

COOPETITIVE PATTERNS OF INTERACTION BETWEEN SUBJECTS OF THE KNOWLEDGE TRIANGLE

Tetyana Mayboroda¹, , Vasyl Karpusha², , Inna Balahurovska^{3*}, 

¹ Ph.D., Associate Professor, Oleg Balatskyi Department of Management, Sumy State University, Ukraine

² Ph.D., Associate Professor, Sumy State University, Ukraine

³ PhD student, Sumy State University, Silesian University of Technology

* Corresponding author: Inna Balahurovska, e-mail: i.balahurovska@management.sumdu.edu.ua

Received: 01.12.2024

Revised: 07.12.2024

Accepted: 08.12.2024

Abstract: The article explores coopetitive interaction patterns among the actors of the knowledge triangle - business, education, and science - as a tool for enhancing innovation potential and fostering sustainable societal development. The study emphasizes that in the context of globalization, rapid technological advancements, socio-economic challenges, and the consequences of war, coopetition becomes a vital strategy to ensure competitiveness and adaptability. The authors analyze the advantages of this strategy, which combines competition and cooperation, to optimize resources, develop innovative ecosystems, and create new educational and research approaches. The paper presents a detailed typology of coopetitive patterns, including partnership, competition, collaboration, and co-innovation. It describes mechanisms enabling a balance between cooperation and competition, which are fundamental to improving the effectiveness of interactions within the knowledge triangle. It is emphasized that each interaction pattern contributes to achieving synergy by integrating knowledge, technologies, and resources while maintaining the individual competitiveness of each participant. Special attention is given to the Ukrainian Universities Alliance case analysis, which serves as an example of an effective coopetitive practice. The signing of a Memorandum of Cooperation by six leading Ukrainian universities of various ownership forms opened new opportunities for developing education, science, and innovation, even under the challenging conditions of war and social upheavals. The Alliance demonstrates how horizontal linkages among academic communities contribute to developing innovative strategies, preserving national identity, strengthening social cohesion, and addressing pressing societal challenges. The article also highlights key aspects of managing coopetitive relationships, including balancing participants' interests, effective knowledge management, setting common goals, and ensuring transparency in relations. In particular, the authors recommend using modern information systems to coordinate cooperation, formalize agreements, and create network structures to optimize interaction. The study underlines that coopetition in the knowledge triangle is a tool for developing an innovative economy and a mechanism for social progress. The findings demonstrate how joint initiatives among universities, businesses, and scientific institutions can create unique synergies to overcome global challenges. The analysis of the Ukrainian Universities Alliance case reveals the effectiveness of integrating competitive and coopetitive strategies to strengthen the position of Ukrainian higher education in the international arena, preserve human capital, and support national recovery. Thus, the study's results confirm that coopetition is a crucial strategy for universities seeking to retain their individuality while contributing to societal well-being. The experience of the Ukrainian Universities Alliance demonstrates the feasibility of implementing innovative approaches to cooperation even in crisis conditions, making it a promising avenue for further research and practical initiatives.

Keywords: coopetition, management, knowledge triangle, alliance.

Funding: This research was funded by the Ministry of Education and Science of Ukraine and performed the results of the projects "Business-Education-Science Coopetition: Institutional and Economic Models of Innovation Transfer for National Security and Sustainable Development" (№ 0122U000772).

Cite as: Mayboroda, T., Karpusha, V., & Balahurovska, I. (2024). Coopetitive patterns of interaction between subjects of the knowledge triangle. *Economic Sustainability and Business Practices*, 1(2), 19–29. <https://doi.org/10.21272/esbp.2024.4-03>.



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1. Introduction. The role of universities has expanded significantly in today's globalized world, going beyond the traditional tasks of training specialists and conducting scientific research. Today, universities become essential agents of change that affect the development of society, economics and politics. In particular, in conditions of rapid technological changes, global challenges and growing competition for resources and talents, universities are forced to look for new forms of cooperation that can respond to challenges more effectively. One such form is coepetitive interaction, which combines competition and cooperation and creates new opportunities for joint development.

Universities face complex challenges due to the war and social upheaval that Ukraine is experiencing. Higher education institutions should ensure the stability of educational process and actively contribute to the revival and preservation of national identity, culture and social ties. In response to such problems, Ukrainian universities have begun new forms of cooperation, combining their efforts in joint projects and initiatives. One such initiative is the creation of the Alliance of Ukrainian Universities, which has become an example of academic solidarity and an innovative approach to developing higher education in Ukraine.

Coepetitive practice becomes an effective tool for achieving the strategic goals of universities, which not only adapt to modern conditions but also form new approaches to teaching, research and cooperation. The entry of Ukrainian universities into the Alliance is an essential step in shaping new educational strategies that consider human capital needs, the challenges of war and social upheaval, and the need to preserve cultural identity and social responsibility.

