

Development of the Theory and Practice of Higher Education Innovatics

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Abstract

Most of the innovative changes in higher education in relation to academic capitalism are based on market principles. The aim of the article is to further study and determine the innovative directions of the reform of higher education. For this, it is necessary to create and implement a scientific and applied system that combines theoretical and practical approaches to the innovative development of higher education. The authors propose the further development of a new scientific direction in the field of higher education - "innovatics of higher education". Theoretical foundations and practical issues of higher education innovatics include innovative changes in a number of activities. The main of these activities are: teaching, training and study; R&D, engineering, IT and technologies development, projects activity and design creativity; financial and economic support of the educational process, R&D, activities development and business expanses; inventive and patent-licensing activities, technology transfer, academic/university entrepreneurship; cultural and moral development, upbringing of cultural, moral and human values; sports, recreational, festive and extracurricular activities including other types of universities activities. Thus, innovatics of higher education includes innovative changes in almost all areas of higher education to enhance the quality training of professionals and responsible citizens of the modern community. More over innovations can guarantee financial independence, economic stability and competitiveness for a university development. This will be useful both for reforming the higher education systems and for universities R&D in Ukraine and other countries.

Keywords: *Academic Capitalism, Higher Education Innovatics, Innovation Management, University Innovation, Academic Entrepreneurship*

INTRODUCTION

It is well known that a period of "academic capitalism" caused by commercialization of budget results and many other university scientific researches began after the Second World War. The impetus for the rapid development of entrepreneurship in the field of science and education was one of the best legislative acts in the United States – the "Bayh-Dole Act" - widely known as the Patent and Trademark Act Amendments (a federal law enacted in 1980). This act "enables universities, nonprofit research institutions and small businesses to own, patent and commercialize inventions developed under federally funded research programs within their organizations." (Ezell, 2019). This was beginning of the rapid development of applied research, the results of which can be turned into new designs and technologies to further commercialization. Historically academic capitalism originated in the United States as a specific intellectual subtype of capitalist system. It is characterized by the extension of the laws and rules of the market economy for higher education and science. Previously higher education and science belonged to non-profit sphere of intellectual activities and was designed to find, generate and disseminate knowledge for the benefit of all mankind. Higher education institutions (HEIs) and scientific institutions (SIs) have turned from "temples of knowledge" into players in the market of educational and scientific services with strict economic rules inherent in the market.

The definition "academic capitalism" was introduced by S. Slaughter and L. Leslie (1997), who proposed the following interpretation: "To maintain or expand resources, faculty increasingly had to compete for external dollars that were tied to market-related research, which was referred to variously as applied, commercial, strategic and targeted research, whether these monies were in the form of research grants and contracts, service contracts, partnerships with industry and government, technology transfer, or the recruitment of more and higher fees-paying students. We call institutional and professorial market or market-like efforts to secure external monies academic capitalism." (p. 17).

Market relations in science and education, the possibility of commercialization of the results of intellectual activity of universities and scientific research organizations have led to the spread of academic or university entrepreneurship and to the accelerated emergence of favorable innovation climate – the accelerated emergence of innovations and their wide dissemination in many areas of society. The contribution from the use of innovations developed and introduced by universities and scientific organizations, for example, into the US economy has brought billions of dollars and has really accelerated the development of applied science and new technologies. Gradually, the influence of academic capitalism began to spread to other countries.

Academic capitalism has transformed the field of higher education and science into an environment of academic innovation. Universities and scientific organizations were transformed from "temples of science" to academic innovative entrepreneurial institutions.

It is known that J. Schumpeter was the first who developed complete description of innovation processes (he analyzed the "new combinations" of changes in the development of economic systems). Referring to the book by J. Schumpeter (1934, p. 65), J. Fagerberg (2008) stresses, that



“First of all, he added a definition of innovation (or “development” as he initially phrased it) as new combinations of new or existing knowledge, resources, equipment and so on. Second, he pointed out that innovation needs to be distinguished from invention. The reason why Schumpeter stressed this difference is that he saw innovation as a specific social activity (function) carried out within the economic sphere and with a commercial purpose, while inventions in principle can be carried out everywhere and without any intent of commercialization. Thus, for Schumpeter innovations are novel combinations of knowledge, resources etc. subject to attempts at commercialization (or carried out in practice). This combinatory activity he labeled the entrepreneurial function and the social agents fulfilling this function entrepreneurs.” (Fagerberg, 2008, p. 21). Later, J. Schumpeter (1976) and G. Mensch (1979) introduced the term “innovation” into scientific circulation, which was defined as the embodiment of a scientific discovery in a new technology or product.

There are many publications devoted to both the problems of academic capitalism and the experience of commercialization of innovations in university research activities (R&D). However, a comprehensive study of different types, forms and directions of innovation activity in the sphere of higher education and science, including HEIs and scientific organizations (SOs) involved in the environment of academic capitalism, has not been performed yet.

The authors of this work conducted a long-term study of the best practices of institutions and organizations innovative activities in the sphere of higher education and science in developed countries. As a result, a new interdisciplinary scientific and applied direction – higher education innovatics – was brought up for open discussion by the authors (Romanovskyi & Romanovska, 2020).

In this work, the authors propose further development and concretization of the theoretical and practical provisions of the innovation of higher education, the definition of the unique features and functions of higher education in modern society under the conditions of academic capitalism.

The authors suggest that findings and recommendations of this study are useful for specialists of higher education and science systems both for developed countries, countries with an average level of development and developing countries.

The aim of innovation of higher education is transformation and improvement of the economic sphere, an area of production, distribution, and trade, as well as consumption of goods and services. P. James et. al. (2015) defines economy as a “social domain that emphasizes the practices, discourses and material expressions associated with the production, use and management of resources” (p. 52). To increase the efficiency of economic activity, it is quite natural to apply various, preferably complex, innovations in the field of production, use and resources management.

It is well-known that economy is a result of a set of processes involving not only economic and production activity but also human culture, values, education, technological evolution, history, social organization, political structure and legal systems, as well as geography, natural resource endowment and ecology, as main factors (Qureshi et al., 2020). Together, these factors determine the content, context and set the rules, conditions and parameters for the functioning of the economy. Thus, the economy is a powerful human-oriented process, carried out by humanity and serves it. The economic domain is a social domain of interrelated human practices and transactions rapidly developing in many fields and directions.

The Reasons for the Research

After collapse of the USSR as a powerful state in the early 1990s, higher education in the post-Soviet republics rapidly began to transform from socialist-oriented, state-directed, budget-financed type into the new environment of academic capitalism. The transformation of HEIs financing from a completely state-budgetary form to a capitalist-oriented one with involvement of private and corporate capital has become a painful phenomenon, ambiguously perceived by society. Great controversy in the society was caused by emergence of private and joint higher educational institutions financed independently from the state (hereinafter – independent universities).

In the first half of 1990s the sphere of higher education in Ukraine, one of the leading post-Soviet republics, was in great need of reforming and further integration into the European and world higher education system.

One of the first innovations caused by the rapid spread of academic capitalism market laws to the sphere of higher education in Ukraine was university entrepreneurship. The research institutes of the Ukrainian Academy of Sciences were also involved in academic entrepreneurship.

The market relations in previously budgetary spheres of activity led to the reform of socialist-oriented legislation and opened up new market opportunities in attracting private and corporate capital to the sphere of activities of higher educational institutions and research institutes.

Independent universities of Ukraine have become real representatives of a new type of activity – academic or university entrepreneurship, as well as real participants in the socio-economic activities of the regions.

State universities and research institutions significant budgetary funding were very slowly rebuilt in the new environment of academic capitalism. Systemic studies to reveal new prospects for the development of higher education and science in Ukraine and other post-Soviet countries under the conditions of academic capitalism were demanded.

Ukrainian-American Concordia University researchers were among the first in Ukraine to study this problem, as well as the essence, directions and forms of innovative activities of universities. Beginning from the second part of 1990s, a group of professors, instructors and researchers from this university began developing the problems of transforming the socialist-oriented system of higher education and science into a capitalist-oriented one, integrated into the environment of academic capitalism.

The authors studied the problem of innovative activity in the field of higher education using experience of leading innovative universities in USA, Japan, Australia, UK, Germany and other countries of Western Europe. The main prerequisite for the study was rapid spread of market relations inherent in the capitalist system to the academic sphere.

Actuality of the Topic

It is widely known that all processes, types, stages, levels, methods of education and methodology of teaching need innovations.

The publication of F. Altbach (2008) presents the integrated role of universities in the period of globalization. In his work, universities are defined as “engines of socio-economic development of society and as national institutions” (pp. 1-2). Universities fulfill a “central academic role” in society, in the multiplication, “preservation and dissemination of knowledge”. (p. 2) Universities are defined as “intellectual centers” (p. 2) and “international institutions”. (p. 3) Author also underlined (pp. 4-10) that: 1). Universities should ensure that higher education is accessible and that educational services are provided fairly by modern higher education institutions. 2). Universities should solve the problems of general education. 3). Universities should develop economic science and academic entrepreneurship, as well as implement their historical prospects for further development and improvement. It is the broad and purposeful introduction of innovations, advanced methods, methodologies and technologies in the field of higher education and science that should ensure the implementation of the integrated role of universities in the globalization period.

