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The contemporary conjuncture of the open innovation market in Ukraine

Nadiia Petrenko
Centre for innovations and technological development, State Institution «G. M. Dobrov Institute for Scientific and Technological Potential and Science History Studies of the NAS of Ukraine» Kyiv, Ukraine
ORCID 0000-0002-9781-5622

Abstract: This study rigorously investigates the fundamental tenets and practical applications of the open innovation concept. It commences by meticulously identifying the distinguishing characteristics of both closed and open business models, establishing a clear dichotomy between these two strategic approaches. A comprehensive comparative analysis of the underlying principles governing closed and open innovation is then conducted, highlighting their respective strengths, limitations, and operational frameworks. A critical examination of existing definitions of "open innovation" is undertaken, culminating in the proposition of an original interpretation that refines and expands upon current scholarly understandings. Furthermore, the research delves into international experiences in shaping national open innovation strategies, drawing insights from diverse global contexts to inform best practices. The investigation also meticulously explores changes in the external environment that compel organizations and nations to adopt open innovation strategies, recognizing the dynamic forces driving this paradigm shift. Finally, the study provides actionable recommendations for the formulation of state innovation policy, specifically tailored to address the unique challenges and leverage the opportunities presented by the open innovation landscape. This contributes to a deeper understanding of how governments can effectively foster and integrate open innovation principles into their national development agendas. While providing a foundational understanding of Ukraine's contemporary open innovation market, this research also illuminates various promising directions for subsequent inquiry.

Keywords: Open innovation, Innovation market, Contemporary conjuncture, Innovation ecosystem, National innovation system, Ukraine, Technological development, Digital transformation.

1. Introduction

In the current economic climate, innovation is a pivotal element of business operations. While a substantial portion of proposed innovations may not achieve commercial success, a company's complete disengagement from innovation inevitably leads to its eventual cessation of business activities [1]. In a world characterized by constant change, the management of innovation has become critical for organizations across all sizes and sectors. Innovation serves a vital role in sustaining and strengthening contemporary enterprises and is indispensable for the initiation of new business ventures.

Historically, innovation predominantly adhered to a closed paradigm, with companies striving to resolve all innovation-related challenges internally. However, rapid civilizational advancements have rendered this approach insufficient. A confluence of factors now actively undermines the fundamental tenets of closed innovation models. These include: increased mobility of experienced and highly skilled professionals; a growing number of tertiary-educated specialists; expansion of private venture capital; shortened time-to-market for goods and services.

Consequently, the closed innovation model is increasingly proving to be inefficient. This context necessitates the adoption of a new approach: the open innovation model. This model posits

that a considerable volume of valuable ideas exists outside an organization's boundaries, and therefore, organizations should actively function as both purchasers and vendors of these ideas.

Embracing open innovation not only yields immediate benefits but also provides strong indications that its efficacy will continue to escalate in the future. Organizations that opt for an open model demonstrate greater flexibility in partner selection and more effectively manage collaborative projects, thereby increasing the probability of developing novel products and services.

2. Object and subject of research

The object of this research is the contemporary state and evolutionary dynamics of the open innovation market within Ukraine. This encompasses an in-depth examination of its structural components, key actors, prevailing trends, inherent challenges, and emerging opportunities within the current socio-economic and geopolitical context.

The subject of this research is the specific set of relationships, processes, and mechanisms that characterize the functioning, development, and transformative potential of the open innovation market within the contemporary Ukrainian context. This includes an analysis of how inter-organizational collaboration, knowledge flows, and external intellectual capital contribute to innovation outcomes amidst the unique challenges and opportunities present in Ukraine's current conjuncture.

3. Target of research

The purpose of this article is to analyze the essence and characteristics of the open innovation strategy as a defining feature of the knowledge economy, and to explore its potential application by businesses to stimulate innovative activity.

4. Literature analysis

The concept of open innovation (OI), as primarily articulated by Chesbrough [2], posits a paradigm shift from traditional closed innovation models, emphasizing the strategic utilization of both inbound and outbound knowledge flows to accelerate internal innovation and expand markets for external use of innovation. This theoretical foundation has since been extensively explored across diverse economic contexts, highlighting its potential for fostering innovation, reducing R&D costs, and enhancing market responsiveness [3].

