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Technological, Scientific and Social Drivers of Open Innovations in the Context of Military and Socio-economic Crisis: Ukraine’s Experience

Abstract. The aim of the article is to identify the peculiarities of the impact of technological, scientific, and social factors on the process of developing open innovations (OI) in the context of an intense socio-economic crisis and war in the case of Ukraine. The article defines the essence of open innovation and its difference from traditional innovation, stages of development and challenges of open innovation in the context of crisis, drivers of OI development, and their impact on solving OI challenges. The key drivers that help organisation overcome challenges of market uncertainty are technological, scientific, and social. Digitalization as a technological driver ensures constant feedback, and flexibility, and creates global access to important resources. Collaboration and interaction of the organisation with the scientific community (universities and educational institutions) provide access to quality knowledge and ensure the alignment of practice and theory, and organizations gain access to qualified personnel. Non-governmental organisations (NGOs) as social driver contributes to the accumulation of the experience of the members of NGOs, provides various

research projects, and disseminate the results among its members and other stakeholders, creating valuable knowledge that is needed for the sustainable operation of organisation.

Keywords: innovation, open innovations, the process of developing innovations and its challenges, digitalization, NGO, university

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1. Introduction

Open Innovation (OI) is a concept that has gained significant traction in recent decades, with increased organizations recognizing the value of utilizing external sources of knowledge and resources to drive innovation. The development of OI is driven by a number of factors. The most significant ones are technological, scientific, and social. Technological factors that drive the development of open innovations include the rapid digitalization of all spheres of life. The scientific factors include the evolution and transformation of the role of universities, and the social drivers include the development of professional organizations, including non-governmental organisations (NGOs).

The rise of technology is driving the global digitalization of all spheres and industries, creating new opportunities and challenges, as well as the emergence of new systems of interaction and business models. In addition, uncertainty is growing, the market environment is changing dynamically. Only in the past decade humanity has dealt with the COVID-19 pandemic, economic crisis, and ongoing war on the European continent. Companies should transform in line with uncertainty in a market environment, be in line with fast-changing competition, and meet the market needs.

If earlier it was possible to increase competitiveness by changing efficiency and changing the company's business practices in line with benchmarks, in the current digitalized environment strong competitiveness can be achieved through the development of ecosystems and implementation of innovations. There is a necessity to update approaches to the development process of innovations.

Customers, stakeholders, institutions, and other market actors are waiting for organisations to be more open and transparent, quicker, more creative, and lead the change. The rapid spread of the Internet and, the rise of e-commerce and online platforms has drastically changed the way companies approach the way of doing business. Retail ecommerce market in 2021 reached 4.9 trillion U.S. dollars and is expected to grow to 7.4 trillion dollars by 2025 (Statista, 2023). With the ability to reach a global audience and track customer behavior through data analytics, e-commerce has opened new opportunities for businesses to interact with customers through innovative informational tools. Exponential progress was

made in the development of technologies such as artificial intelligence (AI), block-chain, cloud computing, advanced analytics based on big data, 5G and mobile, Internet of Things (IoT). These are technologies that ensure new value creation and place ecosystems at the center of innovation development.

Today's world is developing based on the information and knowledge economy, which are components of the innovative development model. Society faces challenges that need to be addressed in new ways and there is an urgent need to use the achievements of science and technology to transform the global economy. A key role is playing the integration of universities in the ecosystem of development OI to stay in line with the dynamic market environment, to develop new advanced technologies, to support relevant knowledge base and balance between practice and theory, and to create new jobs related to the use of advanced intelligence.

One of the roles of universities nowadays is to be an entrepreneurial center with the ability to sustain ease of knowledge transfer and commercialization capabilities. It creates space for OI to be developed (Sharifi et al., 2014). Knowledge transfer as the main activity can be represented through collaborative research, contact research, consultancy to commercialization activities that are associated with academic entrepreneurship and patenting (Perkmann et al., 2013). It may also mean including students in practical problems of industries. The broader engagement activities can be a valuable source where the knowledge transfers to the private sector fast and easily, ensuring continuous development of competitive advantages, and from the other side may be one of the income streams for academic institutions. Interaction between universities and industrial practice opens new opportunities for OI to be developed and increases the significance of these institutions as a part of organisations' ecosystems.