The authors argue that the “prospect of building a knowledge society with an innovation-oriented type of economy in any country requires a profound reform of the national economy humanitarian sphere, innovative development of higher education system, science and scientific-technology activity. This should be done on the basis of reasonable combination of the best foreign experience with national traditions.”



(Romanovskiy & Romanovska, 2020). Also, according to the authors of the study, “the activation of all types of entrepreneurship is both a priority of state policy in the field of innovative development of the higher education sector, the introduction of innovative entrepreneurship of various types and legal forms, as well as the basis of economic reforms and the main lever in the new model of the national economy.” This includes: “innovative academic or university entrepreneurship, which is an integrated social-economic process; accelerated development of both national science and higher education, as well as innovative processes, technologies, and innovative entrepreneurship, which is especially relevant in the period of searching for new economic models and strategies that contribute to the accelerated development of the national production sector and the economic system. Further improvement of the legal and institutional environment for innovation in the state, disclosure and development of the country's entrepreneurial potential as the main institutional resource of the market economy, achievement of higher competitiveness, and raising social standards is clearly necessary.” (Romanovskiy & Romanovska, 2020).

Statement of the Problem

As suggested by the authors it is advisable “to create and develop an innovative direction of interdisciplinary science in the field of higher education system – the Innovatics of higher education. It should be created in context of the spread of market mechanisms in all spheres of humanitarian activity, the emergence of academic university entrepreneurship phenomenon, commercialization of knowledge and results of universities and SIs R&D. Innovatics of higher education is called upon to develop and scientifically explain the theory and practice of innovative development in the field of higher education, to promote the practical implementation of innovative changes in the higher education system, to determine the necessary directions and mechanisms for innovative transformation of higher education industry and its constituents including higher educational and research institutions, organizations and bodies related to higher education.” (Romanovskiy & Romanovska, 2020).

The object of the research focuses on innovative development processes of higher education system in Ukraine in the period of the knowledge society formation.

The scientific novelty of the research lies in the theoretical and methodological approaches developed by the authors, which make it possible to form and substantiate the conceptual foundations of the higher education innovative development and directions for further improving the organizational forms of university entrepreneurship in Ukraine and other post-Soviet countries. The study contributes to the enrichment of market institutions and the disclosure of their own development potential with regard to higher education.

ANALYSIS OF RECENT STUDIES AND PUBLICATIONS

The literature surveys on innovation have found a great number of variety of definitions. Thus, survey (Baregheh et al., 2009) found around 60 definitions in different scientific papers (p. 1325), while another survey (Edison et. al., 2014) found 41 ones (p. 1394). Based on their survey, A. Baragheh et al. (2009) attempted to introduce a multidisciplinary definition and arrived at the following definition: “Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace” (p. 1334).

One of the most complete definitions of innovation is: “Innovation is: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and the establishment of new management systems. It is both a process and an outcome.” (Edison et. al., 2014, pp. 1400-1401).

“Two main dimensions of innovation were degree of [novelty] (i.e. whether an innovation is new to the firm, new to the market, new to the industry, or new to the world) and types of innovation (i.e. whether it is product, process, market or organizational innovation).” (Edison et. al., 2014, pp. 1394-1395).

Well-known and influential scholar Everett Rogers offered the following description of an innovation: “An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 12).

Peter Drucker defined the essence of innovation as follows:

“Innovation is the specific function of entrepreneurship, whether in an existing business, a public service institution, or a new venture started by a lone individual in the family kitchen. It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth.” (Drucker, 2002).

O. Romanovskiy and Yu. Romanovska (2020) conclude that “a significant number of publications are devoted to the problems of introducing innovations into the higher education system. For example, a book of F. van Vught (1989) examines the influences of governmental regulations on the behavior of HEIs in the Netherlands, West Germany and France with respect to designing and implementing innovations in curricula. It describes two basic general governmental strategies (rational planning and control versus self-regulation) and an inventory of the various instruments a government may use to influence society.”

The paper of R. A. Blouin et al. (2009) “reviews trends in higher education, characterizing both the current learning environments in pharmacy education as well as a vision for future learning environments, and outlines a strategy for successful implementation of innovations in educational delivery. The following 3 areas of focus are addressed: a) rejecting the use of the majority of classroom time for the simple transmission of factual information to students; b) challenging students to think critically, communicate lucidly, and synthesize broadly in order to solve problems; and c) adopting a philosophy of evidence-based education as a core construct of instructional innovation and reform.”

In their publication Vieluf et al. (2012), “clearly identifies and arranges profiles in relation to two connected areas of professional teacher practices: classroom teaching practices and participation in professional learning communities.” The authors think that “At the beginning of the 21st century, socio-constructivist ideas (i.e., examining a learner's psychological processes within the context of the learning process) became prominent in normative approaches to classroom teaching. However, research on school effectiveness suggests that practices based on these theoretical ideas are insufficient to foster student learning. Rather, a combination of clear, well-structured classroom management, supportive, student-oriented classroom climate, and cognitive activation (e.g. challenging content that promotes deep reflection in the student) has been shown to be effective. The conceptual framework therefore incorporates both socio-constructivist thinking and more classical process-product research, which provides a way to build a bridge between constructivism and direct instruction approaches to education.” (pp. 13-14). This book provides a practical opportunity to become familiar with teaching methods in n learning communities at the internal (national) and external (international) levels.

In a background report prepared for the second Global Education Industry Summit, held on September 26-27, 2016 in Jerusalem, “covers the available evidence on innovation in education, the impact of digital technologies on teaching and learning, and the role of digital skills and the education industries in the process of innovation, using data from OECD surveys.” (OECD, 2016, p. 9). “Understanding the education industries better, including their market structures and innovation processes, would help to create a more mature relationship with the education sector. Innovation in the industry – which develops the products and services that could drive innovation in schools – does not happen in isolation from



what is happening in the education sector. Only when there is an innovation-friendly culture in education systems, supported by an innovation-friendly business environment and policies, will industries start to engage in risk-intensive research and development. Governments can support this by fostering a climate of entrepreneurship and innovation in education.” (p. 10) Also, the report underlines that: “Innovation in the public sector in general, and in education in particular, could be a major driver for significant welfare gains. Governments provide a large number of services in OECD countries and these services account for a considerable share of national income.” (p.13)

In books S. Slaughter and L. Leslie (1997) and S. Slaughter and G. Rhoades (2009) set out “the innovative transformations in HEIs under the influence of the spread of market relations in humanitarian spheres of society, and the emergence in the second half of the twentieth century a new type of capitalist relations in the scientific, intellectual, technological and educational spheres – academic capitalism. Also, a real opportunity to commercialize R&D results, leading to the rapid development of the university and academic science and technology is shown.” (Romanovskiy & Romanovska, 2020).

The important theoretical researches, practical recommendations and original methodology in the sphere of creating innovative entrepreneurial universities were carried out by a pioneer in this field Burton R. Clark (1998; 2000; 2004). Theoretical and practical approaches to the problems of innovative development of society in accordance with the “triple helix model” proposed by Henry Etzkowitz (Etzkowitz, 2003; 2008; 2019; Viale, Etzkowitz, 2010; Dzisah, Etzkowitz, 2012; Cadorin et. Al., 2019), became the fundamental directions of the development of innovative university entrepreneurship, which significantly increased the role of universities in the innovative development of society (Parveen et al., 2015). The article by S. Graek (2020) examines how universities are now moving towards digital transformation.

An important article of P. Serdyukov (2017) is devoted to the problem of innovation in American higher education. Analyzing publications of American experts in the field of higher education and innovation, studying the existing situation with regards to innovations in higher education institutions, he made a number of valuable conclusions and recommendations.

The paper is based on a literature survey and author research. The author emphasizes that “Actually US education badly needs effective innovations of scale that can help produce the needed high-quality learning outcomes across the system. The primary focus of educational innovations should be on teaching and learning theory and practice, as well as on the learner, parents, community, society, and its culture. Technology applications need a solid theoretical foundation based on purposeful, systemic research, and a sound pedagogy. One of the critical areas of research and innovation can be cost and time efficiency of the learning.” (p.4) Some practical recommendations are given in this paper: “how to create a base for large-scale innovations and their implementation; how to increase effectiveness of technology innovations in education, particularly online learning; how to raise time and cost efficiency of education.” (p. 4)

The issues of pedagogical innovatics are studied at the Institute of Educational Innovations of the Russian Academy of Education at the A.V. Khutorskoy School of Science. According to A. V. Khutorskoy (2005) and S. D. Polyakov (2007) pedagogical innovatics is a division of pedagogic. The laws of origin and development of pedagogical innovations, in regard to the subjects of education, and connection of pedagogical traditions are studied with the aim of future education planning. Educational innovation is based on taking into account the personal characteristics of students using modernized pedagogical tools of teachers (Mandel, 2018; Pedagogicheskaya innovatika, 2020).

