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HACKATHON SYSTEM AS PART OF THE UNIVERSITY INNOVATION ECOSYSTEM

This article attempts to explore the genesis of such concepts as an "ecosystem", "university ecosystem" and a "hackathon system". The study offers an overview of the fundamental differences between these ecosystems which has revealed that a landscape of the socioeconomic background could be represented as a set of industry ecosystems – a certain force field able to integrate localized groups of organizations, business models, markets, networks, supply chains, innovation projects, infrastructure systems, etc. Apart from the above, the study discusses the specifics of shaping the boundaries of the university ecosystem as well as demonstrates that the hackathon system is an element of the overall innovative ecosystem of a higher education institution which in the framework of this study is viewed as a multi-subject system operating within the common domain (managed by a coordinating entity that acts as a core of an organization) with the aim of materializing a value proposition as an outcome of intellectual engagement, where the domain is the HEI environment, the coordination subject is the HEI, and the value proposition is an innovation or an innovative solution. According to the research findings, the university environment is a three-loop space consisting of micro-, meso- and macroloops. It is argued that the university hackathon ecosystem covers not only university structural units which are directly or indirectly involved in innovative activities (e. g., faculties, research laboratories, research groups, employment centres, business incubators, etc.) but also other independent business entities that are not directly related to university activities (such as small innovative enterprises, funds, licensing and certification agencies, expert commissions and others).

Keywords: *ecosystem; socioeconomic system; university ecosystem; university hackathon ecosystem.*

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ХАКАТОН-СИСТЕМА ЯК ЧАСТИНА ІННОВАЦІЙНОЇ ЕКОСИСТЕМИ УНІВЕРСИТЕТУ

У цій статті досліджено генезис таких понять, як «екосистема», «університетська екосистема» та «хакатон-система». Здійснено аналіз принципових відмінностей цих екосистем, який засвідчив, що ландшафт соціально-економічної системи може бути представлений як сукупність галузевих екосистем, які виступають певним силовим полем, що дозволяє об'єднати локалізовані комплекси організацій, бізнес-моделі, ринки, мережі, ланцюжки поставок, інноваційні проєкти, інфраструктурні системи та ін. Крім цього, виявлено особливості формування меж екосистеми університету, а також доведено, що хакатон-система є одним із елементів інноваційної екосистеми закладу вищої освіти, під якою в рамках цього дослідження розуміється мультисуб'єктна система, що функціонує в межах загального для всіх домену (який керується координуючим суб'єктом, що виступає його організаційним ядром) з метою матеріалізації ціннісної пропозиції, що є результатом інтелектуальної діяльності, де домен – це середовище ЗВО, суб'єкт координації – це ЗВО, а ціннісна пропозиція – це інновація або інноваційне рішення. За результатами дослідження встановлено, що університетське середовище – це триконтурний простір, що складається з мікро-, мезо- та макроконтурів. Підкреслено, що елементами хакатон-екосистеми університету варто вважати як безпосередньо структурні підрозділи університету, які

прямо чи опосередковано задіяні в інноваційній діяльності (наприклад, факультети, дослідні лабораторії, науково-дослідні групи, центри працевлаштування, бізнес-інкубатори тощо), так і суб'єкти, що самостійно здійснюють господарську діяльність, але напряму не пов'язані з діяльністю університетів (такі, як малі інноваційні підприємства, фонди, органи ліцензування та сертифікації, експертні комісії та інші).

Ключові слова: *екосистема; соціально-економічна система; екосистема університету; екосистема університетського хакатону.*

Problem statement. Ecosystems, unlike ordinary systems, are characterized by a strong internal unity determined by their territorial localization, i.e. association of business entities within the boundaries of a single territory. This condition allows intrasystem communities and individual participants to interact through the interference of individual fields (inductive behavior) synchronizing the processes taking place in these communities. The integrity and sustainability of ecosystems is ensured through the close interaction of ecosystem subsystems. Modern scientific and educational institutions, universities are complex ecosystems that determine the vector and pace of development of the entire industry complex of the state, on the one hand, and are determined by the conditions of this development, on the other. The role of scientific and educational institutions is predetermined by their position in the processes taking place in the economic, political, social, social and other spheres of society. Therefore, creating conditions and ensuring the effective functioning of these institutions is one of the tools to support the stability of the socio-economic system of the state. The effectiveness of the functioning of the university in modern conditions of development is determined, first, by the demand for their "products", as well as the possibility of its integration into various processes. One of the relevant methods of industry integration of the university product is the creation of a Hackathon system.