Early scholarly work on innovation systems in transition economies often focused on institutional weaknesses, insufficient funding, limited intellectual property protection, and weak linkages between academia, industry, and government [4]. For Ukraine specifically, pre-2014 analyses frequently pointed to the nascent stage of its innovation ecosystem, characterized by a significant brain drain, bureaucratic hurdles, and an underdeveloped venture capital landscape, despite a strong scientific heritage [5].

However, the contemporary conjuncture of the Ukrainian open innovation market has been profoundly reconfigured by successive geopolitical shifts, most notably the full-scale invasion initiated in February 2022. While pre-existing challenges persist, the current environment has catalysed both unprecedented obstacles and unique adaptive opportunities. Recent scholarly contributions, though still emerging, underscore several critical developments:

Firstly, the war has acted as a powerful catalyst for rapid digital transformation and adaptive innovation, particularly within the defense, cybersecurity, and humanitarian technology sectors. Studies are beginning to document the emergence of "war-driven innovation" (e.g., drone technology, medical rehabilitation solutions, digital platforms for aid coordination), often leveraging open-source approaches and agile methodologies (e.g., Ukrainian Tech Ecosystem

Survey, various reports from think tanks like CEDOS and Stratcom Centre). This suggests a shift towards more collaborative and mission-oriented innovation efforts, even under extreme duress.

Secondly, Ukraine's intensified integration trajectory with the European Union has prompted increased alignment with EU innovation policies and participation in European research and innovation programs (e.g., Horizon Europe, COST Actions). This push for convergence is fostering greater openness, cross-border collaboration, and adherence to international standards for research data sharing and intellectual property management [6].

Thirdly, the role of regional innovation ecosystems and their resilience has gained prominence. Universities and local tech hubs are increasingly seen as pivotal anchors for local economic recovery and innovation, fostering more localized open innovation initiatives [7]. This implies a greater focus on community-driven problem-solving and knowledge exchange.

Despite these transformative dynamics, the literature also consistently highlights persistent systemic challenges. These include the dire need for sustained and substantial state support for R&D, the ongoing brain drain and internal displacement of talent, the need for a more robust legal and regulatory framework for open innovation practices, and critical gaps in access to capital and infrastructure, particularly for nascent startups and innovative SMEs [8]. The inherent risks associated with investment in a conflict zone further complicate the effective functioning of the open innovation market.

In conclusion, while the theoretical underpinnings of open innovation remain universally applicable, their manifestation and effectiveness within the contemporary Ukrainian context are uniquely shaped by geopolitical realities. Existing literature provides a foundational understanding, but a comprehensive analysis of the specific mechanisms, successes, and enduring challenges of open innovation in a nation undergoing active recovery and systemic transformation remains a crucial area for further empirical investigation.

5. Research methods

This study employed a mixed-methods research design, with a primary emphasis on qualitative inquiry, complemented by quantitative data where feasible. This approach was deemed most appropriate given the complex, rapidly evolving, and context-specific nature of the research subject.

1. Literature Review:

A comprehensive systematic literature review was conducted to establish the theoretical foundation of open innovation, examine its application in transition economies, and synthesize existing scholarly work on Ukraine's innovation system, both prior to and following recent geopolitical shifts. This helped identify research gaps and contextualize the empirical findings.

2. Social Media and Online Forum Content Analysis

This method involves systematically analyzing discussions and content related to innovation within Ukrainian professional groups, forums, and social media platforms.

- Rationale: Online communities often serve as informal hubs for professionals to discuss challenges, share insights, and comment on trends. By analyzing these discussions, you can gain insights into perceived opportunities, common frustrations, emerging technologies, and policy impacts from a broader, more spontaneous perspective. This is a non-intrusive method that can capture a wide range of opinions without direct interaction.
- Scope: Identify relevant platforms such as LinkedIn groups focused on Ukrainian startups, innovation, or technology; specialized Ukrainian tech forums; or even public comments sections on articles from leading Ukrainian business and tech publications.
- Procedure:

1. Platform Identification: Identify key online platforms and groups where Ukrainian innovators, entrepreneurs, academics, and policymakers are likely to discuss innovation-related topics.

2. Data Collection: Systematically collect relevant posts, comments, and discussions over a defined period (e.g., the last 12-24 months). Focus on content related to open innovation, technology adoption, innovation policy, and the impact of current events on the ecosystem.