W.G. Tiemy and M. Lanford (2016) in their work on problems of innovation in higher education declared that “higher education is currently confronted by global forces that necessitate innovative research, innovative pedagogies, and innovative organizational structures. For these reasons a theoretical understanding of innovation is imperative for higher education’s continued development in the twenty-first century.” Authors analyzed the innovation literature from a big number of academic disciplines and highlighted a conceptual framework of the problem. They delineated “four imminent trends in higher education that may compel innovative responses”: “the emergence of the knowledge-intensive economy” (p. 4); “the need to train a creative and innovative workforce” (p. 5); “global trends in higher education: massification vs. world-class aspirations” (p. 6); “decreased funding and resources for higher education” (p. 8). Authors generated “working definitions of creativity, innovation, and entrepreneurship through the clarification of several terms that are related to innovation.” (pp. 9-16). Also, they “discussed the concepts of sustainable and disruptive innovation by demonstrating how change and innovation has been a consistent fixture of higher education since its inception.” (pp. 17-23) Then, they have considered “three dimensions of innovation – diversity, intrinsic motivation, and autonomy – that positively impact the ability of individuals working within higher education to be innovative.” (pp. 17-23) And, in conclusion, authors addressed “three additional concepts – time, efficiency, and trust – that are important for a thorough consideration of innovation within an institutional setting.” (pp. 23-31).

J. Branch et. al (2018) in their work are presenting “primary examples of innovative teaching and learning practices in higher education. The book is truly international, containing contributions from Australia, Denmark, England, Hong Kong, Italy, Qatar, Scotland, South Africa, Tasmania, Vietnam, and USA. Although the educational contexts are very different across these countries, there appears to be a striking similarity in the approach to innovative teaching and learning.”

The book of P. S. Layne and P. Lake (2019) “examines current trends in higher education and the Scholarship of Teaching and Learning. It introduces readers to pedagogical strategies that instructors worldwide are using to overcome some of the challenges they face in higher education. To maximize their students’ learning, this work argues that institutions are compelled to innovate their policies and instructors must be collaborative and creative in their practices in response to students’ growing demands, needs, challenges in their learning, and shifting of a rapidly globalizing world.”

The book “The International Encyclopedia of Higher Education Systems and Institutions.” edited by editors-in-chief P.N.Teixeira and J.C. Shin (2020) includes most topics from higher education and is available for comparison with other sources. The book examines the problems of higher education in the twenty-first century, analyzes the changes that have taken place and new challenges that may face future scientists and possible research directions.

In their article M. Muftahu and H. Jamil (2021) considered that “one of the most difficult tasks in HEIs is to implement effective and constructive changes in the already functioning system.” They point out, that the “resistance and unwillingness of the members of the institution are the main obstacles for the institution to implement the necessary changes.” The authors suggest “how to facilitate the flow of knowledge and adopt an innovative way of thinking in the context of higher education or higher education institutions.” The paper also analyzes “three areas of a comprehensive implementation plan or change management: structure, culture, and strategies.” The authors propose their program to manage changes. They explain “how a change initiative can be undertaken in a higher education institution in the context of the flow of knowledge and the adoption of innovative thinking. The main message of this publication is that, according to the authors, the institutional mission, vision, and priorities must be clearly understood by every employee in order to support and promote change and innovative thinking.”

In the paper which contributes to the discourse on the future of learning in higher education the author D. W. Stoten (2021) “focuses on the utility of the MBA as a management qualification to those that adopt a more holistic perspective of the development of managerial capability in an uncertain and volatile world.” (p. 53).



In the context of the Covid-19 pandemic, one of the noteworthy innovation is Active Learning Classes (Copridge et al., 2021), helping teachers and their students “to provide: teacher visibility and presence, better feedback and learning, and personal conversations and student dialogue.” (p. 205).

In their research S. Mazzioni et al. (2021) analyze the degree of interconnectedness of processes with organizational innovations, with efficiency in the field of products, market, technical and other innovations, and with social and environmental sustainability. The authors “proposed a theory that allowed us to understand the mechanisms of this relationship by analyzing the impact between innovation and sustainability mediated by efficiency.” (p. 527).

The study of M. J. Mayhew et al. (2021) has the purpose “to test the effectiveness of a theoretically developed pedagogical exercise designed to help students develop their innovation capacities during a single-semester course.” (p. 3). Researchers “organized the theoretical perspectives and empirical literature base through the use of two broad categories: innovation capacity theory and pedagogical frameworks, respectively.” (p. 3). Authors stress that “good teaching is the crucial link between the aspirations of undergraduate education and their subsequent realizations; between collegiate environments and desired outcomes”. (p. 17).

THE PURPOSE OF THE STUDY

The main purpose of the article is the further development and introduction of the concept and fundamentals of the innovatics of higher education into scientific circulation, to concretize and define its tasks as an applied scientific direction in the field of higher education and science, to identify features and directions of application.

At the same time, it is very important to note that, unlike differs from pedagogical innovatics,

Higher education innovatics is the brainchild of academic capitalism. It studies market-oriented innovation processes that have spread to the field of higher education. This is a main difference between the higher education innovatics and pedagogical innovatics (studied and structured in Russian Academy of Education).

We propose the further development of the higher education market-oriented innovatics concept.

METHODOLOGY

Based on the conditions of the higher education development in Ukraine and other post-Soviet countries, the authors defined the research aim: to reveal the economic essence of higher education and science innovative development; to explore “academic capitalism” and “university entrepreneurship” as drivers of innovative change in higher education and science; to summarize the conceptual and methodological foundations of innovative entrepreneurial activity of higher educational institutions in developed countries; to determine the role of universities in the innovative development of higher education and the economy as a whole; to characterize the essence and tools of state policy to support and stimulate the development of entrepreneurial educational activities; to identify the directions of academic (university) entrepreneurship influence on the accelerated development of the knowledge society; to prove the effectiveness of the academic entrepreneurship and innovation incubators; to generalize the approaches and characterize the components of the university innovation management system; to identify and systematize the features, advantages and disadvantages of profitable and unprofitable, open and closed educational corporations; to assess the benefits of investment in education in terms of the trade balance and the total national economic effect; to propose ways for further innovative development of higher education spheres; to summarize the performed range of research in the field of academic capitalism and university entrepreneurship of higher education and science and to create scientific (applied scientific) direction – “innovatics” of higher education.

The research was carried out in the following way. A comprehensive and focused literary search was carried out. The main directions of the search were highlighted: academic capitalism; academic (university) entrepreneurship; innovative development of society according to the “triple helix” model; a variety of innovative models and directions of innovative transformations in the field of higher education and science.

The main types and directions of innovations in the field of higher education and science were identified. Scientific publication, experimental, and supportive materials were studied to review a wide range of university innovations and their real cost-effectiveness. It was useful to find out references, bibliography of articles and books published on the topic of entrepreneurial universities and university innovation including fundamental resources and recent works. Entrepreneurial activities of American, British and European universities were analyzed and compared with Ukrainian. Frameworks in the area of the university entrepreneurship and innovative approach regarding international cooperation were carried out at Ukrainian state and private universities, including: Kiev National University of Technology and Design (state), National Pedagogical Dragomanov University (state), European University (private) and Ukrainian-American Concordia University (private).

The information bases of the research comprises legislative and regulatory acts, reports and official publications of governmental and international organizations, expert assessments of rating agencies, monographic literature, materials of scientific conferences, publications of leading cited journals, electronic resources of the Internet and scientific reports of the world's leading universities. The literature review, including data collection, data analysis, data interpretation from American and British reports were used: U.S.A. – Small Business Administration (SBA); National Institute of Standards and Technology (NIST) Association of University Technology Managers (AUTM); University Companies Association (UNICO); Association for University Research Industry Links (AURIL); UK – The Orchard Network, The Business Across Borders Partnership Network, DTI Global Watch Service; Knowledge Transfer Networks; (UKSPA - United Kingdom Science Park Association); British Technology Group and The Innovation Policy Platform (IPP), developed by the World Bank Group and the Organization for Economic Co-operation and Development (OECD).

All figures presented in the article (Fig. 1 – Fig. 9) are developed by the authors.

RESEARCH METHODS

The authors used a dialectical approach to analyze and comprehend the content and special characteristics of the innovative development of the sphere of higher education on the basis of such a phenomenon as academic (or university) entrepreneurship. Academic entrepreneurship is considered in the work as an economic category in the system of socio-economic ties and relations of an integral economic system in the modern knowledge society. Abstraction methods, systemic-structural and theoretical-informational methods were used to study the conditions for the formation of academic entrepreneurship, the characteristics and essence of university entrepreneurship and its impact on the financial stability of universities, regional and national economic growth, as well as on the competitiveness of countries' economies. Also, the techniques of analyzing the general, generalizing the partial were used to form a holistic final picture of the positive and negative features of academic capitalism and penetration of market mechanisms into academic activities of higher educational institutions. We described architecture and concepts of various types of modern innovative entrepreneurial universities, indicators of the diversity of universities entrepreneurial activities, as well as infrastructure



for the development and support of innovative projects in a research entrepreneurial university. The authors also applied the forecasting framework to assess the indicators of the national economic effect from the results of higher education and science innovative development.