Analysis of recent research and publications. The definition of "ecosystem" was introduced by A.G. Tansley, in his work on ecology. In his study, it was defined as a relatively stable system of dynamic equilibrium, which may consist of communities of living organisms, their habitat, the formed system of connections that allow the exchange of energy between them, expressed in a certain form [12]. The general concept of ecosystem can be applied at many levels or "units" of analysis, assuming some of its elasticity. This elasticity characterizes the concept of biological ecosystems, which can consist of a single plot of soil with plants and microorganisms, or the entire planet [7]. In an economic context, the term "ecosystem" was used by M. Rothschild [10]. He believes that just as a living organism can be defined by its genes and position in the food chain, so an organization can be defined by its place in a network of customers, competitors, business partners and counterparties, as well as by the level of technology development and innovation [10]. Over the past 30 years, since its introduction into science, the term "ecosystem" has become widespread, both in scientific and applied economics, due to the growing interest in the issue of interdependence between organizations and their activities. Along with a number of related ideas such as business models, platforms, cooperation, markets, networks, technological systems, supply chains, the concept of "ecosystem" allowed a different view of the value creation process and the principle of management system organization. However, the increase in the number of possible organizational constructs has created confusion about how to relate these ideas in terms of boundaries, overlaps, redundancy, and the applicability of elements of analysis.

The term ecosystem was introduced into the business literature by J.F. Moore. He defined it as an economic community that is supported by a foundation of interacting organizations and individuals, the organisms of the business world.

An economic society strives to produce products, works and services that can be of some value to customers who themselves are members of this ecosystem. Suppliers, manufacturers,

competitors and other stakeholders can also be members of the company. Over time, they undergo a collective change in their capabilities and roles, seeking to join the direction determined by one or more central organizations. Those companies that occupy leading positions may change over time, but at the same time, the function of an ecosystem leader in society continues to be valued. It allows all participants to move towards a common goal to coordinate their investments and provide mutual support. Considering ecosystems in the context of interorganizational interaction, M. Iansiti and R. Levien believe that ecosystems are a kind of business networks characterized by a huge number of weakly interconnected participants that depend on each other to ensure mutual efficiency and survival [6]. Also, an ecosystem as a network of affiliated organizations is defined by E. Autio, S. Nambisan, L.D.W. Thomas and others [2, 4, 7]. Based on this, the ecosystem can be understood as a structure for agreeing on a multilateral set of partners that must be in interaction.

Due to the fact that the subject structure of ecosystems is quite diverse, it is impossible to talk about its fundamental universality. According to R. Adner, two fundamental types of ecosystems should be distinguished – these are "ecosystem as an affiliation" and "ecosystem as a structure", where an ecosystem as an affiliation is understood as "a community of associated entities defined by their networks and belonging to the platform" of the Silicon Valley ecosystem or the entrepreneurial ecosystem), while the ecosystem as a structure is understood as the configuration of activity determined by the value proposition (Table 1). According to R. Adner, although these ecosystems are fundamentally different, they are mutually consistent [1].

Table 1

The fundamental differences between the types of ecosystem

Ecosystem type	Features
Ecosystem as an accessory	The development of systems of this type is based on the need to focus on increasing the number of factors associated with the coordinating entity, thereby increasing its role and power. By increasing the number of actors in its ecosystem, the focal actor increases its market power, increases the value of the system through direct and indirect network externalities and increases the probability of random interactions between partners, which can open new combinations of interaction, and thereby increase the overall value of the system.
Ecosystem as a structure	This type of ecosystem is defined by the coordinated structure of partners, which must be in interaction in order for the main value proposition of the system to be materialized. This definition highlights the following fundamental points in understanding the ecosystem as a structure is structural coherence. Multi-subjectivity, a specific set of partners, and the materialization of the proposition.