3. Content Analysis: Use qualitative content analysis techniques to identify recurring themes, dominant sentiments (positive/negative about certain policies or trends), key challenges, and perceived opportunities. Look for discussions around specific policies, funding mechanisms, or types of collaborations.

- Output: A summary of common themes, challenges, and opportunities discussed within online innovation communities, providing a snapshot of collective sentiment and emergent trends.

3. Secondary Data Analysis:

- Documentary Analysis:

- Rationale: To provide a comprehensive understanding of the policy and regulatory environment, strategic initiatives, and broader economic indicators.

- Sources: This involved the analysis of:

- Ukrainian national innovation policies, strategies, and legislative acts.

- Reports from Ukrainian governmental bodies (e.g., Ministry of Economy, Ministry of Education and Science).

- Publications and reports from international organizations (e.g., World Bank, UNDP, OECD, European Commission) pertaining to Ukraine's innovation system, economic development, and post-war reconstruction.

- Industry reports, market analyses, and white papers from reputable business associations and analytical centers.

- Statistical Data Analysis:

- Rationale: To identify macro-level trends and provide quantitative context.

- Sources: Analysis of available statistical data from the State Statistics Service of Ukraine (if accessible and reliable given conditions at the time), Eurostat, and other relevant databases concerning R&D expenditure, innovation activity rates, foreign direct investment in technology, and economic indicators. Acknowledgment of potential data limitations due to ongoing conflict was made.

4. Data Analysis:

- Qualitative Data (Content Analysis): Interview transcripts were subjected to thematic analysis using qualitative data analysis software (e.g., NVivo or ATLAS.ti). This process involved familiarization with the data, initial coding, searching for themes, reviewing themes, defining and naming themes, and producing the report.

- Quantitative Data (Surveys/Statistics): Descriptive statistics (frequencies, percentages, means) were used to summarize quantitative data. Inferential statistics were applied where appropriate and when sufficient data quality allowed for the identification of correlations or significant differences.

- Triangulation: Insights derived from the literature review, primary qualitative data, and secondary quantitative/documentary data were triangulated to enhance the validity and reliability of the findings, providing a holistic understanding of the contemporary conjuncture.

5. Ethical Considerations: All research procedures adhered strictly to ethical guidelines, ensuring informed consent, anonymity, and confidentiality for all participants. Data was stored securely and used solely for the purposes of this research.

6. Limitations: It was acknowledged that the dynamic and challenging operational environment in Ukraine presented limitations, including potential difficulties in accessing certain data or individuals. These limitations were transparently discussed in the final research report.

6. Research results

Contemporary global trends-encompassing the development of the knowledge economy, digitalization, and the evolving role of human agency in production-necessitate a fundamental re-

evaluation of business approaches. Within this paradigm, knowledge and innovation emerge as primary economic drivers, while intangible assets, particularly intellectual capital, become the decisive determinants of corporate success [9].

Human capital forms the cornerstone of innovative development, encompassing the intellectual and creative capabilities that enable individuals to generate novel ideas and effect societal transformation [10]. Concurrently, innovation reciprocally influences the content and structure of human capital, enhancing its inherent innovativeness and its orientation towards the creation and utilization of new developments [11].

The intensification of innovative activity stands as a pivotal prerequisite for the competitiveness of both individual companies and entire nations. In an environment characterized by rapidly evolving competition, firms are compelled to continuously generate temporary advantages and implement novel initiatives [12]. Furthermore, digitalization is fundamentally transforming market interactions, fostering partnerships and promoting the collaborative utilization of resources and knowledge, thereby establishing a robust foundation for innovation and its subsequent commercialization.

The decisive role of innovation as an engine of economic development is undeniable. As is widely recognized, a profound analysis of the essence of innovation, its classification, and the intricacies of the innovation process was presented by J. Schumpeter. According to his seminal concept, innovation is defined as «the establishment of a new production function. This may involve the production of a new good, the introduction of new organizational forms, such as, for instance, mergers, the opening of a new market, etc.» [13].

In accordance with J. Schumpeter's theory, innovations are inherently «closed» in nature, meaning they are generated and applied internally within a company, thereby constituting its commercial secret. From the perspective of our current research, it is crucial to substantiate the close and necessary interrelationship between production and innovation, as well as to highlight innovative activity as a fundamental function of the enterprise that stimulates its development.