PRESENTATION OF THE MAIN RESEARCH MATERIAL

The well-being of society members depends on the level of higher education development in this society. That is why development of higher education should be continuous, effective and innovative. According to our opinion the higher education unique features of economically developed countries can be shown as follows (Fig. 1):

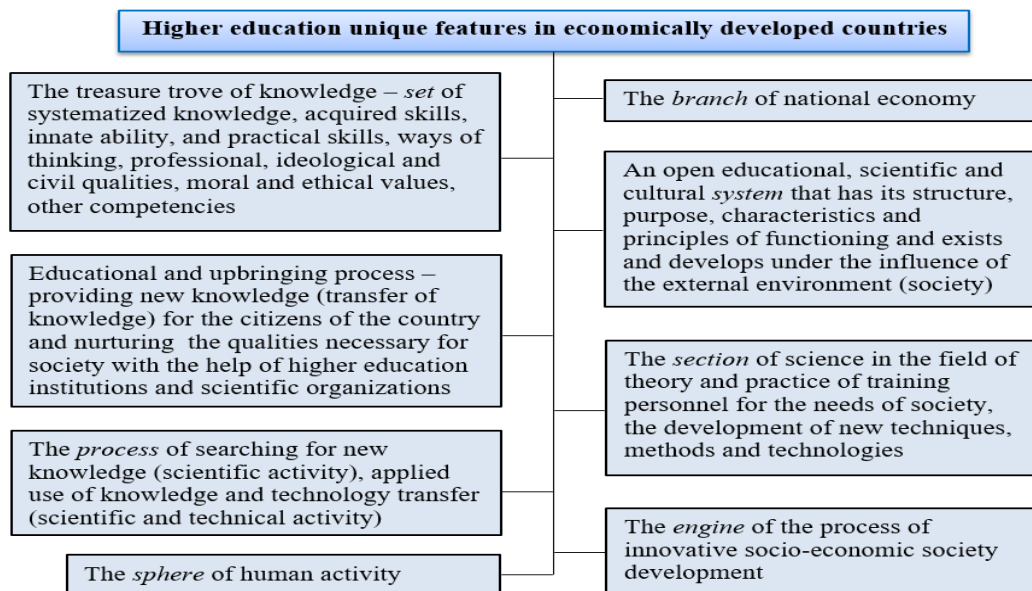


Fig 1. The Unique Essence of Higher Education

Fig 2 shows that in a society, higher education is not only industry (branch) of the national economy, but also is a human-oriented socio-economic process that has social and economic

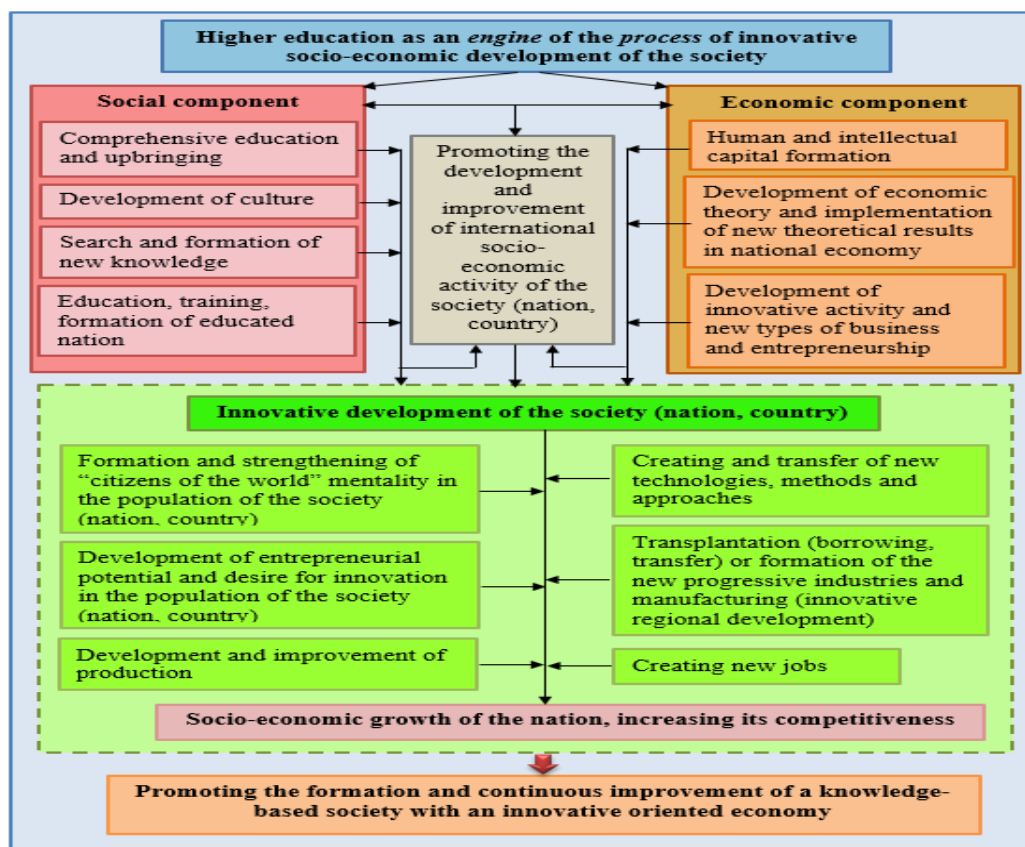


Fig 2. The function and Components of Higher Education in Modern Society

components, promotes innovative development of the society and directly affects social and economic growth of the nation.



The main strategic goal and the desired result of the society innovative development are the formation and continuous improvement of a knowledge-based society with an innovative oriented economy.

Our recent study (Romanovskyi & Romanovska, 2020) has found that:

1. Innovative development of higher education is a state-oriented restructuring and implementation of qualitatively new transformational changes in higher education and science in the social and economic spheres of the nation based on effective activation, motivation, and stimulation of innovative activity in this sphere.
2. The essence of innovative development of higher education is a socially oriented systemic technological and economic process, characterized by the following features:
 - 2.1. The purpose is – innovative reform of higher education.
 - 2.2. The object is – educational and scientific branch of the national economy humanitarian sphere, includes innovative universities, oriented towards university (academic) entrepreneurship.
- 2.3. Implementation of:
 - 2.3.1. establishing innovative business-type universities;
 - 2.3.2. enhancing the role of intellectual entrepreneurship in higher education as a driver for economic growth on the basis of academic (university) entrepreneurship;
 - 2.3.3. innovative economic mechanisms development;
 - 2.3.4. the necessary conditions of public support and favorable legislative framework for innovative academic (university) entrepreneurship;
 - 2.3.5. availability of scientific, pedagogical, engineering and technical staff and students ready for business.”
- 2.4. Expected results:
 - 2.4.1. an innovative self-improving system of higher education and science;
 - 2.4.2. support of the sustainable development and acceleration of the digital knowledge society construction.

The authors also view “innovations in higher education as complex, which have characteristic values of technology, product, market, and organization. Further, the authors argue that:

3. The theoretical foundations of state-oriented innovation development of higher education are as follows: economic science; theory of entrepreneurship and economic development; theory of innovative development; theory of market economy; theory of public administration; human resource theory; theory of state management of economy; international economics; theories of social and economic development and policy of innovative development of the state; theory and practice of higher education; economics of higher education; computer science and information systems; theory of academic capitalism and academic (university) entrepreneurship; and theoretical substantiation and practical confirmation of innovative research-oriented entrepreneurial universities role as accelerators of economic growth.
4. The organizational and methodological foundations of higher education innovative development based on widespread introduction of university entrepreneurship, as the main moderator of innovative transformations in socio-economic and non-industrial (non-material) spheres are: state policy in the field of innovation development of the national economy branches; state, regional and local legislative regulations and rules for higher education and entrepreneurship systems (as a component of all four sectors of the country's economy); development and implementation of innovative models of entrepreneurship, including university (academic) entrepreneurship and granting the rights to universities and research institutes to commercialize the results of R&D performed at the expense of budget financing; financial and tax incentives for the development of university (academic) entrepreneurship; definition of universities development directions and their tasks in socio-economic development of countries, regions and local communities; organizational and methodological decisions of university owners and staff regarding participation in academic business activity; social factors influence.” (Romanovskyi & Romanovska, 2020).
5. It is clear that the main conceptual foundations in the sphere of higher education innovative development consist of: a) the H.Etzkowitz's concept of “triple helix” model for innovative development of society (Etzkowitz, 2003; 2008; 2019; Viale, & Etzkowitz, 2010; Dzisah, & Etzkowitz, 2012; Cadorin et. al., 2019). H.Etzkowitz's concept was successfully used in many countries; b) B. Clark's “concept of transformation and changes of original conventional HEIs into innovative entrepreneurial oriented universities, named as business universities” (Clark, 1998; 2000; 2004). B. Clark's concept has been validated in systems of higher education in different countries.