Source: systematized by the authors based on [1–12].

Thus, the landscape of socio-economic system can be represented as a set of branch ecosystems, acting as a certain force field, allowing to unite localized complexes of organizations, business models, markets, networks, supply chains, innovative projects, infra-structural systems, etc., and capable of long-term functioning due to the circulation of resources, products, and competences.

Despite of wide enough working out of theoretical and methodological positions in the field of small innovative business, the question of forming of effective organizational-economic mechanism of creation and development of Hackathon systems based on institutions of higher education continues to be actual. The need for additional study of this subject area and determined the relevance of the study of this topic and, consequently, setting the research goal of this article.

The purpose of this work is to study the theoretical foundations of creating a Hackathon system as part of the innovation ecosystem of higher education institutions.

Summary of the main results. Today, the term "ecosystem" is also widely used in studies of various aspects and conditions for the functioning of higher education institutions, as a concept of a wider scope, expanding and clarifying the concept of "modern university". The shift in emphasis, directly from the higher educational institution itself, as some integral monolithic unit, to its contour, consists directly of the institution itself and the “environment of the institution”, with its own organizational logic of existence, is caused by the need to determine the place of this organization in the socio-economic environment, a feature of combining with other organizations, determining a promising vector of development and other things. In many studies, the terms "university ecosystem", "ecosystem of a scientific and educational institution", "ecosystem of an institution of a scientific and educational sphere" and other variations are understood as synonyms, combining them with a common concept as a "university ecosystem". This approach is due to the absence of fundamental differences between them, as well as the lack of a research task to separate them.

Thus, in Ukraine, most educational programs were focused on the needs of the serviced sectors of the national economy. In fact, complex regional complexes were created, based on the close connection of academic institutions with a practical base. They should be considered the first models of university ecosystems, the highest result of which was the creation of academic campuses. A feature of the creation and functioning of this ecosystem is precisely the complex compactness, expressed by the chain of relationships – University – Research Institute – Implementation, which later proved to be effective. It was the lack of “complex compactness” that did not allow replicating this model of the scientific and educational ecosystem in other territories and other universities, even with close cooperation with research organizations. Today, this symbiosis for most industrial and scientific organizations has been lost due to changes in the socio-economic formation, while the modern principles and patterns of interaction between universities and enterprises have undergone significant changes. In the best case, a campus eco-system operates based on the university, which can be characterized by the following relationship systems, for example, “Student – Startup – Project”, “Structural unit (department) – Small innovative enterprise – Project”, “Project – University – Structural subdivision”, “State – University” and so on.

Thus, it should be stated that higher education institutions can understand and interpret the definition of an ecosystem in different ways, for example, from the availability of comfortable furniture and teaching tools to close business ties with industrial enterprises of the region and the country, formed both within the framework of formal educational institutions, and outside of them.

The university ecosystem should be understood as a flexible system with a significant number of connections, capable of prompt response to changes in the external and internal environment. The university ecosystem should be opposed to hierarchical systems in which lower-order links are waiting for a managerial impulse from higher-order links. Many authors understand the university ecosystem as a set consisting of clusters, platforms, networks, and incubators [1, 2, 4]. The study of the concepts of "university ecosystem" allowed us to identify a number of their features, in particular: firstly, the ecosystem is a flexible and adaptive entity to external influences, consisting of many subjects occupying their position in the system hierarchy and capable of functioning sides of the focal subject, and , secondly, the university ecosystem, as a rule, consists of an external and internal circuit, where the external circuit is a system of relations with the subjects of the external environment and authorities perceived as potential employers and customers. methodical building of relationships by creating conditions for solving the problems of the subjects of this environment, and the internal contour is the internal environment of the NOU, represented by the totality of its organizational elements (Table 2).

