi.org/10.1051/e3sconf/202123400087> (2021)
13. H. Shevchenko, M. Petrusenko, Rural tourism within the Sustainable Development Goals: the case of Ukraine. *SHS Web Conf.* 95, 01004, <https://doi.org/10.1051/shsconf/20219501004> (2021)
14. Law of Ukraine On Industrial Parks, <https://zakon.rada.gov.ua/laws/show/5018-17#Text> (2013, accessed 10 Apr 2021)
15. Register of industrial parks. <https://data.gov.ua/dataset/8206ed0c-5911-4b88-9c7f-56c6fcd08660/resource/2e670248-f3e2-49c8-a202-3595955af87a> (accessed 10 Apr 2021)
16. Science parks / Ministry of Education and Science of Ukraine, <https://mon.gov.ua/ua/nauka/innovacijna-diyalnist-ta-transfer-tehnologij/naukovi-parki> (accessed 30 Apr 2021)
17. UNIT.city, <https://unit.city/> (accessed 30 Apr 2021)