2. Literature Review

The proposed topics cover several studies that analyse the role of universities in fostering innovation, interacting with different sectors and creating knowledge. Scholars (Benneworth et al., 2010; Quarchioni et al., 2020; Langrafe et al., 2020) examine the role of stakeholders in the process of knowledge creation and use in higher education. The authors consider universities essential players in this process and emphasize the importance of involving different stakeholders. The articles by Perkmann et al., 2007; Kipper et al., 2021; Cheng et al., 2018 analyse the relationship between universities and industry in the context of open innovation and reveal the importance of interaction between educational institutions and industry to stimulate innovation processes. Works such as Geuna et al., 2009; Allameh et al., 2017; Raj Adhikari, 2010 critically examine different approaches to knowledge transfer management in universities. Researchers analyse how these approaches affect the effectiveness of knowledge transfer from academic institutions to industry and other sectors. The articles by Ranga et al., 2013; Cai et al., 2020; Tuunainen, 2002 propose an analytical framework for understanding innovation policies and practices in the knowledge society. The authors develop the concept of the "Triple Helix," which describes the interaction between universities, businesses, and government as a basis for innovation policy. Scholars (Bengtsson et al., 2010; Corbo et al., 2022; Navío Marco et al., 2020) explore new ideas about development and the importance of partnerships between different sectors and emphasize the importance of cooperation and competition (co-optation) for the development of innovation. Chrys Gunasekara (Gunasekara, 2006) analyses the role of universities in developing regional innovation systems and interactions with business and government. The author emphasizes how universities can contribute to regional development through the creation of innovation ecosystems. Powers and McDougall (Powers & McDougall, 2005) examine academic entrepreneurship through the lens of start-up creation and technology licensing. They also explore how universities can facilitate the commercialization of research and the creation of new businesses. Mowery and Sampat (Mowery & Sampat, 2006) examine the role of universities in national innovation systems and their interactions with other sectors. They emphasize the importance of universities as central elements of national innovation systems that provide scientific research and support economic development.

3. Methodology and research methods

The study used a comprehensive approach, including theoretical and empirical methods, to provide a thorough analysis. This allowed for a detailed study of the interaction between entities, identifying patterns of cooperation and competition, and assessing their effectiveness in the face of modern challenges.

At the initial stage of the study, an in-depth analysis of the scientific literature on the concept of coepetition, the knowledge triangle, innovative development, and the features of interaction between universities, businesses, and scientific institutions was conducted. The analysis used works by leading scientists, articles in peer-reviewed journals, monographs, and reports of international organizations. Particular attention was paid to studying the theoretical foundations of coepetition strategies, their impact on the formation of innovative approaches, and the possibilities of their application in conditions of social upheavals, such as war. This stage allowed for the formation of a theoretical basis for further research.

A case study method was used to analyze the practical implementation of coepetition strategies, which allowed us to study the activities of the Alliance of Ukrainian Universities as an example of unique coepetition interaction. As part of the method, data on the structure of the Alliance, its strategic goals defined in the Memorandum of Cooperation, and the results of joint university projects were analyzed. This provided an opportunity to understand better the features of the practical application of cooperation patterns in education

and science, as well as their role in strengthening social ties, preserving cultural identity, and adapting to war conditions.

Comparative analysis methods were used to systematize the data obtained and identify the features of cooperation patterns. In particular, a comparison was made of the main types of interaction between the knowledge triangle subjects: partnership, competition, collaboration, and co-innovation. The analysis allowed us to determine the advantages and disadvantages of each of the patterns and assess their feasibility depending on the specific conditions and goals of interaction.

The systematic approach in the study provided the integration of heterogeneous data and the analysis of the relationships between business, education, and science. In particular, the systematic approach allowed us to assess the synergistic effect of these subjects' interaction, determine the optimal mechanisms for managing cooperation, and develop strategies for ensuring innovative development. In addition, this approach contributed to the generalization of the results obtained and the formulation of conclusions about the role of cooperation in achieving sustainable development and social progress.

The study's use of an interdisciplinary approach contributed to the formation of new knowledge about the role of cooperation in the context of global changes and social challenges.

4. Results

4.1. Cooperation in the triangle of knowledge

Cooperation, a strategy of simultaneous cooperation and competition, is increasingly important in the interaction between business, education and science, the so-called triangle of knowledge. Such a strategy allows different organizations and institutions to use their resources and knowledge effectively to achieve common goals while maintaining individual competitiveness.

Scientists have described the term cooperation as a situation where companies cooperate and compete simultaneously (Armstrong et al., 1997). Cooperation is a form of strategic interaction that allows organizations to maintain their independence and compete in certain areas, collaborating with others to achieve expected benefits.