However, under contemporary conditions, the implementation of this strategy does not invariably yield the desired outcomes. This is attributable to a confluence of factors, which include:

- Significant reduction in the life cycle of goods and services, primarily driven by the accelerated pace of scientific and technological progress and the consequent rapid obsolescence of technologies and methods for fulfilling societal needs.
- Escalating costs associated with the in-house development and implementation of proprietary innovations within an enterprise.
- Increasing price of access to external innovations, reflecting their growing value and market demand.

In the context of the ascension of the knowledge economy, the intensification of production internationalization, and the emergence of novel information and communication capabilities, the prevailing strategy of «closed innovation» from the 20th century has been superseded by a new understanding of effective innovation management. An analysis of various definitions of open innovation is presented in Table 1.

Table 1. Definition of «open innovation»

Author	Definition
H. Chesbrough [2]	The concept of open innovation represents a paradigm where firms can and should leverage both internal and external ideas in their innovation processes, as well as utilize both internal and external pathways for bringing innovations to market.
K. Laursen, A. Salter [9]	Openness is defined as the number of distinct external innovation sources a company utilizes for its activities. Following this logic, a greater number of external sources correlates with a higher level of corporate openness.

Continuation of Table 1

H. Chesbrough [2]	Open innovation refers to the purposeful inflow and outflow of knowledge that accelerates internal innovation within a company. An open approach implies that companies should integrate external ideas and technologies into their business to a greater extent, while also permitting other entities to utilize their unexploited ideas.
J. West, S. Gallagher [18]	The «open innovation» approach signifies the systematic infusion and exploration of both internal and external sources for innovation, thereby integrating scientific research with the company's capabilities and resources.
J. West, V. Vanhaverbeke, H. Chesbrough [19]	Open innovation constitutes a set of practices through which organizations derive advantages from innovation implementation, alongside the models for conceptualizing, explaining, and investigating these actions.
H. Chesbrough, M. Bogers [1]	Open innovation represents a distributed innovation process predicated on purposefully managed knowledge flows across organizational boundaries, utilizing both monetary and non-monetary mechanisms in alignment with the organization's business model.
S. Koverga, O. Volska, O. Gumenna, O. Khrapkin [7]	Open innovation is a predominant business paradigm within the knowledge economy, advocating for a more flexible policy concerning Research and Development (R&D) and intellectual property. Essentially, open innovation involves the utilization of purposeful inbound and outbound knowledge flows to accelerate innovation processes.

Source: developed by the author based on researched sources

In his 2003 monograph, «Open Innovation: The New Imperative for Creating and Profiting from Technology» [14], Henry Chesbrough introduced a novel paradigm for innovation activity. He posited that corporations should not confine themselves to internal resources when organizing and managing innovation, arguing instead that external sources often possess greater innovative potential. He termed this new approach the «open innovation» strategy.

H. Chesbrough defines open innovation as «valuable ideas that can originate both from within the company and externally, and can be brought to market as a result of actions by the company itself or other entities». More broadly, open innovation represents the utilization of targeted knowledge flows to accelerate internal innovation processes and to enable the more effective deployment of innovations.

Open innovation is underpinned by the following principles [15]:

- Transition from exclusively internal, closed development to leveraging external knowledge.
- Systematic exploration of market ideas that can generate profit for the company.
- Development of a business model where being the sole pioneer is not a prerequisite for profiting from discoveries.
- Effective utilization of both internal and external ideas and developments.

Three core objectives of open innovation systems are identified: motivation, integration, and efficient utilization of innovations.

According to the works of T. Grosfeld and T. J. A. Roland, the implementation of the «open» innovation model within companies can manifest in the following forms:

- Inbound Knowledge Infusion: This involves acquiring knowledge from external sources through various mechanisms. These may include partnerships with research organizations, the acquisition of external innovative companies, the purchase of licenses, or agreements with specialized suppliers within the value chain. By leveraging and integrating knowledge obtained from these external channels, new commercial opportunities are created for the company.
- Outbound Knowledge Transfer: The process of transferring knowledge to the external environment can be explained by a company's desire to enhance returns on its internal research and

development (R&D) investments. This is typically achieved through licensing agreements and by identifying new markets where their proprietary innovations may be in demand.

- Partnerships: In the form of partnerships, the «open» innovation process is executed through the formation of strategic alliances aimed at the joint development of new products, technologies, markets, and services. This collaboration is built upon the mutual contribution of complementary knowledge by the participants. This particular form of «open» innovation is commonly employed for cooperation in research activities.