The development of civil society and democracy is characterized by the emergence and development of non-governmental institutions. NGOs play a critical role in promoting open innovations in civil society by fostering collaboration and encouraging creative problem-solving. They provide a platform for communities and associations from people with different backgrounds to come together, identify challenges, and work towards finding solutions. Through their advocacy efforts, expertise, and community-building initiatives, NGOs help to create an environment that supports innovation and fosters the development of new ideas. They also provide valuable resources and support for individuals and organizations working on socially impactful projects that lead to qualitative change on different levels: from policy making to improvement of individual life. The establishment of NGOs and their evolution is a sign of the maturity of civil society and its openness to dialogue and constructive feedback which are critical for the development of open innovations.

Transformation is taking place on the way to changing the existing economic regime of Ukraine and strengthening the role of a democratic society, in particular, the introduction of digitalization in the interaction between citizens and the state, the development and formation of NGOs, and the role of universities is transforming to support and stimulate innovative development. This process has been accelerated by the socio-economic crisis and war.

It remains unexplored how to effectively use the main drivers of development (technological, scientific, and social) of open innovations in the current crisis conditions in Ukraine and ensure sustainable development in the post-crisis period.

The article aims to identify the peculiarities of the impact of technological, scientific, and social factors on the process of developing open innovations in the context of an intense socio-economic crisis and war.

To achieve this goal, the article will address the following tasks: defining the essence of open innovation and its difference from traditional innovation, stages of development and challenges of open innovation in crisis contexts, drivers of OI development and their impact on solving OI challenges.

2. Literature Review

The concept of innovations has been widely spread in scientific research. However, the scientific community and practitioners have ongoing discussions about a common definition of “innovation.” In the era of 4th Industrial Revolution “innovation” is defined as a process, an outcome, and a mindset (Kahn, 2018, 453–460). The study about innovations, their typology, and development process was led by M. Bogers and J. West (2012), H. Chesbrough (2003a), C. Höllmüller (2008), and others. Among Ukrainian scientists who led studies in this area are S. Ilyashenko (2010), K. Kostianchuk and O. Zozuliov (2020), O. Pryhara (2020), A. Starostina and V. Kravchenko (2020), et al.

Marketing innovations as one of the types of innovations that occur in the evolution process of industries. With the development of advanced technologies and easy access to the Internet, the role of marketing innovations increases. Marketing innovation can be one of the product or process (Chen, 2006, p. 101–123). Digitalization and online shopping create a wide range of opportunities, as well as risks. Decision strategies of consumers are developed to reduce the risk and help them to act with relative confidence in the environment of large amounts of information and make the consequences of their actions more meaningful (Bauer, 1960). Organisations should be aware of customers’ behavioral charac-

teristics including an understanding of risks and seek solutions that create ways of reducing them.

Marketing innovations are one of the instruments that help to reduce perceived risks of customers and add dynamic competitive advantage for the business. Based on firms' need to combine their internal and external developments there are two types of innovations: closed and open (Chesbrough 2003a; 2003b; 2004). Closed Innovations (CI) refer to the traditional method of creating innovations. They are created by the organization's own departments and Research and Development (R&D) center. Thus, the organization fully controls the entire process of creating innovations. At the same time, the disadvantages of creating closed innovations are the excessive cost of development, lack of flexibility, and the launch process can be lengthy. The main difference between OI and CI is in using external resources within the creation process (Figure 1).