This approach to interaction is not limited to business; it also finds its application in a broader context, particularly in cooperation between industry, education, and science. Knowledge plays a vital role in the development of society and the modern world's economy. One of the essential concepts explaining the interaction of different sectors for the knowledge creation and dissemination is the knowledge triangle (Shapiro et al., 2007; Groumos, 2013). This concept illustrates the integration and cooperation between business, education and science.

Figure 1 shows the visualization of the knowledge triangle, which presents three components: business, education and science. Each of these elements interacts with others, forming an influential network of cooperation and competition that promotes innovation and development.

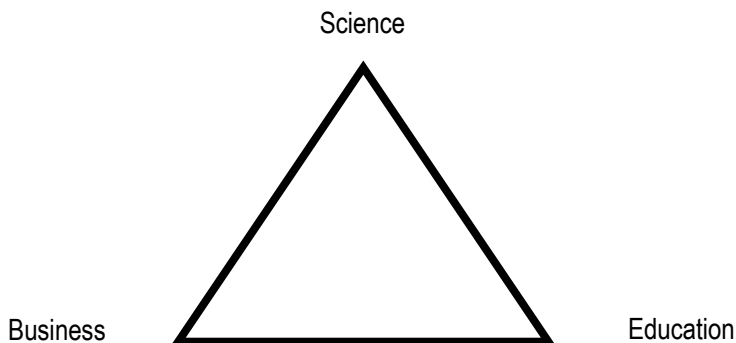


Figure 1. The Triangle of Knowledge

Sources: compiled by the authors

Consequently, the knowledge triangle concept shows how vital cooperation between business, education and science is to achieve common goals. The synergy between these components allows efficient use of resources and knowledge for innovative development, contributing to economic growth and social progress. Also, such interaction emphasizes the need for a constant exchange of information and experience between these sectors, which ensures the creation of new knowledge and technologies that can be commercialized and used for the benefit of society.

In conditions of the knowledge triangle, cooperation is particularly important because it promotes innovation by integrating different kinds of knowledge and resources. Let us consider the interaction between business, education and science in more detail.

1. *Business and Education.* Companies collaborate with universities to develop training programs that meet the needs of the labor market. For example, many technology companies fund research projects and provide student grants while engaging them in internships and employment (Etzkowitz et al., 2000).
2. *Business and Science.* Enterprises invest in scientific research, providing funding for innovative projects. In turn, scientific institutions provide access to the latest research and technology that companies can commercialize. Such interaction helps to accelerate the process of introducing scientific developments into production (Carayannis et al., 2009).
3. *Education and Science.* Universities and scientific institutions cooperate in research, knowledge exchange, and publication. Joint projects allow students to participate in advanced research, contributing to the training of highly qualified specialists (D'Este et al., 2007).

One striking example of co-competition in the knowledge triangle is the Silicon Valley project in the United States, where close interaction between technology companies, leading universities (such as Stanford and the University of California at Berkeley) and research centres has contributed to creating a unique innovation ecosystem (Gertler et al., 1995). Another example is the European Program Horizon 2020, which brings together businesses, scientific institutions, and educational institutions to address global challenges jointly through research and innovation (EU, 2014).

Co-competition in the knowledge triangle is an essential catalyst for innovation and sustainable development of society. This approach promotes active interaction between businesses, educational institutions and research centres, which leads to numerous advantages. Joint research and knowledge sharing drive the rapid adoption of the latest technologies (Chesbrough, 2003), improving the industry's competitiveness and the economy as a whole. Efficient use of resources, such as financial, human and technological, is made possible by joint projects (Lundvall, 1992), simplifying the solution of complex problems and increasing production processes' efficiency. In addition, co-competition contributes to improving the quality of education since educational institutions can adapt their programs to the modern requirements of the market, providing students with relevant knowledge and skills (Leydesdorff et al., 1998). This approach contributes to society's intellectual development and allows for solving global problems, combining efforts to achieve common goals and create an innovative environment.

Therefore, co-competition in the knowledge triangle is a powerful tool that contributes to creating an innovative economy and ensures the sustainable development of society through the combination of knowledge, resources and technologies from business, education and science.

4.2. Typology of co-competitive patterns between business, education and science

The typology of competitive patterns between business, education, and science is essential in studying the interaction between the subjects of the knowledge triangle. The proposed classification allows the revealing of various models of cooperation, competition, collaboration, and co-innovation arising from these sectors' interaction. The patterns of interaction between business, education, and science contribute to the development of innovative potential and increase the organisation's competitiveness.