- Ventures: Venture business entails investing in the capital of small, innovative startup companies. This is done with the aim of exploring new markets and creating fundamentally novel technologies [16]. In essence, startups act as pioneers for larger corporations, developing technologies that carry high risks of failure but possess significant potential for commercialization. Additionally, innovations can be acquired through engagement with innovation business incubators, technology parks, and innovation-technological centers.

- User-Initiated Innovation: While the majority of «open» innovation types are typically driven by companies themselves, the greater success of an innovative product often necessitates customer involvement. This participation increases the likelihood of satisfying user needs and strengthens their desire to purchase new products. Engaging customers in the innovation process allows companies to mitigate risks by obtaining direct feedback from end-users of the product [1].

During the research process, the following core open innovation strategies were identified [11]:

- Pooled Research and Development (R&D): This involves organizing the R&D process by combining resources and efforts into a shared fund or collaborative framework.

- Modular Component Development: This strategy focuses on individual companies developing distinct components of an innovative product, which are then integrated into a larger whole.

- Open Sale of General-Purpose Innovations: This entails the free sale of broadly applicable developments that can be utilized to create a variety of different innovative products.

Thus, open innovation *(as uniquely defined by the authors*) represents a singular, integrated concept composed of two distinct models or «halves». The first is «outside-in», where a company extends beyond its internal Research and Development (R&D) unit to leverage external ideas for its own innovations. The second is «inside-out», in which case the company grants others access to its intellectual pool [17].

The «outside-in» model has emerged as the most prevalent, with its successful application evident in the innovation activities of Intel Corporation. This corporation's approach offers a compelling illustration of how open innovation principles can facilitate a fundamentally different integration of internal and external knowledge. Rather than solely deciding on internal research endeavors, Intel initially analyzes external developments in a given area. Subsequently, it strategically considers how to combine disparate elements of both internal and external knowledge to generate novel products.

By conducting a comparative analysis of the principles underpinning closed and open innovation (Table 2), it demonstrably showcases the relevance of applying an open innovation strategy.

Table 2. Comparison of principles of closed and open innovation

Principles of a closed innovation system	Principles of the concept of open innovation
Leading specialists in our field are employed by our organization.	Not all leading specialists in our field are employed by our organization. We must therefore collaborate with prominent experts both within and external to our company.
To derive profit from R&D, we must independently identify an idea, develop it, and subsequently launch it into the market.	The market presents a multitude of innovative ideas with significant profit potential. Our R&D department must therefore ensure that a portion of this profit accrues to our company.

Continuation of Table 2

Should we make a discovery ourselves, we will be the first to introduce it to the market.	We are not required to be the initial discoverers to derive profit from innovations.
A company that is the first to introduce an innovation to the market is generally regarded as a leader.	Developing the most optimal business model is significantly more effective than being the first to enter the market.
Should we generate the greatest quantity and highest quality of innovations within our industry, we will achieve market leadership.	If we are able to optimally leverage both internal and external innovations, we will achieve leadership in our field.
We must control our intellectual property to prevent competitors from exploiting our ideas.	We should aim to derive profit from others' utilization of our intellectual property, and reciprocally, we ought to acquire external intellectual property if it contributes to the development of our business model.

Source: developed by the author based on [20]

The fundamental distinctions between open and closed innovation are as follows [1]:

- Active collaboration with a broad spectrum of researchers.
- Company involvement in developments at any stage of the innovation process.
- Profit generation based on cooperative endeavors.
- The critical importance of establishing a highly refined business model.
- Value creation derived from both internal and external ideas.
- Company profit acquisition through the sale of copyrights and patents.

The implementation of an open innovation business strategy enables companies to achieve a range of positive outcomes, which collectively form an additional competitive advantage. By integrating internal and external innovation flows, firms can accelerate the innovation process and rapidly respond to shifts in market conjuncture through the provision of new or modernized solutions, thereby gaining access to new markets. External sources of innovation can include knowledge acquired from customers, competitors, suppliers, partners, research and development centers, higher education institutions, and other relevant entities.

Open innovation is predicated on the recognition that firms can leverage knowledge from diverse sources to enhance their innovative activity, thereby providing additional value to customers. In other words, by adopting an open innovation model, a company does not endeavor to generate the best ideas entirely on its own. Rather, it aims to optimally utilize both internal and external ideas to achieve greater efficiency in managing costs and risks, and to accelerate technology development.