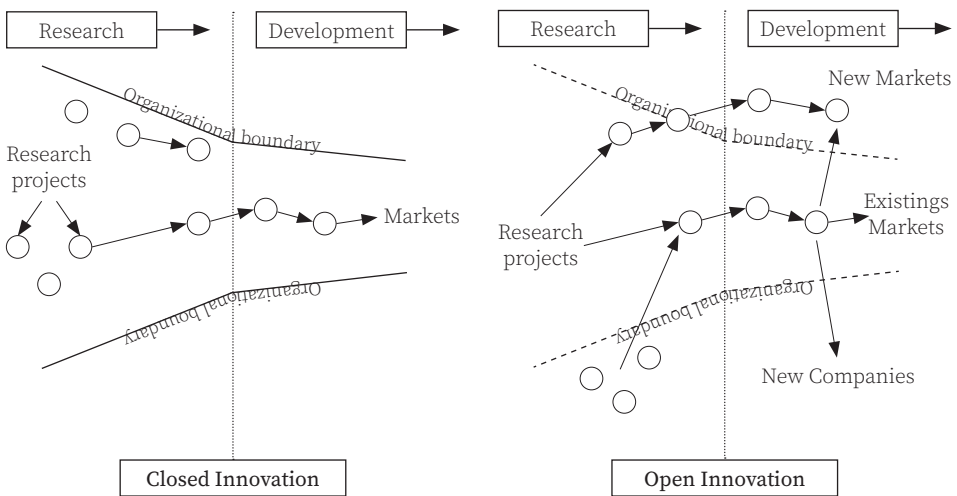


Figure 1. Difference between closed innovation and open innovation

Source: Höllmüller (2008), authors

Distributed innovation is dispersed beyond organizations boundaries (Bogers and West, 2012; 2014). The concept of OI was first introduced by Chesbrough in 2003. Chesbrough defined OI as “the paradigm that assumes that firms can and should use external ideas as well as internal ideas.” The central idea of OI is to open access to the process of creating innovations to other businesses, individuals, research centers, universities, consumers, and other stakeholders to ensure the free flow of ideas inside and outside the organization (Chesbrough, 2004). Open innovation is also defined as “a modification to the vertical integration paradigm.”

The Oxford Review Encyclopaedia of Terms defines two types of open innovation:

- ▶ *inbound innovation* – search and acquisition of experience outside the organization.
- ▶ *outbound innovation* – commercialization and capture of ideas developed within the organization in the external environment (The Oxford Review, 2021).

The process of developing innovation consists of five main stages: defining the problem and ideation, research and development, prototyping, testing and validation, commercialization, and scaling.

The first stage of developing open innovation is to define the problem or opportunity. This involves identifying the specific area where the company needs to innovate, such as a new product or service, a new production process, or a new business model. The company must also identify the specific goals and objectives that it hopes to achieve through the innovation process. The second stage is to conduct research and develop prototypes. This includes identifying potential partners, such as universities, research institutions, start-ups, and other companies, that have the expertise and resources to contribute to the innovation process. The third stage is prototyping. This involves building prototypes and testing them. The company must also establish a process for evaluating the acceptance of prototypes in the market. The fourth stage is to evaluate the prototype and determine its viability. At the last stage of commercialization and scaling organisation brings innovation to the market and scales it.

However, during a social economic crisis or war, these stages face various challenges that can hinder the success of the innovation. In the context of a crisis, access to funding and resources for idea generation may be limited, leading to a reduction in the number of new ideas being generated. Another challenge that organisation faces is a shortage of skilled workers, raw materials, financial funding, and other resources. It becomes more difficult to develop and test prototypes. An uncertain environment can lead to a lack of access to technology and equipment, making it difficult to build and test prototypes effectively. There may also be a lack of access to data, customers, and other resources, making it difficult to obtain accurate results. Challenges that occur at the last stage are a decrease in consumer demand, leading to reduced sales and slower growth.

3. Technological, Scientific, and Social Drivers of Open Innovations

3.1. Technological Drivers of OI: Digitalization

One of the factors that influence change in the process of OI development is the exponential growth of technologies and the formation of a digital economy. The focus is on the amount of data that is produced with digitalization, and the rising need for its protection, analysis, and full transparency.

AI, advanced analytics, hybrid cloud, 5G and mobile, IoT, and blockchain are technologies that ensure further development of open innovation and the creation of ecosystems. AI enables machines to approximate capabilities of the humans; advanced analytics enables huge data of analytics to be processed in real-time and with deep insights. Hybrid cloud supports integrated, efficient, modular infrastructure and unifies public and private cloud services. IoT creates opportunities for new business models. Blockchain works as a trusted digital ledger that supports transactions and other exchanges among partners. 5G and mobile enables high-speed data transfer.

With the help of rising technological advancement, organisations create ecosystems of interaction within their marketing environment. One of the real case studies of emerging OI as ecosystems is State Bank of India. India's largest bank built its customer-centric platform called YONO which means "You only need one". It connects to one hundred businesses. It addresses lifestyle and personal needs including banking (Lele, 2022). The number of SBI users has grown to more than 50 million users by mid-2022 and became an essential part of "go-to-market" of other businesses (e.g., Amazon India) (ibm.com, 2022).