Partnership Pattern

Business, education, and science partnerships create joint projects and initiatives to achieve mutually beneficial goals. Such partnerships may include joint research projects, study programs, company student internships, and business research funding. According to the research results, such partnerships increase the innovative potential and competitiveness of companies and educational and scientific institutions (Freeman et al., 2013; Ritala, et al., 2021). Figure 2a visualizes the collaboration between business, education and science.

The partnership is depicted as an equal interaction between all actors in Figure 1. That is, each participant in the process interacts with others on equal terms, exchanging resources and information. In partnership, it is essential to harmonise goals and equitable access to shared resources, which contributes to mutual development and support. Each entity – business, education and science – plays an equal role in achieving common goals, ensuring stable and practical cooperation.

Pattern of competition

Competition between subjects of the knowledge triangle arises when they compete for the same resources, such as funding, talent, or market opportunities. For example, academic institutions can compete with companies for research grants, and universities for the best students and teachers. Such competition can stimulate improvements in the quality of education and research, but can also create tension between subjects (Leydesdorff, et al., 2020; van den Besselaar et al., 2012). Figure 2b depicts the competition between business, education and science.

Competition is shown as an adversarial relationship between the subjects. Here, each subject competes for resources or opportunities, which leads to a competitive environment. In such an interaction model, it is important to consider strategies that can minimize conflict and ensure healthy competition, which encourages innovation and increased efficiency. Competition can improve processes and improve the quality of products or services.

Pattern of collaboration

Collaboration involves close cooperation and collaboration between business, education and science to achieve common goals. It may include creating joint research laboratories, developing new technologies, organizing conferences and seminars. Collaboration allows you to use the resources and knowledge of each partner effectively, which contributes to innovative development (Powell et al., 2006; Bruneel et al., 2010). Figure 2c shows the collaboration between business, education and science.

All subjects work closely together with such interaction, combining their efforts to achieve a common goal. Collaboration often involves the creation of joint teams or project teams that work on new product development, research or educational programs. Such interaction contributes to integrating knowledge and resources, increasing the innovative potential and efficiency of joint activities.

Pattern of co-innovation

Co-innovation is co-creating new products, services or technologies between business, educational and scientific institutions. This pattern involves the active participation of all parties in all stages of the innovation process from generating ideas to commercializing results. Co-innovation can significantly improve the efficiency of the innovation process and reduce the risks associated with developing new products and technologies (Chesbrough, 2003; Enkel et al., 2009). Figure 2d shows the process of co-innovation between business, education and science.

Co-innovation is depicted as a continuous cyclical process of innovation, where each entity interacts with others at all stages of creating new products or services. With such interaction, ensuring a constant exchange of knowledge and resources is essential, allowing you to develop innovations at every stage. Co-innovation promotes the development of new ideas and technologies, combining the efforts of business, education and science to achieve expected results. It is a cyclical process that is constantly updated with new contributions from each subject.

