

Formation of educational ecosystems through the digital transformation of the educational environment

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Abstract. Cognitive and digital transformation stimulates both academic and applied interest in the concept of socio-economic ecosystems. Today, traditional interaction chains in education, cooperation forms, for example, network ones, should give way to new organizational-economic interaction mechanisms – educational ecosystems. Research purpose is development of theoretical approaches to the formation of cross-geographic educational ecosystems through the digital transformation of the educational environment. The study is based on general scientific methods of systematization, comparison and generalization of research in the field of formation and functioning of ecosystems. Structural-functional and integrated approaches were used to develop the concept of formation of educational ecosystems. A comparative analysis of three overlapping ecosystem concepts (business ecosystems, knowledge ecosystems and innovation ecosystems) was carried out. The type, approaches and strategies for the formation of cross-geographic educational ecosystems have been determined. It is noted that digital transformation forms a digital educational environment, which can serve as the basis for the formation of cross-geographic educational ecosystems. As a typical basis for the formation of an educational ecosystem, it is proposed to use a business ecosystem as a form of socio-economic interaction of actors. As a strategy for the formation of an ecosystem, a structural strategy is defined with the allocation of a core – a leading university or an association of universities, and as actors – universities, students, post-graduate students, teachers, employees, graduating students, employers and other stakeholders. It is noted that the core plays a key role in the formation of a cross-geographic educational ecosystem. An effective strategy of the educational business ecosystem depends on the ability of the core to place other participants in positions and endow them with roles, on the one hand, corresponding to the strategy of the ecosystem as a whole, on the other hand, ensuring the actors' satisfaction.

Keywords: business ecosystem, knowledge ecosystem, innovation ecosystem, digital educational environment

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1 Introduction

Sustainable social development at the current stage is faced with interrelated transformational shifts in society and education: cognitive transformation and the transition from knowledge economy 1.0 to knowledge economy 2.0 [1], digital transformation and the transition to the digital economy and digital educational environment [2]. Cognitive and digital transformation stimulates both academic and applied interest in the concept of socio-economic ecosystems. Traditional interaction chains, cooperation forms, for example, network ones, are giving way to new organizational-economic interaction mechanisms. In this case, different organizations and consumers who seek to actively participate in the value creation processes can contribute to the customer value creation.

Ecosystems are formed and developed both at the regional level and at the level of markets and industries [3, 4]. A number of researchers [1, 5-7] note the importance of including universities in the socio-economic ecosystem of territories. Kremneva et al. associate the modern transformation of the higher education system with the development of an educational model, the key form of organization of which is the educational ecosystem. Research on educational ecosystems is mainly aimed at the formation and development of territorial ecosystems, but emerging ecosystems in other industries are global and not tied to any boundaries [8]. In this regard, it is interesting to consider the possibilities of forming an educational ecosystem that is not bound by geographic boundaries.

2 Methods

The study is based on the analysis of theoretical materials and practical information in the field of formation and functioning of ecosystems, obtained by domestic and foreign scientists. The methods used for the analysis and systematization of scientific views and conceptual ideas made it possible to specify the criteria for the classification of ecosystems, to highlight approaches to the formation of ecosystems; methods of structural-functional analysis and comparison made it possible to identify the basis, type and strategy for the formation of ecosystems.

3 Results

Modern research on management and innovation distinguishes three overlapping ecosystem concepts: an entrepreneurial or business ecosystem, described by Moore [9], a cognitive or knowledge ecosystem, an innovation ecosystem [5, 10].

Business ecosystems are currently the most studied ones. The concept of a business ecosystem as an element of the economy was introduced by Rothschild [11] and Moore [9], who noted that a business ecosystem is “an economic community of interacting companies and entrepreneurs creating a value proposition for consumers”. Participants (actors) of a business ecosystem jointly develop their capabilities, roles and competitive advantages, strive to correspond to the general development vector determined by one or several central companies [12, 13]. Further research on business ecosystems [8, 14] has expanded the traditional industry framework by viewing a business ecosystem as an interconnected group of actors who collaborate to create customer value.

Knowledge ecosystems focus on generating new knowledge and technologies [10]. A knowledge ecosystem aims to create, store, transfer and use knowledge through interaction between ecosystem actors through learning and to create new knowledge and technologies.

Access to these resources determines the integrity of the system and contributes to its development.

A business ecosystem is related to the creation of customer value, a knowledge ecosystem is related to the creation of knowledge and technology, while an innovation ecosystem combines the research concept of the knowledge ecosystem and the production concept of the business ecosystem and focuses on the joint value creation [10, 15]. An innovation ecosystem or “co-innovation network” emerges as an integrating ecosystem between generating new knowledge and using it to create value in business ecosystems [5, 16-18].

Studying strategies for the formation of ecosystems, Adner [19] considers two approaches: affiliation and structural ones. The analysis of an ecosystem as a set of links is more suitable for the macro-level. In the case of ecosystem formation in education, in the authors’ opinion, it is necessary to consider an ecosystem as a structure that focuses on the joint value creation.