Tech giants such as Apple also take care of being with their customers whenever and wherever they need them. It can be effortless to pay with a phone or AppleWatch with ApplePay or monitor health with a health tracker on mobile devices. Apple makes innovations that are inevitable for its ecosystem of products and services (Loboyko, 2021).

One of the successful case studies in Ukraine with OI model is neobank Monobank (Barabash, 2022). It had more than 5 million customers in 2022. It gives their customers a whole ecosystem of services: from cashback while buying various categories to contactless pay in popular restaurants in Kyiv. During the period of war, they created the most convenient and easy-in-use instrument called "banka", which helps thousands of volunteers to receive donations from Ukrainians in a few clicks (Shkil, 2022).

Introduction of innovations to the insurance market in Ukraine such as Internet insurance is one of the ways of reducing the effect of market risk factors that are associated with the low consumer paying capacity, high tariffs for insurance services, fraud cases, distrust of the population, etc. (Starostina et al., 2020, pp. 44–55). The role of Internet insurance by Ukrainian companies increased because of the war. In the early days of the war, there was a shortage of paper forms. The electronic policy does not require printing of the Green Card, so drivers could apply for it via smartphone and receive it in PDF format by email. This alternative relieved the burden on insurance companies during the rush and helped Ukrainians get insurance remotely. In mid-March, *hotline.finance* launched the online Green Card issue. The entire process — from filling out an application to receiving insurance — takes 5 minutes. As of May 2022, every 5th Green Card policy has been issued through the *hotline.finance* service (*forbes.ua*, 2022). The introduction of innovation led to a decrease in processing time, reduced costs and tariffs, and made it available in other countries.

During the active phase of COVID-19 in Ukraine, a study about behavior and perceived risks connected with online shopping was conducted. The study is part of research that creates a broader view of markets of ready food, Internet education, shoes and clothes, and cosmetic products. The survey about Internet education and online learning services was conducted in May-June 2020 and 650 responses were received from students, while 69,1% of them were suitable for further processing.

The research of online learning services is one of the examples of OI that appeared with the rapid digitalization of processes in society. Internet education provides a variety of courses that are easily accessible (IT courses, courses in studying languages, etc). These educational materials widely spread knowledge and skills and are forming future researchers, scientists, entrepreneurs, and others, making OI the leading paradigm in the educational sphere.

Research results show that 90% of respondents consider online learning to be a protective measure for their health during the COVID-19 pandemic. The three most important risks for consumers in online learning services are inappropriate quality, psychological dissatisfaction with the purchase, and loss of money (Table 1).

Perceived risk of inappropriate quality correlates with the high standards that consumers expect from online education. This indicates a desire to become highly qualified specialists. The risk of psychological dissatisfaction with the purchase is fear of obtaining knowledge that does not meet the requirements that will be imposed on consumers of online courses in a professional environment in the near future. Although the quality of the courses may be high, students are afraid that they are receiving outdated knowledge (Henderson and Lyons, 2013, 1–12).

Table 1. Ranking of risks for consumers of online learning services (on a 5-point scale)

Types of risks	Mean value	Ranking
1. Inappropriate quality	4,06	1
2. Psychological dissatisfaction with the purchase	3,66	2
3. Loss of money	3,65	3
4. Personal data loss	3,47	4
5. Inappropriate warranty service	3,46	5
6. Violation of the terms of service provision	3,23	6
7. Health disorders	3,03	7

Source: Calculated by authors

Understanding perceived risks help organisation to use appropriate risk management methods and implement innovative solutions. For example, to reduce the risk of loss of money and risk of inappropriate quality – Taras Shevchenko National University of Kyiv implemented transparent communication within available and convenient channels for students (website, social media, emails). Information includes all the information about study programs, requirements, and feedback from graduates.

3.2. Scientific Drivers of OI: Universities

OI appears in the response to challenges in macromarketing environment and constant feedback between organisation and its micromarketing environment (suppliers, customers, stakeholders, institutions, and others). Interaction between actors creates a strong ecosystem. One of the important actors that drives open marketing innovations in Ukraine is universities. Universities provide a strong theoretical and systematic knowledge base about marketing. Mostly, researchers in Ukraine have a stronger background and comprehensive view of marketing, and market research than real businessmen. It happens because practitioners tend to simplify the interpretation of the process of marketing research from the perspective of the so-called digital marketing, which undermines a single, reliable information basis for making business decisions (Starostina and Domina, 2022, p. 7–19). Interaction in the micromarketing ecosystem within universities and businesses can significantly increase the quality of the managerial decision-making process and stimulate innovative activity.