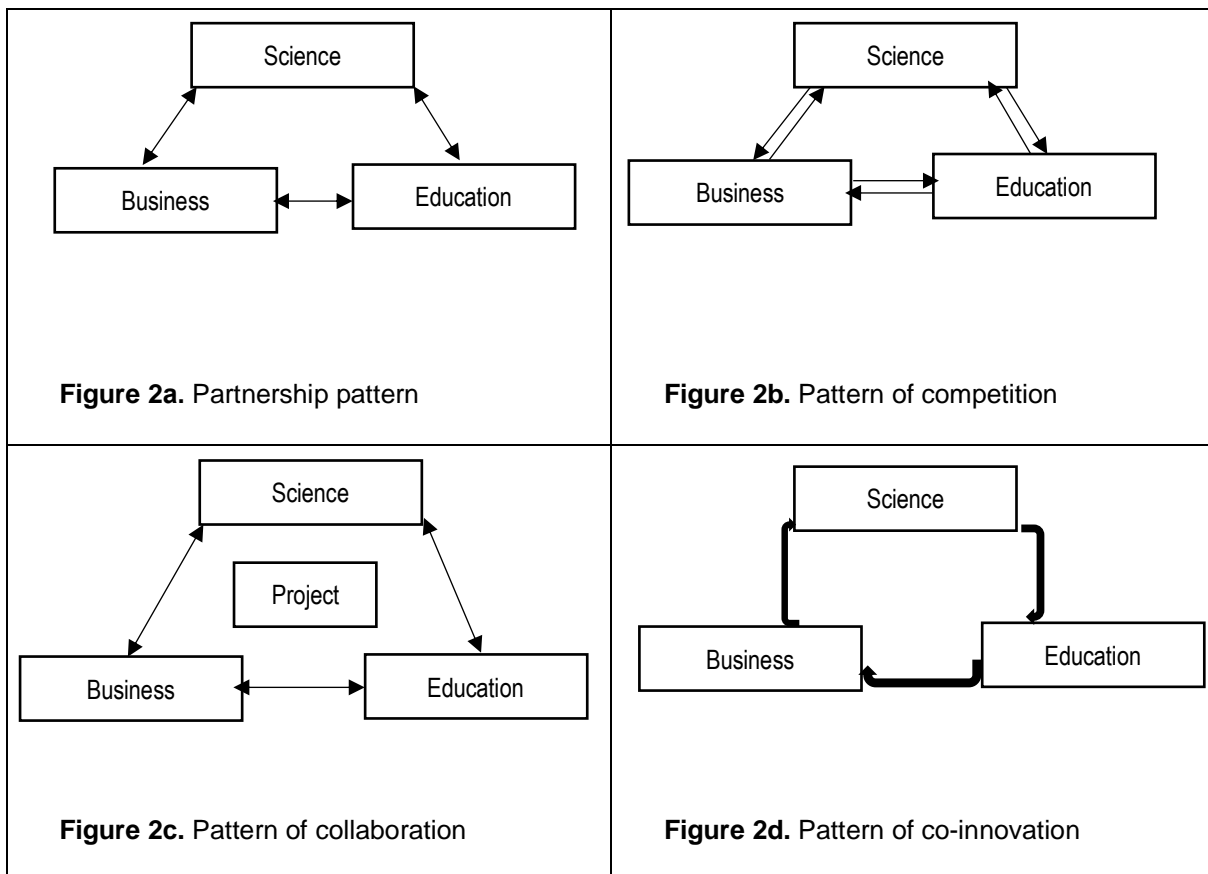


Figure 2. Coepetitive patterns of interaction between business, education, and science
Sources: compiled by the authors

Therefore, coepetition in the knowledge triangle is a powerful tool that contributes to creating an innovative economy and ensures sustainable development of society through combining knowledge, resources, and technologies from business, education, and science.

4.3. Interaction management of the knowledge triangle subjects in coepetitive relations

Managing the interaction between business, education, and science in coepetitive relations is a complex and multifaceted process requiring the integration of different strategies and mechanisms to ensure practical cooperation between competition and collaboration.

Coopetition management strategies include several key elements. First, it balances the participant's interests, which ensures equality and mutual benefit for all parties. Second, knowledge management is critical because it facilitates the effective exchange of information and innovation between partners. Finally, the definition of common goals is necessary to harmonize the efforts and directions of development, which ensures the long-term sustainability and success of coopetitive relations.

One of the main tasks in coopetitive relations is *balancing the interests* of all subjects. It is important to develop mechanisms for harmonizing goals and avoiding conflicts. Constant monitoring of interactions and adjustment of goals in accordance with changes in the environment are important aspects of such a strategy (Shvindina, 2019). Balancing interests also involves identifying shared priorities and creating the conditions for open dialogue between actors.

Knowledge management is critical in coopetitive relationships in terms of protecting confidential information and sharing knowledge between actors. Effective knowledge management contributes to increasing innovation capacity and creating competitive advantages (Seepana et al., 2020), which may include the creation of platforms for knowledge exchange, the use of modern technologies to store and transfer information, and the development of privacy and intellectual property policies.

Another important element of coopetitive relations management is the *definition of common goals and objectives*. Shared goals help unite subjects' efforts and direct them to achieve specific results. This approach may include joint research projects, developing new technologies or products, and student training programs and internships (Czakov et al., 2020).

For successful coopetition management, it is important to use a *variety of mechanisms* that promote effective interaction between competitors who cooperate simultaneously. Such a set of measures includes creating conditions for sharing resources, reducing risks and ensuring the stability of coopetitive relations. An important aspect is also the formalization of the rights and obligations of each party, which promotes transparency and trust in the relationship. The mechanisms for managing coopetition include:

- contracts and agreements are the main instruments for regulating coopetitive relations, allowing the formalisation of each subject's rights and obligations, which helps reduce risks and provides legal protection (McGrath et al., 2019). Contracts may include provisions for information sharing, intellectual property protection, profit and risk sharing, and conflict resolution mechanisms.

- the use of modern information systems allows you to manage coopetitive relations effectively, ensuring transparency and efficiency in the information exchange. Such systems promote better coordination and interaction between the subjects of the knowledge triangle (Sahut et al., 2022). Information systems may include collaboration platforms, databases, facility management systems, and communication tools.

- network structures can provide flexibility and adaptability in the interaction between the subjects of coopetitive relations. Such structures allow you to create dynamic and flexible links between different organizations and institutions, contributing to more efficient use of resources and knowledge (DeBresson et al., 1991). Network structures can include formal and informal networks of cooperation and various forms of partnerships and alliances.