The authors state that practical principles and necessary conditions of higher education innovative development mean: “a) effective university entrepreneurship as the main factor of innovative transformations in educational and scientific activity of society, connected with public entrepreneurial mentality and national recognition of the role of universities in economic, scientific and technological development; b) a favorable legislation to support academic entrepreneurship and commercialization of R&D results is necessary and very important; c) willingness and readiness of the teams of research and other types of universities to academic entrepreneurship; d) the presence of entrepreneurship leaders and employees of the university with the necessary entrepreneurial traits of character, knowledge and skills in the field of entrepreneurship; e) the existence of supply and demand markets in the academic, educational, scientific and engineering fields; f) the awareness of the necessary transformational conditions by the university communities (according to B. Clark), innovation policy and innovation relations, as well as corporate entrepreneurial culture; g) the cooperation of universities with industry and business with the effective support of governments; h) economic efficiency of university (academic) entrepreneurship; i) the availability of diversified sources of financial revenues to the HEIs budget; j) the endowment institute; k) commercialization of R&D results, transfer of new technologies, creation of spin-offs and start-ups of companies (small enterprises) with the direct participation of employees, students and graduates of universities.” (Romanovskyi & Romanovska, 2020).

6. The authors determined that “the prerequisites for innovative changes in higher education are connected with the formation and development of university entrepreneurship under the influence of: a) globalization processes of society transformation; b) the new societal challenges to raise the level of the labor resources education and the quality of their professional qualifications due to the sharp increase in knowledge and significant complication of production and technological processes; c) the reforming higher education systems and changing the paradigm of training specialists in accordance with current socio-economic needs of society and market requirements; d) the reduction of budget funding for universities and colleges; e) the need for competitive financial support for highly qualified university staff, statutory activities of universities, the implementation of fundamental and applied research and development of the material and technical base together with necessary universities infrastructure; f) the extending of mechanisms and foundations of a market economy to humanitarian spheres.” (Romanovskyi & Romanovska, 2020).

The authors identified that:

7. The preconditions for such changes are: the new expanded role of universities and colleges and the need for their financial independence; enhancing the socially beneficial role of entrepreneurship and its extension to all spheres of human activity; the improving and disseminating business education and much more.



8. The main task of innovative development of higher education in any country is creation of the necessary conditions for a direct purposeful organizational-economic, scientific-educational and engineering-technological activity aimed at the formation of a knowledge society with an innovation-oriented type of economy of the state.” (Romanovskyi & Romanovska, 2020).

Further, in Figure 3, the authors identified and presented the fundamental tasks of innovative academic (university) entrepreneurship:

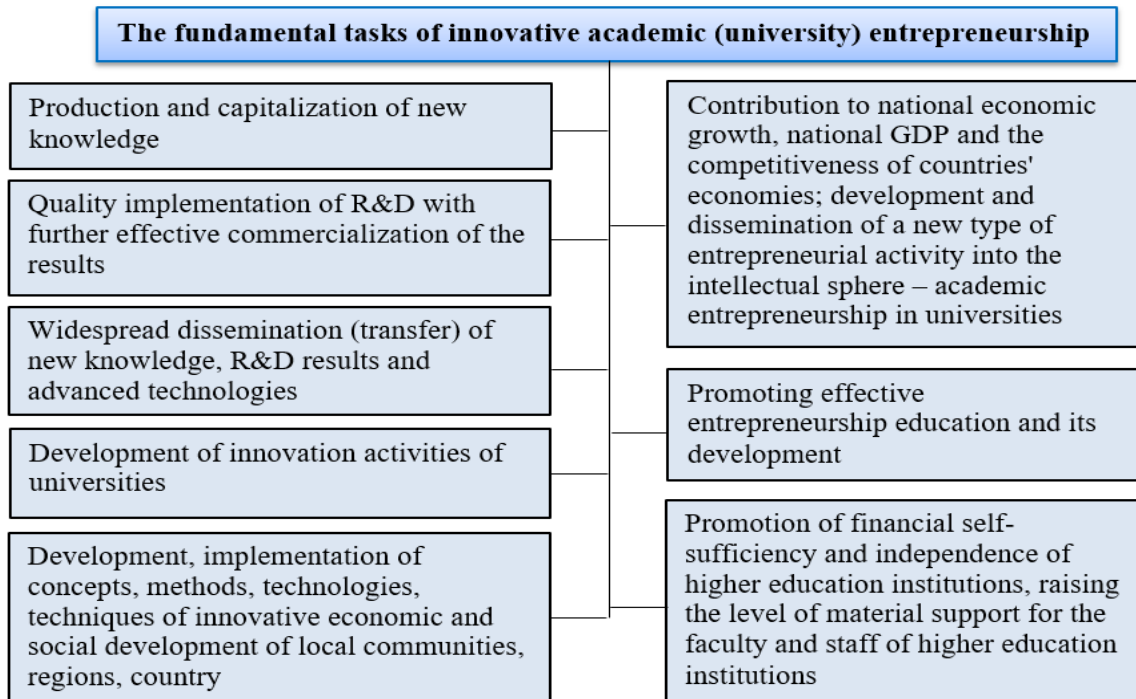


Fig 3. The main tasks of innovative academic (university) entrepreneurship

9. The authors believe it necessary to define the direction of further innovative development of higher education and science in Ukraine and possibly in other developing countries. According to O. Romanovskyi and Yu. Romanovska (2020) these directions of further innovative development of higher education and science can be as following (see. Fig. 4):

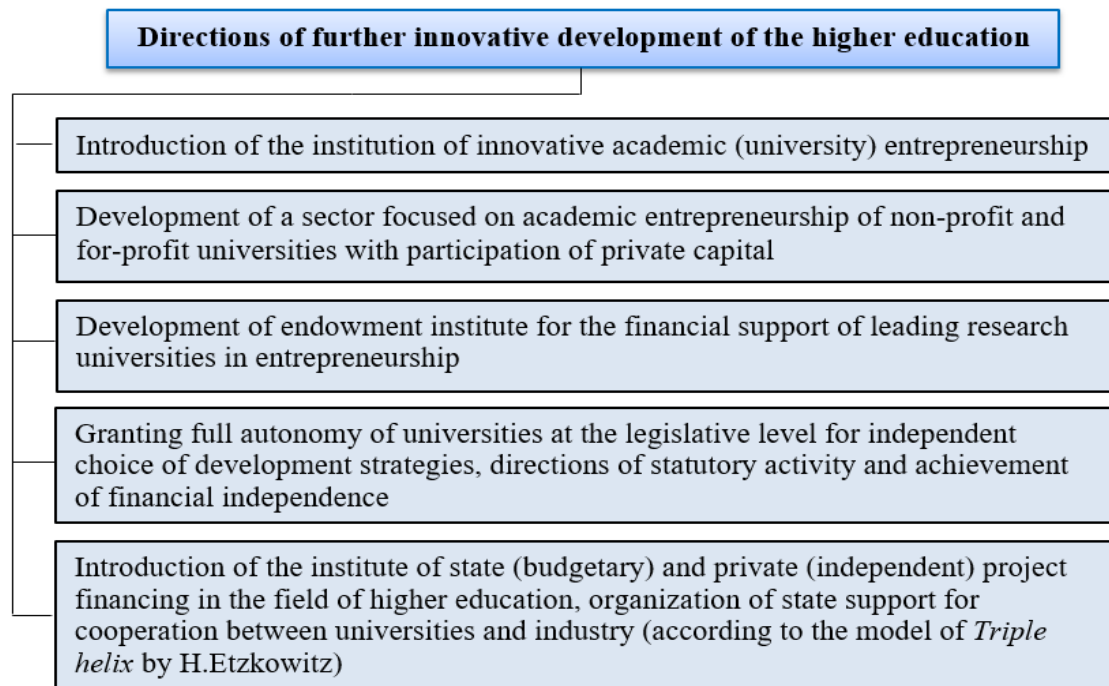


Fig 4. Advisable Directions for Further Innovative Development of The Higher Education in Ukraine and other Developing Countries

10. Authors consider academic capitalism (Slaughter, & Leslie, 1997; Slaughter, & Rhoades, 2009) and university entrepreneurship (Clark, 1998; 2000; 2004; Etzkowitz, 2003; 2008; 2019; Viale, & Etzkowitz, 2010; Dzisah, & Etzkowitz, 2012; Cadorin, et. al., 2019) as “economic categories having their own characteristics, related to capitalization and commercialization of intellectual products, such as new knowledge, technologies, teaching methods. Academic capitalism is a new economic and social environment in which SIs and systems of higher education including all universities of late XX – early XXI centuries exist. Academic capitalism includes university entrepreneurship as an intellectual

type of entrepreneurial activity of researchers, professors, faculty, engineers, technologists, designers, and university students.” (Romanovskyi & Romanovska, 2020).