Both the external contour of the university ecosystem and the internal one have their own fundamental features and logic of functioning, which correspond to a specific university, a specific organization, a specific stakeholder, etc. The contour representation of the university ecosystem

allows one to judge its boundaries, making it possible to single out a set of metric indicators, reflecting the characteristics of the system, as well as build an evaluation system.

Table 2

Features of the contours of the university ecosystem

The contours of the ecosystem	Features
External	The formation of the external contour of university ecosystem assumes not just the presence of different contacts, but a clear understanding of the existing and future demands of business entities, formed by the existing market conditions, the vector of technological development, social and economic environment, etc. As a rule, the external contour is formed in the framework of partnership interaction of science, business, and government, considering their mutual interests and the interests of third parties.
Internal	It is formed within the organizational boundaries of the university between the structural units. The key feature of this contour is the presence of certain contradictions between the interacting subdivisions due to the presence of hierarchy and subordination. In a rare educational institution, it is possible to meet the organizational and administrative environment, not only forming potential of development of students and teachers, but also focused on effective realization of this potential, both in the labor market, and organizations of the industry.

Source: systematized by the authors based on [1–12].

Any ecosystem, regardless of the sphere, must have its own foundation or basis. According to the authors, the basis of the university ecosystem should be understood as a platform that can provide multiple horizontal communications [3]. In our opinion, this platform, along with horizontal links, should also ensure the formation of vertical (or corporate) links.

Along with the concept of "ecosystem of the university", the literature also uses the concept of "innovative ecosystem of the university". The basic concept of the term "innovative ecosystem of the university" is the concept of "innovative ecosystem". The concept of "innovation ecosystem" describes a set of heterogeneous but complementary organizational entities working together to create system-level products, similar to the "ecosystem service" that natural ecosystems provide [11]. Innovation ecosystems differ from other organizational systems (such as supply chains, networks, etc.) in terms of how they are managed, as well as the results of their operation. Unlike traditional supply chains, innovation ecosystems are not defined by contractual relationships alone. These and other features lie in the definition of the concept of "innovation ecosystem" by various authors and researchers. For example, Adner, R., considering the innovation ecosystem through the prism of strategic management, defined it as an agreed structure of a multilateral set of partners that must interact to materialize the main value proposition [1]. By analogy with biological ecosystems, innovation ecosystems are considered at various spatial levels – organizational, urban, suburban, regional, national, and global.

In a spatial context M. Feldman, D.S. Siegel, M. Wright define an innovation ecosystem as an institutional, geographic, economic, or industrial context that can be analyzed at different levels of aggregation (for example, firms, industries, universities, regions, and countries) [4]. Innovation researchers have emphasized aspects of knowledge and learning, defining innovation ecosystems as clusters (physical or virtual) of innovation activity around specific practical areas of activity (for example, biotechnology, electronics, pharmaceuticals, and software) [9]. Innovation ecosystems are also considered at non-spatial levels of analysis. In a non-spatial context, the concept of "innovation

ecosystem" has been used to refer to the target firm, its partners, and suppliers, who do not have to be in the same space if they belong to the same sector, platform, or industry. Different levels also tend to be associated with different thematic focus in terms of the key issues being addressed. While spatial applications tend to focus on the dynamics of different ecosystem communities (e.g., learning and knowledge creation), non-spatial applications tend to focus on issues related to management and coordination.

The second direction of the spread of the concept stems from the nature of collectively generated "ecosystem services" or "ecosystem products" in other words, "innovations" [11]. Therefore, the term "innovation" can refer both to the results of innovation processes (e.g., products, services, processes, business models and knowledge) and to the process itself. In the context of an ecosystem, innovation is conceptualized in the form of products and services, such as software, mobile communications, and others. Also, innovation has been conceptualized as new ventures (startups, hackathon events) that embody innovation in business models, as well as new knowledge.

Thus, innovation can be divided into three broad categories: the first category is innovation in products and services (assumes a situation where the results of different, non-coordinated (in terms of formal coordination) participants in the ecosystem are combined or can be assembled into a coherent proposal at the ecosystem level, targeting a specific audience (e.g. photovoltaic solar systems, mobile application ecosystems, etc.) second category – new innovative ways to create, deliver and capture value – business model innovations that are not targeted as any audience third category – the production of new, usually research-based, knowledge that has previously been extensively studied within (regional) innovation systems (Fig. 1).