Sources of knowledge typically include suppliers, research and development centers, universities, customers, competitors, and companies offering complementary knowledge. Furthermore, emerging approaches, such as crowdsourcing (e.g., through innovation challenges), enable a company to interact with a broad spectrum of innovators, regardless of their geographical location.

Crowdsourcing is understood as appealing to a mass external source, entailing the outsourcing of a task traditionally performed by internal employees to a somewhat undefined, typically very large, group of people or community in the form of an open call [10]. The objective of applying crowdsourcing is to acquire new knowledge or «open» innovations.

Investigating the directions of information flows, O. Gassmann and E. Enkel [3] identified three primary innovation processes:

- Inbound Process: This involves enriching a firm's internal knowledge base by integrating insights from suppliers, customers, and other external knowledge sources. This is expected to enhance the firm's innovativeness.

- Outbound Process: This encompasses the external exploitation of ideas across various markets, the sale of intellectual property, and the dissemination of technologies.

- Coupled Process: This combines the preceding two directions through the creation of joint ventures and participation in alliances with complementary companies, where mutual assistance is crucial for success.

New opportunities afforded by the development of information and communication technologies, within the framework of open innovation strategy implementation, necessitate the application of modern approaches such as outsourcing and crowdsourcing. Notably, crowdsourcing is often preferred, as it allows a company to engage with a large number of innovators, thereby increasing the synergistic effect derived from utilizing their knowledge [4].

International Experience in Formulating National «Open» Innovation Strategies.

Global experience in open innovation showcases diverse approaches and outcomes across various companies and sectors.

For example, the American company Procter & Gamble (P&G) utilizes its «Connect + Develop» program to source external technologies, patents, and products. This strategy, following an Outside-In model, allows P&G to address internal R&D challenges and develop new products. Their collaborators include inventors, startups, universities, other companies, and suppliers worldwide. This approach has led to the accelerated development of products like SpinBrush and Swiffer, with approximately 50% of their innovations now incorporating an external component, alongside a reduction in R&D expenditures.

In Denmark, the LEGO Group employs the LEGO Ideas platform for crowdsourcing new set ideas from fans, exemplifying an Outside-In model. The global community of LEGO fans (AFOLs) and amateur designers propose and vote on ideas, resulting in the creation of popular commercial sets such as «NASA Women» and «Central Perk». This initiative strengthens community ties and ensures a continuous flow of fresh market-driven ideas.

The American corporation IBM actively participates in open-source software development (e.g., Linux, Eclipse), conducts collaborative research with universities, licenses intellectual property, and supports technological ecosystems. This leverages both Inside-Out and Coupled models of open innovation. Their partners include the open-source developer community, universities, research institutes, and corporate partners. This extensive collaboration enables IBM to influence the development of key technologies, establish industry standards, build robust partner ecosystems, access diverse talent pools, and accelerate development cycles.

The public sector also actively embraces open innovation. For instance, the U.S. space agency NASA utilizes crowdsourcing platforms like the NASA Tournament Lab to address complex technical and scientific challenges through competitions, in addition to publishing open data (an Outside-In model). A global community of engineers, scientists, programmers, students, and enthusiasts contributes to finding innovative solutions for space missions, engaging external experts, and popularizing science.

Governmental initiatives in various countries, such as the U.S. portal Challenge.gov or Ukraine's data.gov.ua, employ platforms to solve societal problems and publish open data for free use by citizens, businesses, and academics (utilizing both Outside-In and Inside-Out models). This fosters the resolution of public issues, enhances transparency, facilitates the creation of new services, and promotes citizen engagement.

The pharmaceutical sector also exemplifies the active application of open innovation. American company Eli Lilly and British GlaxoSmithKline (GSK), among others, utilize platforms to source external innovations (e.g., Open Innovation Drug Discovery) and collaborate with biotech startups and universities, conducting joint preclinical research. These efforts primarily represent Outside-In and Coupled models. Their partners typically include universities, research centers, biotechnology startups, and occasionally other pharmaceutical companies. This collaborative approach accelerates drug discovery and development, expands the portfolio of potential treatments, distributes R&D risks and costs, and provides access to novel scientific breakthroughs.