One of the responses to the risk of inappropriate quality and risk of psychological dissatisfaction as perceived risks of consuming online learning services was the creation of Diia.Business KNU based at Economic Faculty of Taras Shevchenko National University of Kyiv (business.diia.gov.ua, 2020). Diia.Busi-

ness KNU is a center that connects students, and future entrepreneurs with active businesses of different sizes and governmental initiatives from the Ministry of Digital Transformation providing educational activities from different levels of specialists (from junior managers to CEOs). It helps students to understand that university is in line with current business practices and ensures the quality of education (balance of theory and practice) for a successful career path in the future. So, joint efforts of universities, businesses, and NGOs are critical to developing effective open innovation.

3.3. Social Drivers of OI: NGO

Another significant actor in micromarketing environment is non-governmental organisations. Appearance of NGOs indicates a qualitative transition to the stage of maturity of marketing science in Ukraine (Starostina and Domina, 2022, pp. 7–19) (OMU, 2023). One of the examples is the Ukrainian Union of Marketing Experts which was founded in 2019. The role of the NGO is to accumulate the experience of the members, conduct various research projects based on it, and disseminate the results among its members and other stakeholders.

The current research project conducted by the Ukrainian Union of Marketing Experts in partnership with Taras Shevchenko National University of Kyiv shows that the most important spheres for NGO activity are providing research for the purpose of recovery of economic potential in Ukraine, development of partnerships with the business community, establish partnerships with foreign professional organisations in marketing sphere (Table 2).

Table 2. Rating of the importance of the activities of the NGO Ukrainian Union of Marketing Experts in 2022 (on a 7-point scale)

Main activities	Grouped median	Ranking
Carrying out research for the purpose of restoring economic potential of Ukraine	6,69	1
Development of partnerships with business community in Ukraine	6,57	2
Establishment and development of partnerships with foreign professional organisations in marketing sphere	6,40	3
Supporting of the members of the NGO in their professional activities	6,23	4
Development of partnerships with governmental authorities	6,19	5
Organization of conferences, round tables and publication of articles	5,95	6

Source: Calculated by authors

The survey was conducted in April-May 2022 among higher education institution employees in the context of ongoing war. The mentioned activities were placed as priorities in the strategic plan of the NGO. Results of the survey were sent to the Ministry of Education and Science and the Union of Rectors of Ukraine to be incorporated into the development of state policies in the economy, education, and science.

3.4. Ecosystem of Organisation in the Process of Development of

The creation of an ecosystem between an organization and its micro-marketing environment has become increasingly important. Technological advancement