Also, the management of coopetition between the subjects of the knowledge triangle requires a clear *definition of roles and responsibilities* for all participants, including several essential components that contribute to successful interaction and achieving common goals. The elements of this process include:

- identification of the interaction leader is an essential element of effective management. The leader coordinates actions, resolves conflicts, and monitors joint project implementation (Sheehan et al., 2020) and can also act as an intermediary between the subjects, contributing to the establishment of effective communication and cooperation.

- the distribution of resources between the subjects should be clearly defined and balanced and include financial and human resources, allowing the maximum effect of cooperation and competition (Amata et al., 2021). It is also essential to consider the potential of each entity and its contribution to joint projects.

- measurement and evaluation of cooperation results, which allows for identifying the interaction effectiveness of problems and developing recommendations for their solution (Bengtsson et al., 2000). Assessment metrics may include financial performance, number of innovations, partner satisfaction, and societal and economic impact.

4.4. Analysis of coopetitive practice of the Alliance of Ukrainian Universities

In conditions of global changes and the rapid development of technology, educational institutions face new challenges in ensuring the quality of education and training of qualified specialists. In today's world, education needs to adapt to rapidly changing conditions, which requires innovative approaches and strategies.

Cooperation between universities becomes an important driver of success. Interaction between educational institutions allows the exchange of experience, resources and best practices, which contributes to improving the quality of the educational process. Joining forces through joint research projects, academic programs, and international partnerships can give students access to advanced knowledge and technology. In addition, integrating modern technologies into the educational process helps universities respond flexibly to the new requirements of the labor market and quickly introduce the latest teaching methods. This approach

allows for improvement in the training of specialists and ensures their competitiveness at the international level. Therefore, practical cooperation between universities is an important aspect of successful education development in conditions of global change, contributing to the formation of innovative educational strategies and providing training of specialists that meet modern requirements.

6 leading Ukrainian universities of various forms of ownership signed a Memorandum of Cooperation that consolidated their cooperation in the Alliance in 2023. It includes Taras Shevchenko National University of Kyiv (Kyiv), Private University Kyiv School of Economics (Kyiv), National University of Water Management and Nature Management (Rivne), National Technical University Dnipro Polytechnic (Dnipro), Sumy State University (Sumy), Ukrainian Catholic University (Sumy), which is the first such alliance in Ukraine.

The Alliance of Ukrainian Universities is a unique example of cooperative practice in Ukraine through a combination of cooperation and competition between educational institutions representing different regions of the country. In this case, universities, which traditionally can compete for students, resources and recognition, work together to achieve the main goal. The purpose of this Memorandum (2023) is to consolidate the efforts of the Parties to ensure the effective development and preservation of the Ukrainian nation and state by focusing on human capital, Ukrainian culture and qualitative social ties between people as the response of university communities to the challenges of war, demonstrating the significant potential of horizontal ties and cooperation between academic communities; promoting the unification of the academic environment in the form of launching the activities of the Alliance of Ukrainian Universities for inter-institutional and interdisciplinary cooperation for the restoration and modernization of Ukraine.

This approach allows universities to use their unique resources and competencies to solve jointly large-scale problems that would be impossible to achieve within one institution. At the same time, each university retains its individuality and the ability to compete in other aspects of academic activity. Alliance activities create synergies, where cooperation enhances the overall effectiveness and efficiency of all participants, and healthy competition stimulates innovation and improved quality of education and scientific processes.

The signed Memorandum (2023) emphasizes the importance of horizontal ties and cooperation between universities, demonstrating the potential of such interaction for the restoration and modernization in Ukraine. In accordance with the principles of cooperation and openness, human centrism, quality, effective management, responsibility, fair contribution, ethics, ensuring the development of academic knowledge, social responsibility, Ukrainian territorial and intellectual sovereignty, universities undertake to promote inter-institutional and interdisciplinary cooperation, which is the basis for the development of innovative educational and scientific initiatives that will contribute to the revival of the country.

Thus, the cooperation of Ukrainian universities in the Alliance testifies to the ability of academic communities to adapt to difficult conditions and respond to modern challenges effectively. The described cooperative practice is an example of how educational institutions can not only survive, but also develop in global changes, using the resources and knowledge to create new opportunities. The Alliance demonstrates that joint efforts in an academic environment can be a powerful tool for achieving national and social goals, while ensuring that each participant is able to maintain their individuality and competitiveness.