O. Romanovskyi and Yu. Romanovska (2020) also think that “it is necessary to study, summarize experience and describe theoretical foundations and practical provisions of innovation activity in the field of higher education on the bases of the already known innovative activities in this field. It is advisable to distinguish theoretical foundations and practical provisions of innovation activity in higher education as a separate scientific direction. The authors propose to introduce a new scientific direction in the sphere of higher education with a new scientific term Innovatics of higher education. The use of the term higher education innovatics is appropriate to designate a separate scientific direction in the system of higher education together with other scientific areas, such as: Fundamentals of Higher Education, Theory and Practice of Higher Education, Economics of Higher Education etc.

By its definition, theoretical foundations and practical provisions of a new scientific direction in the sphere of higher education – the innovatics of higher education – includes a number of innovative changes in the following types of activities inherent in higher education: teaching, training, learning, studying; scientific and R&D activities, new technologies development, construction and design creativity; engineering, technical, informational activities; financial and economic support of the educational process and R&D, operating and business expenses, development and expansion of activities; inventive and patent-licensing activities, technology transfer; academic (university) entrepreneurship; cultural and moral development, upbringing of human values; education of honesty, justice and peacefulness; tolerance, mercy, charity and compassion; sports, recreational, festive and extracurricular activities; and other types of activities of universities, colleges and other institutions related to higher education.

Thus, innovatics of higher education (as a set of innovations in the whole sphere of higher education) includes innovative changes in almost all areas of higher education to enhance and improve the quality of professionally trained for modern community responsible citizens and university development. These can be useful for reforming the national higher education system and for the development of new scientific directions in the field of higher education.

We have researched and developed the foundations and concepts for innovatics in higher education based on general theories of innovation activity in other human activities spheres.” Innovatics of higher education should comprehensively promote activities shown in Fig. 5.

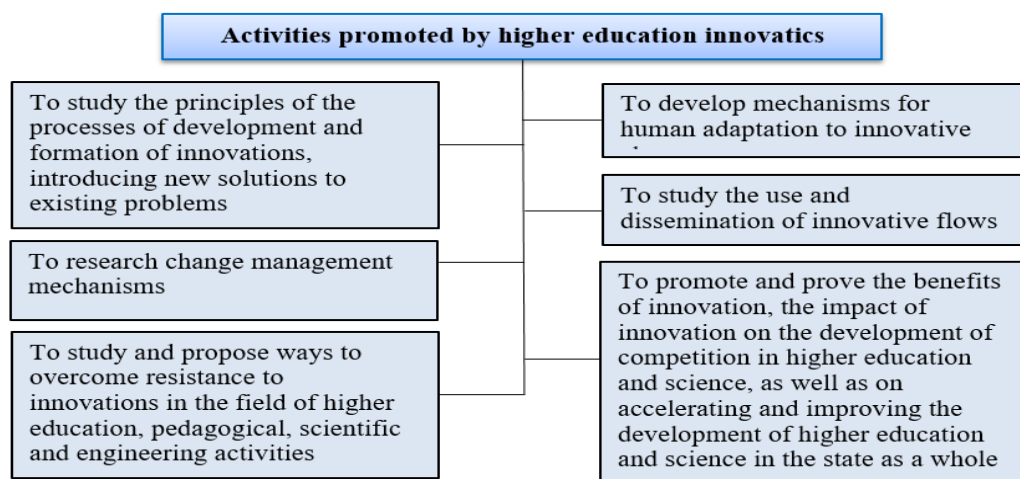


Fig 5. Activities promoted by higher education innovatics

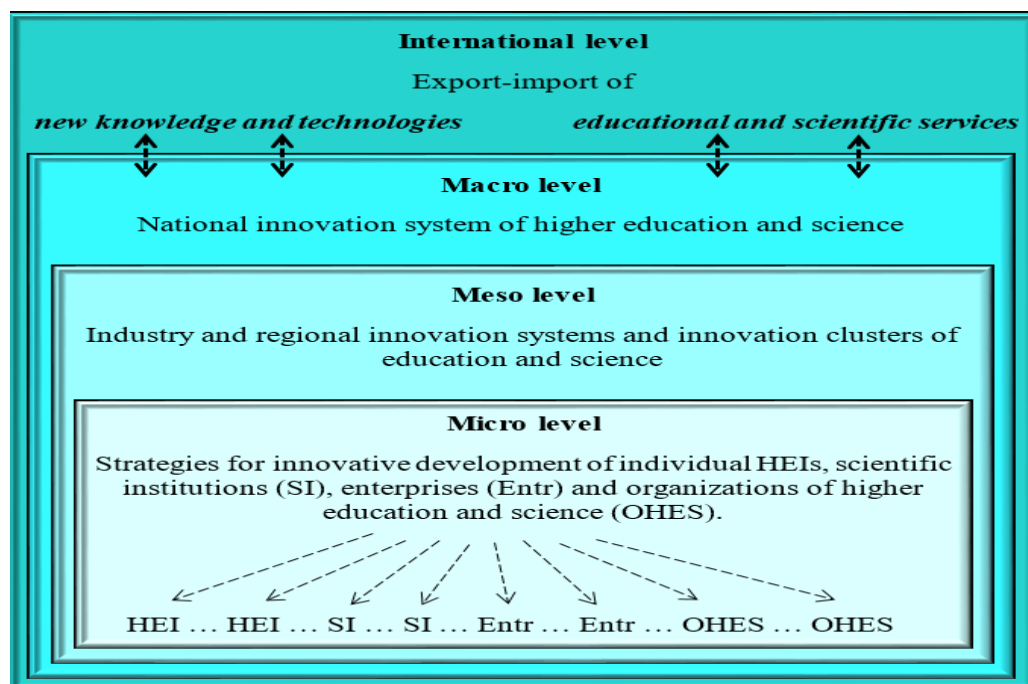


Fig 6. Levels of the innovation process in the field of higher education

The authors think that “the subject of higher education innovatics is characterized by the principles, laws and consistent pattern of innovation processes in higher education and science as a part of a socio-economic system. The subject of higher education innovatics includes models and methods of description, research, organization and management of innovative activities (educational, pedagogical, scientific, technical, organizational and economic) at the macro level (national innovation system of higher education and science), meso level (industry and regional innovation systems and innovation clusters of education and science), and micro level (strategies for innovative development of individual HEI, SI, SO, enterprises and organizations of higher education and science).” (Romanovskyi & Romanovska, 2020). As shown in Fig. 6, the highest, international level, characterized by international cooperation activities includes export-import of new knowledge and technologies, as well as an export-import of educational and scientific services. The interaction with the national innovation system on the macro level takes place.

Two complementary components can be distinguished in higher education innovatics scientific field; they are theoretical and applied innovatics.

According to O. Romanovskyi and Yu. Romanovska (2020), theoretical innovatics of higher education “should solve problems of creation and development of scientific methodology of innovation in higher education and science, theoretical problems of synthesis of innovatively complex organizational and technical systems (new knowledge, ideas, pedagogical methods, techniques, technologies, inventions, discoveries, etc.). Applied higher education innovatics refers to the direction of innovation for solving problems of planning, organizing and implementing innovations in the higher education system. The task of applied innovations of higher education is to solve the organizational and legal issues of innovation, the creation and implementation of innovative projects, etc.”

The expected results of innovative researches and their implementations into the system of higher education are the achievements of practical effect as well for the welfare of the local, state, nation community and humanity as a whole.

The main areas of higher education innovative activities in the sphere of national socio-economic life include immaterial production, that is a sphere of social production of intangible services: search and store of new knowledge (basic science); development samples of new technics, equipment, methods and technologies (applied research); dissemination of new knowledge, training, educating (education); creation, preservation and promotion of spiritual values (culture and arts); health protection and treatment of the population (health care) as well as retail trade, public catering, passenger transport and communications (public and household services), etc. The authors suggest that all these directions of higher education innovation “directly accelerate the economic and intellectual growth of the nation and include:

a) theoretical foundations:

- pedagogical innovation (pedagogical innovatics);
- scientific, technological and technical innovation;
- innovative organizational and economic activities in the field of higher education;

b) theoretical foundations for the formation of innovative corporate entrepreneurial culture in the higher education system; c) models and modeling (including economic) of innovation processes; d) organization and management of innovation development and innovation activity; e) state regulation of innovation activity; f) management of innovative business, including university academic entrepreneurship, spin-offs and start-ups; g) management of innovative projects; h) management of investments in innovative projects; i) commercialization of scientific, technical and creative activities results; j) human resources management in the process of innovative development of socio-economic system; k) managing risks in innovation; l) technical marketing (early-stage marketing of a product or technology); m) logistics of innovation processes; n) management of intellectual property.” (Romanovskyi & Romanovska, 2020).

It should be emphasized that the innovative transformation and development of the higher education and science system is a state restructuring that implements new qualitative transformations and changes in the field of higher education and science. This improves and develops the social, economic, civil and humanitarian activities of society using the effective activation, stimulation and acceleration of innovative activity in this area.

The authors argue that “transformations can be carried out based on the latest scientific achievements, theoretical and methodological foundations, under the clear legislative and executive control of the state and economic bodies, in an effective system of organization and management. The strategy of structural transformation of the higher education economy is based on the principles of self-organization and application of theoretical and practical achievements of economic science. Innovative activity in the field of higher education and science is a process of creating, implementing and disseminating of new ideas, means, scientific, engineering, pedagogical, organizational, managerial, economic methods and technologies in the practice of higher education, scientific and engineering activities. As a result the achievement indicators of structural components within higher education system, scientific, technical activities and scientific services are increased and their transition to a qualitatively higher level takes place.