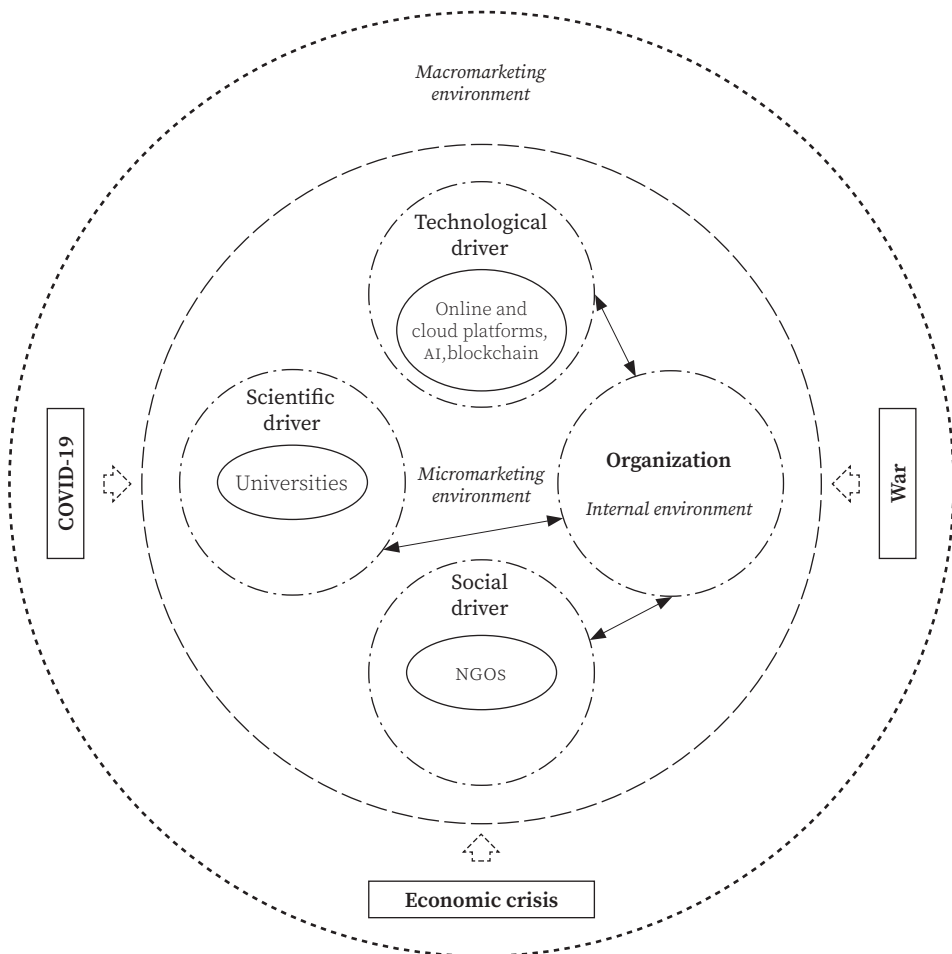


Figure 2. An ecosystem of organisation within micromarketing environment

Source: Developed by authors

has transformed the way organizations interact with their customers and stakeholders, making it crucial for them to effectively manage and utilize technology in order to succeed (e.g. generate valuable data and transform it into insights). The interaction with scientific communities such as universities and interaction with NGOs can provide organizations with valuable insights, resources and expertise that can help enhance innovational efforts and overall operations. Building strong partnerships with these organizations can also help organizations stay ahead of industry trends, maintain their competitive edge, and contribute to the development of sustainable solutions in the uncertain market environment. The ecosystem of an organization within the framework of its interaction with the micromarketing environment can be represented as follows in Figure 2.

Creating an ecosystem within micromarketing environment with the help of technology helps an organisation constantly receive feedback from all within it and collect it as a dataset. The collected dataset is transformed into valuable knowledge about the market and creates opportunities to develop OI. All of the involved are receiving access to information and knowledge in different proportions, except competitors where organisation receives feedback and does not share it back. It is possible to receive feedback from competition because of the data gathered with open sources, for example, social media. Also, everyone who is involved in organisations ecosystem gets a reward. Rewards can be financial and non-financial. For example, reducing order processing time for customers because of the feedback they had given, or increasing the quality of the university study program.

In the ecosystem of constant feedback from all, open innovation develops faster, and this helps the company to gain a dynamic competitive advantage and act fast in an unpredictable macromarketing environment. An organisation receives a lot of unstructured real-time data that lately is proceeded to into valuable insights about the innovation that is needed in the market. Information flows in real-time which also helps to clearly communicate all goals and objectives within an ecosystem to all stakeholders.

3.5. Solving the Challenges of OI in the Conditions of Crisis in Ukraine

The process of innovation development during a social economic crisis or war can be greatly hindered by a shortage of resources, limited access to technology and skilled workers, and reduced demand for products and services. These challenges can be addressed with the help of key drivers of OI among which are technological, scientific, and social. With the help of digitalization as part of the technological driver, it enables organisations to have wide access to resources and

expertise, to connect and collaborate globally. It facilitates access to technology through cloud-based platforms and open-source software, reducing the need for expensive infrastructure. And digitalization enhances knowledge sharing through online platforms and communities, leading to more efficient and effective innovation processes.

Scientific and social factors that are represented by universities, educational institutions, and NGOs, provide access to research and development capabilities, and facilitate partnerships between universities, NGOs, and businesses, creating a supportive ecosystem for innovation. Also, it offers opportunities for skills development and capacity building, enabling communities with different backgrounds to participate more in the innovation process and ensure its effectiveness.

In times of economic crisis and war, it is important to provide and encourage stakeholders of the innovation process to focus on solving real-world problems and meeting local needs, leading to more sustainable and relevant innovations.