The Alliance of Ukrainian Universities demonstrates several cooperative patterns in its activities. The partnership pattern creates mutually beneficial conditions for cooperation between businesses, scientific institutions, and educational organizations. The Alliance of Ukrainian Universities supports initiatives aimed at developing new technologies and promotes internships for young specialists. This approach is characteristic of an equal partnership, where each entity contributes and receives corresponding benefits. The collaboration pattern involves joint work on innovative activities and technologies, an essential part of the Alliance's activities. Creating research laboratories and holding joint conferences and seminars indicates close cooperation between the Alliance members. The co-innovation pattern encompasses integrating business, education, and science into developing new products and technologies, which ensures a constant exchange of ideas and knowledge at all stages of the innovation cycle - from idea to commercialization. In this interaction pattern, all Alliance members are involved in creating innovations. The pattern of competition is not dominant in the activities of the Alliance but may manifest itself at the level of choosing partners or defining strategies for attracting resources. However, it is instead an auxiliary element that contributes to improving processes within the partnership. Thus, the main cooperative patterns of interaction used by the Alliance are partnership, collaboration, and co-innovation, which ensure effective interaction between business, education, and science and contribute to the achievement of innovative and strategic goals. Thus, the cooperation of Ukrainian universities within the Alliance demonstrates the ability of academic communities to adapt to complex conditions and effectively respond to modern challenges. The described cooperative practice is an example of how educational institutions can survive and develop in the face of global changes, using the integration of resources and knowledge to create new opportunities. The Alliance demonstrates that joint efforts in the academic environment can become a powerful tool for achieving national and societal goals while ensuring that each participant has the opportunity to maintain their individuality and competitiveness.

5. Discussion

Cooperation in the knowledge triangle is an essential catalyst for innovation and sustainable development of society. This approach promotes active interaction between businesses, educational institutions, and research centers, which leads to numerous benefits. Joint research and knowledge exchange stimulates the rapid implementation of new technologies (Chesbrough, 2003), improving the competitiveness of the industry and the economy. The efficient use of resources, such as financial, human, and technological, becomes possible thanks to joint projects (Lundvall, 1992), simplifying the solution of complex tasks and increasing production processes' efficiency. In addition, cooperation contributes to improving education quality since educational institutions can adapt their programs to modern market requirements, providing students with relevant knowledge and skills. (Leydesdorff et al., 1998) This approach contributes to society's intellectual development and solves global problems by combining efforts to achieve common goals and create an innovative environment.

For successful cooperation management, it is important to use various mechanisms that promote effective interaction between competitors who are cooperating simultaneously. This set of measures includes creating conditions for sharing resources, reducing risks, and ensuring the stability of cooperation relations. An important aspect is also the formalization of the rights and obligations of each party, which contributes to transparency and trust in relations. The mechanisms for managing cooperation include:

- contracts and agreements, which are the main instruments for regulating cooperation relations, which allow formalizing the rights and obligations of each subject, which helps reduce risks and provides legal protection. (McGrath et al., 2019) Contracts may include provisions on information exchange, protection of intellectual property, distribution of profits and risks, and mechanisms for resolving conflicts.

- the use of modern information systems allows for the effective management of cooperative relations and ensures transparency and efficiency in the exchange of information. Such systems contribute to better coordination and interaction between the subjects of the knowledge triangle. (Sahut et al., 2022) Information systems can include platforms for collaboration, databases, project management systems, and communication tools.

- network structures can provide flexibility and adaptability in the interaction between the subjects of cooperative relations. Such structures allow for dynamic and flexible connections between different organizations and institutions, contributing to more efficient use of resources and knowledge. (DeBresson et al., 1991) Network structures can include formal and informal networks of cooperation and various forms of partnerships and alliances.

Also, managing cooperative relations between the subjects of the knowledge triangle requires a clear definition of roles and responsibilities for all participants, which includes several essential components that contribute to successful interaction and achievement of common goals. Elements of such a process include:

- identification of an interaction leader is an essential element of effective management. The leader ensures coordination of actions, conflict resolution and monitoring of the implementation of joint projects (Sheehan et al., 2020), and can also act as a mediator between entities, facilitating the establishment of effective communication and cooperation.

- the distribution of resources between entities should be clearly defined and balanced and include financial and human resources, allowing for the maximum effect of cooperation and competition. (Amata et al., 2021) It is also essential to consider each entity's potential and contribution to joint projects.

- measurement and evaluation of cooperation results, which allows for determining the effectiveness of interaction, identifying problems, and developing recommendations for their resolution. (Bengtsson et al., 2000) Evaluation metrics can include financial indicators, the number of innovations, partner satisfaction, and the impact on society and the economy.

6. Conclusions

In conditions of global challenges that pose unprecedented challenges to the Ukrainian higher education system, cooperation between universities is essential for ensuring sustainability and innovative development. Analysis of the Alliance of Ukrainian Universities case shows that joint efforts and partnerships, even between traditional competitors, can create new opportunities for improving the quality of education, preserving national identity, and strengthening social ties.