The innovation activity, supported by the state, is based on theoretical and methodological principles of pedagogical, scientific, technical and economic innovation of higher education; is aimed at restructuring transformations of the higher education system; aims at innovative development of higher education and science; is carried out to solve the strategic task of the social-economic, public and humanitarian activity of the nation for further building the information society of knowledge with an innovation-oriented type of economy.

Innovations in higher education and science are related to the formation and accumulation of new knowledge; the use and commercialization of research and development results; the transformation of R&D, other scientific and technological developments into new or improved products, technologies, services introduced on the market, as well as into a new or improved technological process used in practice, or a new approach to social services; formation and accumulation of intellectual capital and formation of human capital; formation of entrepreneurial mentality and corporate entrepreneurial culture in subjects of innovation activity of the higher education system; using new tools, methods and technologies to accelerate the economic growth of society.” (Romanovskyi & Romanovska, 2020).

The main objects of innovative activity in the field of higher education and science are presented by O. Romanovskyi and Y. Romanovskaya (2020) in Fig. 7 as follows:

The authors determined that “the subjects of innovation activity in the field of higher education and science are individuals or legal entities (HEIs, SIs, structural units of the educational and scientific system, etc.), that carry out innovative activity, attract property and intellectual values, invest their own or borrowed funds in the implementation of innovative social-economic, public and humanitarian activity in the sphere of national projects.

Innovation in higher education and science is designed to produce an innovative product, new service, innovative technology, methodology or new solution. An innovative product is a research or experimental design development of a new technology (including information technology) or experimental designs products.” (Romanovskyi & Romanovska, 2020).

B. Clark (1998) and H. Etzkowitz (2003) suggest that “innovative activities in higher education directly affect the intellectual and socio-economic development of states.” That’s why “the main task of innovative development of the national higher education sphere should be considered as a direct purposeful organizational-economic, scientific-educational and engineering-technological activity aimed at the formation of a knowledge society with an innovation-oriented type of the state economy.” (Romanovskyi & Romanovska, 2020).



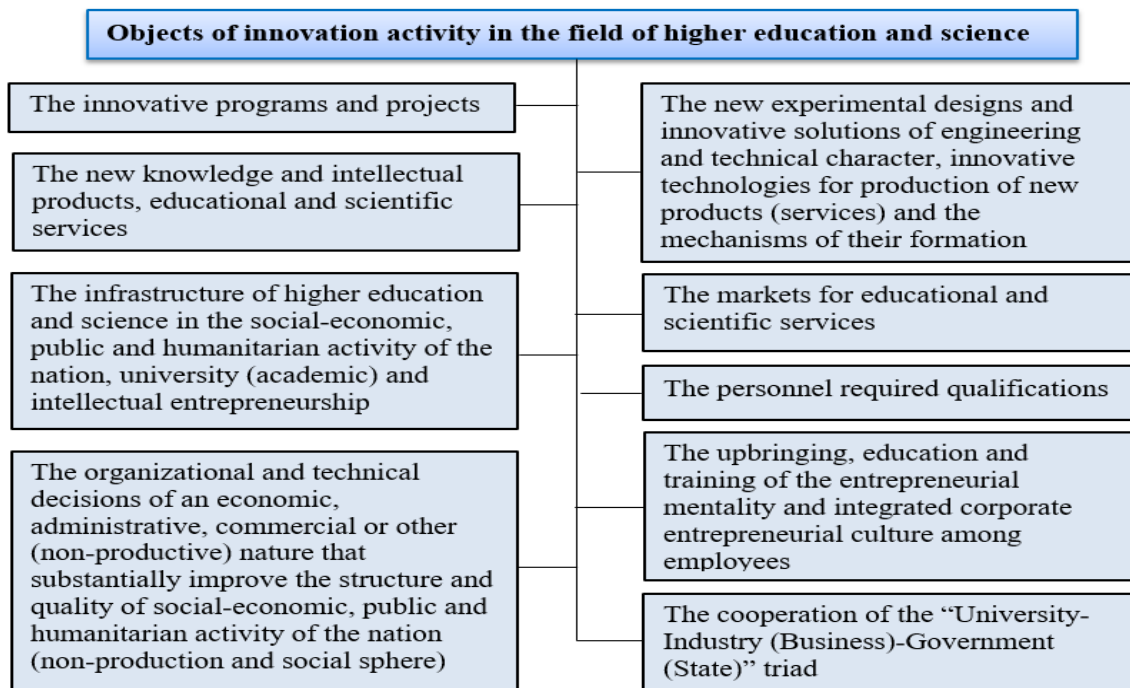


Fig 7. The Main Objects of Innovation Activity in The Field of Higher Education and Science

The authors' research shows that this solution to the problem includes the following:

1. Accelerated formation of new knowledge, progressive innovative technologies, innovative resource, materials, means of production, forms of consumption and distribution of manufactured products and services.
2. Ability to produce innovative products and services using global advanced technologies and advanced techniques, becoming a dominant source of competitive advantage. A distinctive feature of countries with innovation-oriented economy is the production and export of new global knowledge (technologies, methods and techniques) necessary for the development of innovation and further socio-economic growth of countries.
3. The innovation-oriented stage of the state economic development is characterized by increase in entrepreneurial activity, including the growing role of intellectual entrepreneurship. For over a century, there has been a tendency to increase the intellectual level of economic activity, which has been manifested in almost all industrialized countries, ranging from small firms to large organizations.
4. Advance of intellectual capital. The world economic system of late XX – early XXI centuries is characterized by a new paradigm of economic development based on a significant reduction of material and resource components role in social production and the increased role of intellectual component. Knowledge production, distribution and use form the basis for a knowledge-based economy, characterized by the growing interconnection between capital markets and emerging technologies, and the global nature of knowledge creation and use. In new economic conditions, purposeful formation of innovative potential, increase of intellectual capital and their competent use become the basis of economic growth.
5. Formation of national human capital. The base of the knowledge society is a highly educated nation with specialists of the high quality at all levels of the state system.” (Romanovskyi & Romanovska, 2020).

The most important directions of innovative development of the system of higher education according to the authors approach include:

1. “Establishment of an entrepreneurial mentality in the society through active promotion of entrepreneurial activity as a mechanism of self-realization of a person and creation of new jobs. The state support of all types of entrepreneurship as the main factor of economic growth of the state is necessary. Also it is necessary to strengthening economic and entrepreneurial education, to teach the basics of economic knowledge and develop entrepreneurship vocational training, to increase courses of theoretic and practical training, practical life-long entrepreneurship training.” (Clark, 2000; 2004).
2. “Widespread state supported introduction of innovative academic university entrepreneurship, intellectual entrepreneurship, creation of legislative and regulatory acts to stimulate invention, R&D development, implementation and commercialization of scientific and technical activities results.” (Dzisah & H. Etkowitz, 2012).
3. “Giving broad (full) autonomy to universities of all types and forms of ownership.
4. Strengthening the role of research universities.
5. Strengthening of the state role in support of the triad of society University – Business – Government, where the core of innovation is the university.” (Clark, 2000; 2004; Etkowitz, 2003; 2008).
6. “Integration of university research with academic and sectoral science is important for Ukrainian and other post-Soviet countries. For example, it can be achieved on the basis of merger of HEIs with academic and sectoral research institutes and laboratories with the aim of forming educational and scientific associations, scientific and techno-parks with the prospect of further cooperation with industry and business. Creation and development of incubators, spin-offs and start-ups of venture capital companies is also important.
7. Establishment of independent institutions for licensing and accreditation of HEIs activities.
8. Creating new forms of budget financing for higher education and research, grants and public procurement solely on a competitive basis with the involvement of public and media members.” (Romanovskyi & Romanovska, 2020).

As a result of the research, the authors have identified the following “main stages in the implementation of innovative developments in the field of higher education:

1. Formulation of scientifically grounded innovative changes, directions and organizational principles of their implementation.
2. Calculation of material costs for the introduction of innovative changes.

3. Creating the necessary economic and organizational conditions for effective implementation of innovative changes.” (Romanovskyi & Romanovska, 2020).

Based on the results of our study of world experience (Romanovsky, 2012), we can assert that innovative changes in the field of higher education and science occur in objectively defined directions (Romanovskyi & Romanovska, 2020). Now we will consider the directions of innovative changes in the system of higher education and science and the expected results (Fig. 8).

Thus, the authors argue that the transformations and implementation of a complex of innovative changes in the sphere of higher education and science leads to:

“a) dissemination and promoting of innovative academic university entrepreneurship in the field of higher education; b) creation of innovative HEIs and business-type scientific institutions; c) enhancing the role of innovative intellectual entrepreneurship, linked to the production of innovative products, technologies and services through the use of new knowledge and based on high-level intellectual activity; d) accelerating the economic growth of the country and increase its competitiveness on the world stage.” (Romanovskyi & Romanovska, 2020).

