Ecosystem approach and innovative educational ecosystems

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Abstract. The article discusses innovative educational ecosystems. Special attention is paid to the analysis of the concept of innovation ecosystem (eco-innovation). This study analyses environmental innovations as a part of the innovation ecosystem. As information resources, we used periodical, analytical, and translated literature, which investigated the issues raised in this article.

1. Introduction
The ecosystem approach is actively spreading in all spheres of society. This approach also affected the educational area. In ecology, the ecosystem approach is a strategy for the integrated management of natural resources that ensures their conservation and sustainable use. In terms of education, this approach leads to a change in the way we learn, think, and act. The modern educational model requires new methods of organization, which will be based on the integration of knowledge and the involvement of students. Ecosystem thinking provides an opportunity to create an effective learning environment with constant interaction, real-life practice, involvement of the culture and knowledge of local communities.

The purpose of this article is a brief study of the concept of the ecosystem approach and an analysis of innovative ecosystems, their functions, and stages of development.

2. The analysis of the approach and the educational ecosystem
The ecosystem approach is based on the application of an appropriate scientific methodology that covers all levels of the organization, including the main structures, processes, functions, and relationships between participants and their environment. This approach recognizes that people with their cultural diversity are an integral part of many ecosystems.

The ecosystem approach to implementing innovative economic development processes has been applied relatively recently. It is based on the concepts of innovation systems and the innovation environment. Its main distinctive feature is a high level of self-organization and cooperation of subjects, which leads to the optimization of all innovation processes and the intensification of innovative development. Within the ecosystem, innovation activities are carried out on an integration basis, accumulating human, financial, intellectual, and other resources to ensure effective commercialization of innovative developments.

Ecosystem thinking uses a biological metaphor in response to the complexity of the world around us. In addition, some of the key features of biological ecosystems ideally suit to the requirements for changes in education, which makes it easy to understand why they are metaphorically attractive for thinking about the future. Ecosystems provide [1]:
1. diversity – multiple participants perform many roles, ensuring the stability of the ecosystem;
2. maximal productivity and resource cycling in the ecosystem-resources (resources are optimized and distributed, so nothing is wasted);
3. adaptability: ecosystems can adapt and respond to the needs of learners in changes in the institutional environment (as opposed to more stringent approaches of partnership and networking);
4. scalability: ecosystems can operate at various scales, from groups of students or specific schools to a planetary community.

An ecosystem approach offers a greater diversity, flexibility and interdisciplinarity, not only in providing relevant content and appropriate educational technologies, but also in identifying the need for professional and soft skills through natural mechanisms of self-regulation and self-development. Besides, it can demonstrate a greater effectiveness and efficiency compared to traditional hierarchical models. The starting point for the analysis of the ecosystem approach is the recognition of a new role of education in ensuring the prosperity of all people and communities in a complex and rapidly changing world by solving the accumulated and new problems of the twenty-first century. These include: the digital divide, the imbalance of information flows, growing economic and social inequality, ethnic and cultural differences and unprecedented environmental pressures on the Earth's nature, as well as the destruction of traditional labour markets as a result of technological progress.

The educational ecosystem develops the ability to learn and relearn, to adapt to different situations through various educational formats. Namely, these are constantly developing global online platforms that give a person an idea of the world picture (common and basic values, professional knowledge); communities of practice, where a person develops professionally together with other colleagues, implements projects, and works in working teams [2].

Innovative educational ecosystems [3]:
1) allow you to diversify educational resources and educational routes for students;
2) provide mutual exchange of educational resources and new ways of learning;
3) provide the required dynamics of content updating;
4) include formal and informal educational institutions and resources, traditional and new entrants;
5) have a distributed management based on mutual interest, community support, horizontal and ascending links;
6) motivate students for their future success and development;
7) increase the interest of students to participate in solving the problems of the world around them, and not only in academic achievements.

Ecosystem can help to produce the economy (and society) of the future: ecosystems for technological innovation - production teams (entrepreneurs/technologists); ecosystem for dynamic labour markets - "competencies of the future", rapid response to growing demand; ecosystems for the production of new crops.

Ecosystem can help to overcome (local and global) challenges: ecosystems for creating an eco-sustainable society - eco-competencies, regeneration practices, prototypes of new technologies and lifestyles; ecosystem for overcoming inequality.

The innovation ecosystem is an environment that is formed directly by the participants of the innovation process, in which their interaction takes place, aimed at the development of innovations.