Exploring the concepts of innovative ecosystems by E. Autio, L. Thomas single out the following features: firstly, it is structural heterogeneity, i.e. innovation ecosystems are made up of heterogeneous actors playing different roles (although other concepts that describe organizational teams also characterize heterogeneity of participants, the heterogeneity of participants exhibited by innovation ecosystems is often wider and can span several industries and sectors of the economy); secondly, the innovation ecosystem is able to organize the production of products at the system level (by analogy with the “ecosystem service”), i.e. much more than a single participant can provide (although system-level outputs are also common, for example, in supply chains, the outputs of innovation ecosystems tend to be more diverse and widely replicated); thirdly, the nature of the interdependence between the participants of the innovation ecosystem differs sharply from the interdependencies between networks and supply chains; Fourth, interactions between ecosystem participants are managed by consensus structures that allow ecosystem participants to specialize in specific roles that are not necessarily determined by formal contracts [2].

Innovation ecosystems may or may not be spatially bounded. Spatially bounded innovation ecosystems, such as entrepreneurial and knowledge ecosystems, build on “what happened before”. Thus, the modern incarnation of entrepreneurial ecosystems with a focus on innovation in digitally enhanced business models will show a different dynamic than "entrepreneurial clusters" or other similar regional business associations in the absence of these technologies. For example, the classical entrepreneurial cluster, which was formed back in the 1990s and formed the basis of many regional innovation systems, emphasized linear, technological innovations. In this case, the entrepreneur acted as an agent converting the results of innovative activity into commercial results. To ensure this translation of knowledge, business cluster support structures were optimized, for example, by creating science parks, etc. The digitalization of key areas of business and social activity made it possible to use these structures to support the process of experiments and discoveries of improved business models, as a result of which many science parks were converted to new venture accelerators. Because of this, it can be argued that in commercial and scientific ecosystems, the formation processes should not focus on building a new ecosystem from scratch,

which was previously characteristic of many classical entrepreneurial clusters. They are a consistent qualitative change in the existing cluster for a new principle of action through the creation, for example, of new venture capital accelerators in the region. Other types of innovation ecosystems – business ecosystems, platform ecosystems, etc. – arise in a scheme that is different from the one considered. While spatially delimited innovation ecosystems may emerge as a result of gradual transformation (while maintaining the structures and processes that dominated in an earlier era), spatially decoupled ecosystems are often new formations and therefore require more intensive work to ensure the process of their functioning [1–12].