O. Romanovskyi and Yu. Romanovska (2020) assume that “the result of the active expansion of academic university entrepreneurship, activities of innovative entrepreneurial universities, enhancement of the role and importance of intellectual entrepreneurship in higher education should be:

1. Innovative educational technologies, training methods and techniques.
2. Search, acquisition and dissemination of new knowledge and technology transfer.
3. Commercialization and industrial implementation of R&D results.

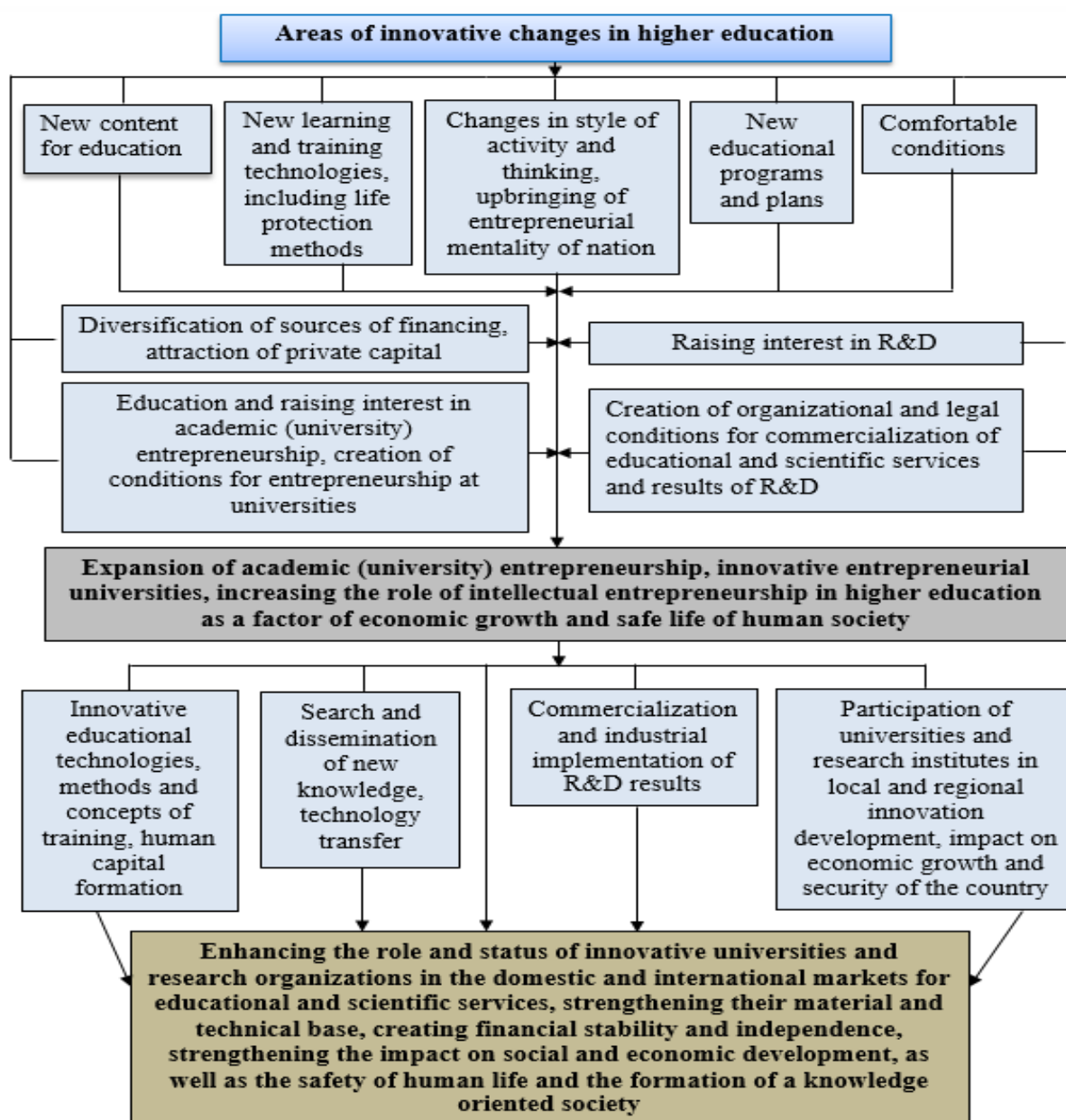


Fig 8. Areas of innovative changes in higher education

4. Participation of universities and research institutes in local and regional innovation development with the influence on the economic growth of the state.

The most important results of such innovations are the enhancement of the role and status of innovative HEIs and research organizations in the domestic and international markets of educational and scientific services, strengthening their material and technical base and financial independence, influence on the socio-economic development, security of human life and the formation of the knowledge-orientated society.”

Summarizing the results of a comprehensive study of the phenomenon of academic (university) entrepreneurship, it should be noted that innovative entrepreneurial universities implement their activities in higher education and science in the current market laws of the economic system, interact with the internal forces of society (respond to its challenges and requests) and are influenced globalization pressure of the world community (as schematically shown in Fig. 9).

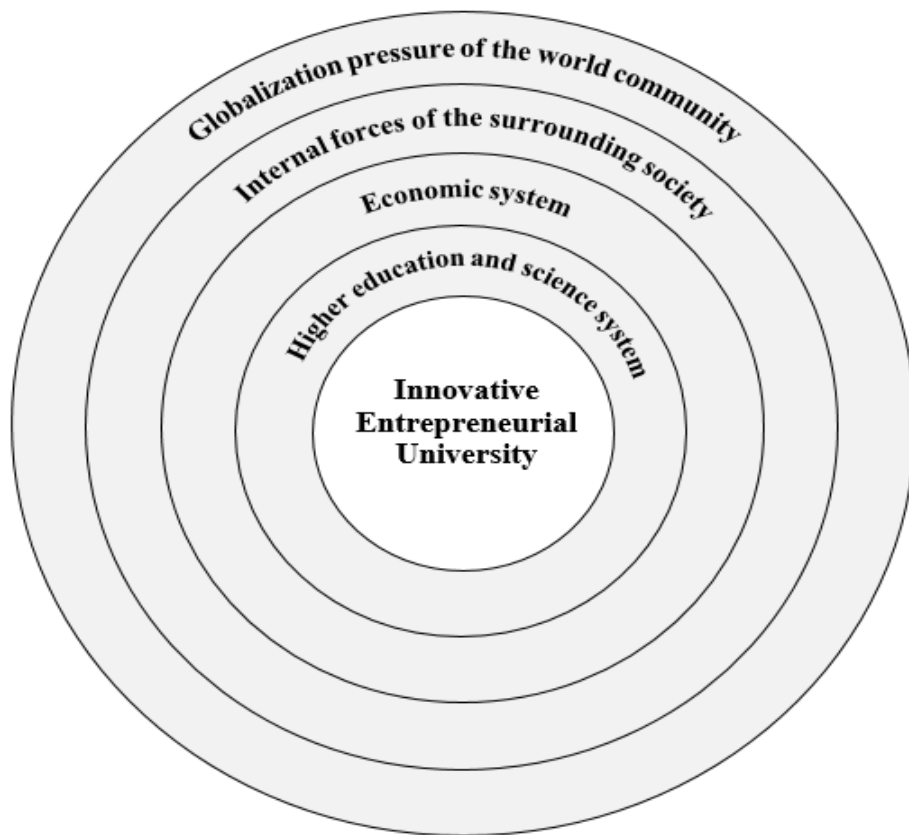


Fig 9. Innovative Entrepreneurial University in the Environment

CONCLUSION AND RECOMMENDATION

Higher education innovatics is very useful and important. This multidisciplinary scientific and applied direction is collecting, generalizing and classifying the advanced experience of many leading universities innovative activities. The same refers to SIs and all organizations related to higher education. The system of these innovative activities in the field of higher education is interesting and practically useful for both developed and developing countries. Summarizing the results of a comprehensive study of the innovation in university education as a factor of society sustainable development it is necessary to note that higher education innovatics is a complex interdisciplinary scientific and applied direction in the field of knowledge. Higher education innovatics deals with the diverse and comprehensive fields of higher education and science, that are constantly producing and developing knowledge.

Higher education is connected with all spheres of human activity, because life needs competent and trained individuals. Thus, higher education innovatics is one of the most multidisciplinary scientific and applied directions in the system of diverse knowledge of mankind.

In this short article, the authors managed to present only a small part of the research conducted in the field of higher education innovatics. In particular, the types of innovations in the field of higher education, their purpose and classification were beyond the scope of the materials of this article. Some other results of this study that are not included in the article may also be of interest. The authors plan to publish other materials of the study in the future. The authors encourage specialists in the field of innovation of higher education to participate in the development of higher education innovatics theoretical and applied foundations. We recommend them to deepen research on the possible impact of academic university entrepreneurship not only in the sphere of economics, but to expend it to the social and public sectors of the community, as well as to find the ways to use intellectual entrepreneurship for the service of health protection in the context of the COVID-19 pandemic.

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