It follows that an innovation ecosystem should be understood as a self-organizing, self-regulating, and self-developing open system that is characterized by input flows of ideas, people, resources, and information.

Innovation activity considers a large set of scientific, organizational, financial, and technological activities leading together to innovative projects. One of these types of innovations is environmental innovations, which are aimed at improving environmental safety, both in the production process and as a result of using innovative products.

The concept of the Innovation ecosystem (IES) was proposed by Charles W. Wessner [4] in 2004. It is a tool for creating conditions that increase the competitiveness of organizations in national and
regional economies. At the heart of the concept lies the idea of innovation as a process of transformation of scientific research into a market product or service, which requires a lot of collective efforts of participants: companies, universities, research companies. The innovation ecosystem shapes these efforts, allowing for a synergistic effect.

The term "innovation ecosystem" synthesizes two key concepts: "innovation" and "ecosystem". The innovation ecosystem is based on innovators (innovative individuals) — all those who designs, develops and promotes innovations based on their own beliefs or demand. All participants in the innovation ecosystem should be divided into two types: those who create the demand for innovation and those who create the innovation itself.

Environmental innovations are technological and social innovations in the field of environmental protection, rational use of natural resources and the formation of environmental values among citizens [5]. Eco-innovations ensure the interaction between economic development and environmental conservation to a large extent by producing additional interconnected internal and external effects. Environmental innovations should help prevent the occurrence of socio-environmental problems and reduce the cost of eliminating the consequences of technological progress.

The trend of increasing use of environmental innovations is observed all over the world. Countries have different motivations for using environmental innovations and green technologies, but most of them have already realized the importance of these technologies.

Promoting innovation on a global scale contributes to solving not only economic problems, but also environmental ones, in particular the rational use of natural resources. Because of this, complex and global innovations of various types and levels are very significant, the implementation of which should be important and dynamic.

All elements of the innovative development model should be closely interrelated, which implies a constant process of exchange of various flows (information, resources). Each of the ecosystem elements, in turn, can be divided into subsystems of different levels that solve separated local problems.

Analysis of the elements of the innovation ecosystem allows identifying the functions and tasks of each level. Despite sufficient global experience in building innovative ecosystems, there is no comprehensive list of conditions for ensuring the success of an innovative ecosystem, since each country has individual characteristics (climate, geopolitical, socio-cultural, resource, etc.). Each country, territory, corporation, and university should define individual methods for managing the formation and development of innovation processes in order to achieve success in innovation activities.

3. Results
Analysis of research and development models reveals the main stages of formation of innovative ecosystems:

1. The stage of resource concentration is characterized by increasing the research potential for any level of the innovation ecosystem (individual, corporate, territorial, national, and supranational).

2. The stage of transformation of the regional economy and the formation of an innovative ecosystem. This stage is characterized by a symbiosis of technological projects of small innovative enterprises and large high-tech businesses.

3. The stage of innovation and technological breakthrough – a significant increase in the number of technological projects.

4. The maturity stage of the innovation ecosystem. The created innovative infrastructure for supporting innovative enterprises is working effectively, becoming more "technological" and scalable; the innovation ecosystem is developing its own brand; it is being integrated into existing technological chains and creating new ones based on international cooperation.

The ecosystem approach requires flexible adaptive management that takes into account both the complex and dynamic nature of ecosystems and the lack of a complete understanding of their functioning mechanisms. Ecosystem processes are often non-linear, and their results are often delayed,
so the lack of strict regularities can create some ambiguity or lead to unexpected results. Management should be flexible enough to respond to difficulties in a timely manner and use elements of "learning by doing" or feedback from research workers in its tactics. Action may be necessary even if the final link between cause and effect has not yet been fully established scientifically.

4. Conclusion
The ecosystem approach will change the processes of learning and thinking. In education, this will lead to a shift to networked models of shared voluntary learning and development, instead of hierarchical systems based on coercion. Of particular importance is the ability of institutions to manage complex research projects. This will be facilitated by the creation of technology parks, special centres, in which the achievements of science and technology will be implemented in practice. Many projects are created by student communities, based on entrepreneurial programs and events. Educational ecosystems are networks of interconnected and diverse actors involved in lifelong learning, education, and development. Educational ecosystems strive to develop the individual and collective potential of students and the community. They are diverse, dynamic, and constantly evolving. The main goal of educational ecosystems is to create a better future for people and communities.

References
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