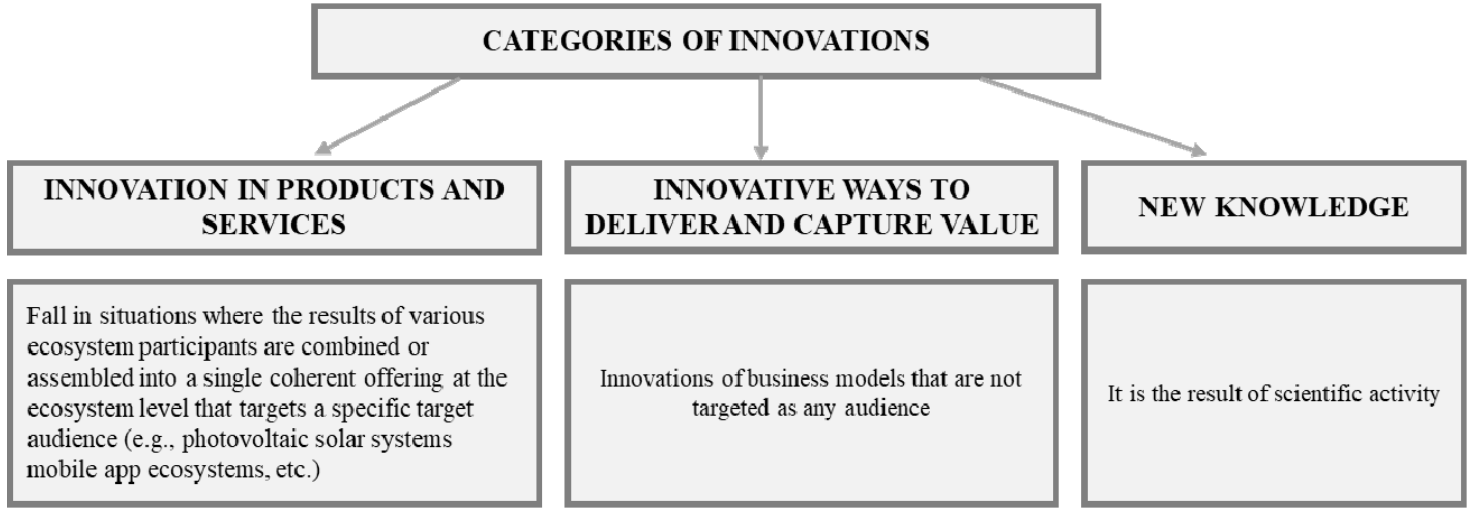
The aspects of the basic terminological apparatus presented above allow us to proceed to the formulation of the author's understanding of the "Innovative Ecosystem of the University" as a fundamental term. In our opinion, the innovative ecosystem of the university should be understood as a hierarchical multi-subject system functioning within the boundaries of a common domain for all, managed by a coordinating subject, acting as its organizational core, in order to materialize the value proposition that is the result of innovative activity, where the domain is the environment of the university, coordinating the subject is the university and the value proposition is the innovation. The result of the functioning of the university's innovation ecosystem is innovative and educational activities, innovative and administrative activities, and scientific and innovative activities. On Fig. 2 presents the content of the main areas of innovative activity of the university.

The elements of the innovation ecosystem of the university are both directly structural units directly or indirectly involved in innovation activities (for example, faculties, laboratories, research groups, employment center, etc.), and entities related to the activities of the institute, but without the help others carrying out economic activities (for example, funds, licensing and certification bodies, expert commissions, and others). The institute's innovation ecosystem is a kind of controlled symbiosis of environmental subjects that determines the conditions for their functioning and development.

One of the modern elements of the innovation ecosystem of higher education institutions is the Hackathon, a university ecosystem created on its basis, on the initiative of both employees and graduates of these institutions, and the institution itself in order to commercialize the results of innovation.