To fully realize the potential of open innovation in the context of socio-economic crisis and war, it is important to create an enabling environment that supports collaboration and knowledge sharing. This includes the creation of dedicated platforms, funding mechanisms, and policies that encourage and support innovation.

4. Conclusions and Discussion

In conclusion, open innovation is a powerful concept that allows organizations to access a wider pool of knowledge and resources, which can lead to more diverse and innovative solutions. By effectively utilizing OI, organizations can gain a competitive advantage in today's fast-paced, highly competitive business environment.

The process of developing open innovation includes defining the problem and ideation, research and development, prototyping, testing and validation, commercialization, and scaling. By adopting open innovation, companies can access a wider pool of ideas and resources, faster innovation and product development, increased collaboration and knowledge sharing, greater flexibility and adaptability, and improved innovation performance and competitiveness. However, in the context of socio-economic crisis and war, organisations are facing challenges. Among the main of them are access to funding and resources for idea generation may be limited, leading to a reduction in the number of new ideas being generated. Another challenge that organisation faces is a shortage of skilled workers,

raw materials, financial funding, and other resources, a lack of access to technology and equipment, and a lack of access to data, customers, and other resources, making it difficult to obtain accurate results. Challenges that appear at the stage of commercialization are a decrease in consumer demand that leads to slower growth and a decrease in sales.

Technological, scientific, and social drivers are some of the main ones that help to overcome challenges in the process of development OI in the uncertainty of the market environment. As was shown, the digitalization of processes helps ensure constant feedback, ensures flexibility, and creates global access to important resources. Collaboration and interaction with the scientific community (universities and educational institutions) provide access to quality knowledge and ensure the alignment of practice and theory, and organisations gain access to qualified personnel. NGOs as an essential part of civil society contribute to the accumulation of the experience of the members of NGOs, conduct various research projects based on it, disseminate the results among its members and other stakeholders, and create valuable knowledge that is needed for sustainable operation of organisation.

In the context of an uncertain market environment organisations develop an ecosystem within their micromarketing environment. That helps them to overcome challenges, innovate effectively based on gathered data, and have constant feedback from the market in real-time. An organisation has a wide picture of uncovered needs that creates a dynamic competitive advantage.

Based on the ecosystem approach for the development of OI suggested next steps for further research are: evaluation of factors that influences interaction efficiency within micromarketing environment and organisation, defining the role of universities, NGOs, governmental institutions, and their influence on the efficiency of development of OI within organisation.

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Technologiczne, naukowe i społeczne czynniki napędowe otwartych innowacji w kontekście kryzysu militarnego i społeczno-gospodarczego: doświadczenia Ukrainy

Streszczenie. Celem artykułu jest identyfikacja specyfiki wpływu czynników technologicznych, naukowych i społecznych na proces rozwoju otwartych innowacji w kontekście głębokiego kryzysu społeczno-gospodarczego i wojny na przykładzie Ukrainy. Artykuł definiuje istotę otwartych innowacji i ich odmiennosć od tradycyjnych innowacji, etapy rozwoju i wyzwania otwartych innowacji w sytuacji kryzysu, motory rozwoju OI i ich wpływ na rozwiązywanie wyzwań OI. Kluczowe czynniki, które pomagają organizacjom w pokonywaniu wyzwań związanych z niepewnością rynku, mają charakter technologiczny, naukowy i społeczny. Digitalizacja jako technologiczna siła napędowa zapewnia stałe sprzężenie zwrotne, elastyczność, tworzy globalny dostęp do ważnych zasobów. Współpraca i interakcja organizacji ze środowiskiem naukowym (uniwersytetami i instytucjami edukacyjnymi) zapewnia dostęp do wysokiej jakości wiedzy oraz dostosowanie praktyki i teorii, a organizacje zyskują dostęp do wykwalifikowanego personelu. Organizacje pozarządowe (NGO) jako czynnik społeczny przyczyniają się do gromadzenia doświadczeń członków organizacji pozarządowych, realizują różne projekty badawcze i rozpowszechniają ich wyniki wśród swoich członków i innych interesariuszy, tworząc cenną wiedzę, która jest potrzebna do zrównoważonego działania organizacji.

Słowa kluczowe: innowacje, otwarte innowacje, proces tworzenia innowacji i jego wyzwania, digitalizacja, NGO, uczelnia