In the structure of each ecosystem, there is a core with key resources. The core largely determines ecosystem goals, the nature and order of interactions between its participants [12]. The key role of the core is to ensure that ecosystem participants are satisfied with their place in the ongoing interactions, their contribution to the value creation and their rewards [19]. An ecosystem in which all participants are satisfied with their position will be successful and competitive. There is no hierarchy in ecosystems, but there are certain rules governing the format and order of interaction. The core defines the overall architecture, while the participants have significant autonomy. If there is a need for changes in the structure, an ecosystem generates new processes and rules. Modularity allows the core to avoid over-coordination and creates conditions for the ecosystem development and growth.

To date, two established approaches to the formation of ecosystems can be distinguished, which can be found in the scientific literature. These two approaches can be interpreted as organizational [19] and technological ones [20]. The organizational approach is focused on the issues of interaction and interdependence of ecosystem participants, the strategy implementation. Within the framework of the technological approach, an ecosystem is considered as a combination of the owner of the technological platform and the providers of complementary services. In technological ecosystems, peripheral actors are linked to a central platform by open technologies and standards. By linking to the platform, ecosystem participants generate complementary services and gain access to platform consumers.

The experience of various industries shows that a technological approach based on a single digital educational environment is more suitable for the formation of an ecosystem in higher education in the context of digital transformation.

Having determined the strategy and approach to the educational ecosystem formation, it is necessary to determine the type of ecosystem. The table summarizes the features of using different types of ecosystems for higher education.

Table. Features of ecosystem types in higher education

	Business ecosystem	Knowledge ecosystem	Innovation ecosystem
Basis	Digital educational environment	Knowledge and technology	Creation and commercialization of innovations
Approach	Technological	Technological	Organizational
Strategy	Structural	Structural	Affiliated

Interaction	Centralization without strict hierarchical control	Decentralization, synergy through knowledge sharing	Sectoral and cross-sectoral clusters, different levels of cooperation
Actors	Core – leading universities (association) Actors – universities, students, employees, graduating students, etc.	Core – leading scientific institutes and universities. Actors – research institutes, universities, students, postgraduate students, employees, graduating students, etc.	Core – universities, research institutes, innovative companies (association) Actors – government, business, scientific institutions and universities, innovation brokers and financial organizations
Activity logic	Joint creation of educational, managerial and support resources in a single digital educational environment	Knowledge and technology bank open only to actors	Regional and cross-regional clusters uniting around innovation hubs

4 Discussion

An educational business ecosystem provides for the joint participation of actors in creating the consumer value of educational services in a single digital educational environment on the basis of modularity and autonomy. A knowledge ecosystem assumes accessibility of knowledge and technology for all the actors through digital repositories and databases. An innovation ecosystem is a collection of knowledge ecosystems and business ecosystems that interact around hubs, supported by intermediary actors.

To form a cross-geographic educational ecosystem, one can consider a business ecosystem as a form of socio-economic interaction of actors. As a strategy for the formation of an ecosystem, a structural strategy is determined with the allocation of a core – a leading university or an association of universities and, as actors – universities, students, postgraduate students, teachers, employees, graduating students, employers and other stakeholders.

In the formation of a cross-geographic educational ecosystem, the core plays a key role. The core ensures the regulation of the structure, determines the coordination and rules governing the format of participation, the procedure for interaction and reward. An effective strategy of an educational business ecosystem depends on the ability of the core to place other participants in positions and endow them with roles, on the one hand, corresponding to the strategy of the ecosystem as a whole, on the other hand, ensuring the actors' satisfaction.

Regulation is one of the key factors in forming a cross-geographic education ecosystem. All ecosystems are dynamic and changeable. It should be understood that the satisfaction of ecosystem participants is not permanent. The ecosystem logic can change under the influence of external and internal factors. It should be borne in mind that any ecosystem cannot be viewed as a simple set of participants and as a set of two-way interactions. Interactions and interdependencies in an ecosystem are diverse. The value proposition formed by an educational ecosystem and which is its foundation is connected not only with the content, but also determined by interactions between participants.

5 Conclusion

Digital transformation forms a digital educational environment that can serve as the basis for the formation of cross-geographic educational ecosystems. They can be created as business ecosystems based on a technological approach and structural strategy and subsequently transformed into cross-geographic innovation ecosystems.

The organizational component is an important one in the formation of educational ecosystems. In ecosystems, there is a certain level of organization, these are organizational structures that are held together provided that their actors are in formal or informal agreement on a common goal and logic of interactions.

In the formation of an educational ecosystem, the main role belongs to the core. The core should form the basis for the development of the digital educational environment of the ecosystem, define formal and informal rules governing the format of participation, the procedure for interaction and remuneration of all actors. On the other hand, it is necessary to understand that over-regulation of interactions can make the development of an ecosystem impossible and transform it into a system of numerous two-way interactions.

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