The creation of the Alliance, which unites leading Ukrainian universities, is not only a reaction to current challenges, in particular military actions and social upheavals but also an indication of the maturity and ability of the domestic academic community to think and act strategically. Cooperation within the Alliance facilitates the exchange of knowledge, resources and best practices, which ultimately increases the competitiveness of Ukrainian universities in the international arena and provides training for specialists who can work effectively in the face of constant changes.

The study also showed that different patterns of cooperation, such as partnership, competition, collaboration and co-innovation, can coexist and interact within a single initiative, as happens within the Alliance. Such results indicate universities' ability to cooperate in research and educational projects while maintaining a competitive component. In addition, the analysis emphasizes the importance of effectively

managing the interaction between the subjects of co-opetition, which includes balancing interests, ensuring transparency, trust, equitable distribution of resources and compliance with ethical standards.

Thus, the study's results emphasize the importance of cooperation as a strategy for modern universities. They show that universities that integrate cooperative approaches into their activities can succeed significantly in global change. The success of the Alliance of Ukrainian Universities can inspire further research and practical initiatives aimed at developing cooperation in the educational environment.

Conflicts of Interest: Authors declare no conflict of interest.

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КООПЕТИЦІЙНІ ПАТЕРНИ ВЗАЄМОДІЇ МІЖ СУБ'ЄКТАМИ ТРИКУТНИКА ЗНАТЬ

Тетяна Майборода, к.е.н., доцент, кафедра управління, Сумський державний університет, м. Суми, Україна

Василь Карпуша, к.фіз-мат.н., доцент, Сумський державний університет, м. Суми, Україна

Інна Балагуровська, аспірантка, кафедра управління, Сумський державний університет, м. Суми, Україна;
Сілезька політехніка, м. Гливиці, Польща

В статті розглянуто коопетиційні патерни взаємодії між суб'єктами трикутника знань - бізнесом, освітою і наукою - як інструменту підвищення інноваційного потенціалу та стійкого розвитку суспільства. У роботі акцентовано увагу на тому, що в умовах глобалізації, стрімких технологічних змін, соціально-економічних викликів та наслідків війни коопетиція набуває важливого значення для забезпечення конкурентоспроможності і розвитку суспільства. Автори досліджують переваги стратегії, що поєднує конкуренцію та співпрацю, для ефективного використання ресурсів, розвитку інноваційних підходів, створення нових освітніх та дослідницьких підходів. У роботі представлено детальну типологію коопетиційних патернів, до яких належать партнерство, конкуренція, колаборація та коінновація. Описано механізми, які дозволяють забезпечити баланс між співпрацею та конкуренцією, що є основою для підвищення ефективності взаємодії між суб'єктами трикутника знань. Наголошено, що кожен із патернів взаємодії сприяє досягненню синергії через об'єднання знань, технологій та ресурсів, водночас зберігаючи індивідуальну конкурентоспроможність кожного учасника процесу. В дослідженні особливу увагу приділено аналізу кейсу Альянсу українських університетів, який став прикладом ефективної коопетиційної практики. Підписання Меморандуму про співпрацю провідними українськими університетами різних форм власності відкрило нові можливості для розвитку освіти, науки та інновацій навіть у складних умовах війни та соціальних потрясінь. Альянс демонструє, як інтеграція горизонтальних зв'язків між академічними спільнотами сприяє розвитку інноваційних стратегій, збереженню національної ідентичності, посиленню соціальної згуртованості та вирішенню актуальних суспільних викликів. Стаття також висвітлює сторони управління коопетиційними відносинами, що передбачає балансування інтересів учасників, ефективне управління знаннями, визначення спільних цілей та забезпечення прозорості у відносинах. Зокрема, автори рекомендують використання сучасних інформаційних систем для координації співпраці, укладення договорів і формування мережових структур для оптимізації взаємодії. У статті підкреслено, що коопетиція у трикутнику знань є не лише

інструментом розвитку інноваційної економіки, але й механізмом соціального прогресу. Результати дослідження демонструють, як спільні ініціативи між університетами, бізнесом і науковими установами можуть створювати унікальну синергію для подолання глобальних викликів. Аналіз кейсу Альянсу українських університетів виявив ефективність інтеграції конкурентних та кооперативних стратегій для зміцнення позицій вищої освіти України на міжнародній арені, збереження людського капіталу та сприяння відновленню країни. Таким чином, результати роботи підтверджують, що коопетиція є важливою стратегією для університетів, які прагнуть зберегти індивідуальність, одночасно працюючи на благо суспільства. Досвід Альянсу українських університетів свідчить про можливість реалізації інноваційних підходів до співпраці навіть у кризових умовах, що є перспективним напрямом для подальших досліджень і практичних ініціатив.

Ключові слова: коопетиція, менеджмент, трикутник знань, альянс