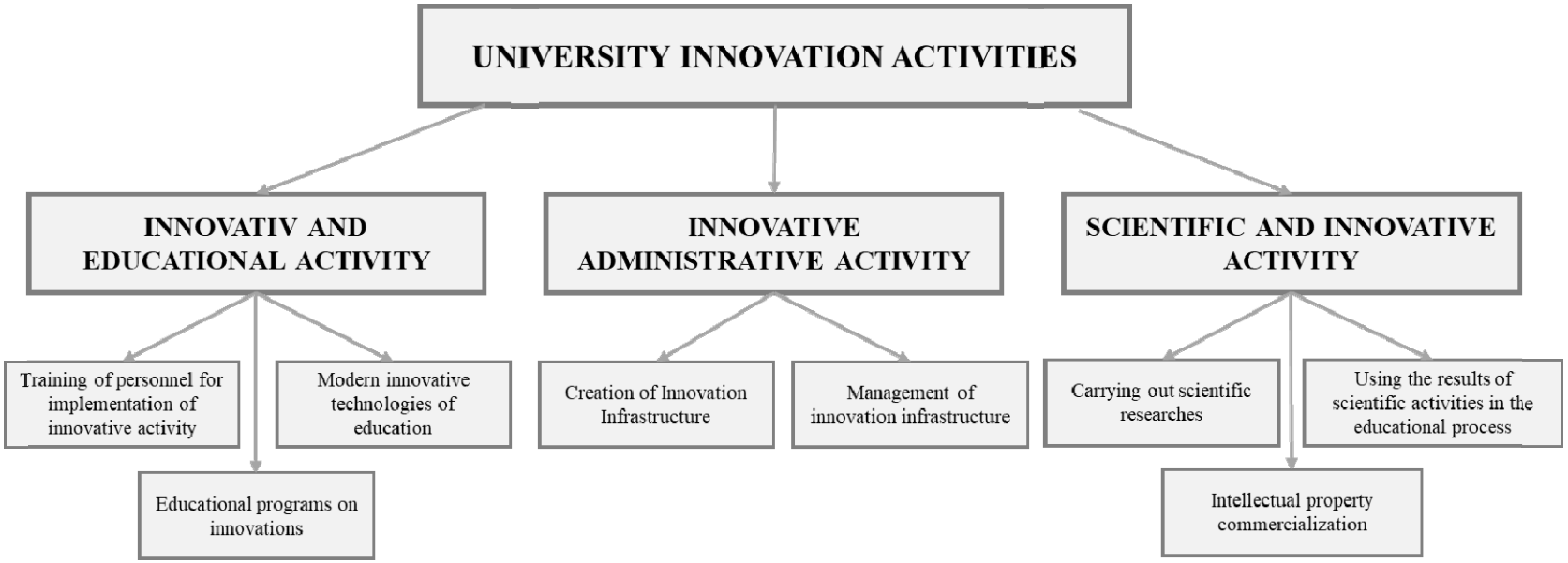
The first aspect that forms the peculiarity of the Hackathon of the university ecosystem (HEU) is the structure, form and content of the knowledge being transferred. Thus, the practice of creating and operating CES shows that two types of knowledge are usually transferred in this system – these are systematized (explicit) knowledge and coded (implicit) knowledge, where systematized knowledge is understood as the most noticeable results of research activities that can be easily copied, which requires their protection by a legal contract, and coded knowledge is understood as personal experience gained in the course of research activities [2, 14]. Systematized knowledge, according to K. Hindle, J. Yencken, can include published knowledge based on science or technology related to “discovery”, new knowledge contained in patents, copyrights, registered industrial designs, etc., At the same time, coded knowledge is the content of postgraduate or bachelor's education [5].

Along with systematized knowledge, input knowledge is also of particular importance. This type of knowledge includes, for example, the ability to find ideas that can be turned into opportunities brought to new ventures through the continued involvement of the original inventors, familiarity with a specific product or industry, entrepreneurial experience in running a start-up, and access to business networks. The transfer of systematized knowledge to a new company always involves the transfer of implicit knowledge of the inventor, except in the case of off-the-shelf inventions. In some cases, HUE may include knowledge acquired by the university from a second institution.



Source: Authors based on [11].

Fig. 1. **Categories of innovation**



Source: Authors based on [2, 5, 11].

Fig. 2. **Structure and content of university innovative activity**

The second aspect that determines the features of HEU is the persons and stakeholders involved in its creation. Any researcher can start a new company, thereby becoming an academic entrepreneur, or, alternatively, the university can independently find an external entrepreneur with business experience to manage the new company. Students may also be included as they are different from researchers or surrogate entrepreneurs. Student startups are more likely to be seen as part of their entrepreneurial experience in their professional development. Students can use the knowledge gained through the study program, entrepreneurship at the university and study at the university, supporting students in the creation of their companies.

The third aspect that determines the features of the creation of HEU is the relationship that arises and is maintained between the university and the business structure. So, the institute can become a principal source of resources, for example, money in the form of funds and loans, the necessary knowledge, human capital, equipment, etc. Therefore, on the one hand, the economic interest of the university in the activities of HEU.

Conclusions. Summarizing, we can say that the implemented set of measures is aimed at creating and supporting the hackathon of the university ecosystem, as well as the overall innovative development of the state, which made it possible to ensure the development of this area. At the same time, despite a wide range of positive effects achieved during the implementation of various programs and projects, a negative trend has recently been observed in the functioning of the Hackathon of the university ecosystem. This trend is caused by a wide range of problems, which levels the previously achieved result and forms a negative conjuncture in this area. It can be assumed that the development of the KhEU complex requires a revision of the scheme of their formation, development, and support, both from the university and the state, which became the goal of subsequent research.

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