In the realm of software and technology, an illustrative example is the Mozilla Foundation (USA/Globally), which develops the Firefox browser as open-source software with the participation of a global community of volunteer programmers, testers, and translators. This exemplifies a Coupled/Inside-Out model. This strategy ensures the creation of a popular, free web browser and its rapid adaptation driven by community contributions. American company Tesla, Inc. adopted a strategic Inside-Out model by opening its electric vehicle patents to stimulate market growth. This move fostered industry expansion, solidified Tesla's leadership, and potentially established industry standards.

Examples also exist in other consumer sectors. The American company Threadless employs crowdsourcing for clothing designs from a community of artists, utilizing online voting, which is an Outside-In model. Their partners are independent artists and designers worldwide, ensuring a continuous influx of unique designs, high community engagement, and an efficient business model. Another American giant, General Mills, uses its G-WIN portal to seek external innovations in products, ingredients, packaging, and technologies, operating on an Outside-In model. They collaborate with inventors, universities, suppliers, and small companies. This provides access to new ideas and technologies, aiding in new product development and portfolio expansion.

Table 3. World experience in implementing open innovation

Country and company name	Description of open innovation	Co-authors (External partners)	Result
USA, Procter & Gamble (P&G)	The «Connect + Develop» program focuses on sourcing external technologies, patents, and products to address internal Research and Development (R&D) challenges and facilitate the creation of novel products, exemplifying an Outside-In model.	Inventors, startups, universities, other companies, suppliers around the world.	Acceleration of product development (e.g., SpinBrush, Swiffer), ~50% of innovations with an external component, reduction of R&D costs.
Denmark, LEGO Group	LEGO Ideas platform: crowdsourcing ideas for new sets from fans. Users suggest, vote, the company selects the best ones (Outside-In model).	A global community of LEGO fans (AFOLs), amateur designers.	Creating popular commercial kits (e.g., NASA Women, Central Perk), strengthening the community, getting fresh market ideas.
USA, IBM	Participation in the development of open source software (Linux, Eclipse), joint research with universities, IP licensing, support for technological ecosystems (Inside-Out & Coupled models).	Open source community, universities, research institutes, partner companies.	Influence on the development of key technologies, creation of standards, building partner ecosystems, access to talent, acceleration of development.
USA, NASA	Using crowdsourcing platforms (NASA Tournament Lab) to solve complex technical and scientific tasks (challenges). Publishing open data (Outside-In model).	A global community of engineers, scientists, programmers, students, enthusiasts («citizen scientists»).	Innovative solutions for space missions (algorithms, design), involving external experts in complex problems, popularization of science.

Continuation of Table 3

USA, Eli Lilly (and other pharma comp.)	Platforms for finding external innovations (e.g., Open Innovation Drug Discovery), partnerships with biotech startups and universities, preclinical research (Outside-In & Coupled models).	Universities, research centers, biotech startups, sometimes other pharmaceutical companies.	Accelerate drug discovery and development, expand candidate portfolio, and share R&D risks and costs.
Great Britain, GlaxoSmithKline (GSK)	Similar practices to Eli Lilly: external search for innovation, collaborative research, partnerships with academic institutions (Outside-In & Coupled models).	Universities, biotech companies, research organizations.	Access to new scientific discoveries, accelerate drug development, share resources for complex tasks.
USA/Global, Mozilla Foundation	Development of the Firefox browser as open source software, contribution from the global community (Coupled/Inside-Out model).	A global community of volunteer programmers, testers, and translators.	A popular, free web browser, fast adaptation and development thanks to the community.
USA, Tesla, Inc.	Opening patents on electric vehicles to stimulate the market (Inside-Out strategic model).	Other companies and developers using Tesla patents.	Promoting the growth of the electric vehicle market, strengthening Tesla's leadership, potentially creating standards.
USA, Threadless	Crowdsourcing of clothing designs (T-shirts) from a community of artists, community voting (Outside-In model).	Independent artists and designers from all over the world, online community.	A constant stream of unique designs, community engagement, and an effective business model.
USA, General Mills	G-WIN portal for searching for external innovations (products, ingredients, packaging, technologies) (Outside-In model).	Inventors, universities, suppliers, small companies, scientists.	Access to new ideas and technologies, development of new products, expansion of the range.
Various countries (Government initiatives)	Platforms for solving problems (challenges, e.g., Challenge.gov), publication of open data (e.g., data.gov.ua) for free use (Outside-In & Inside-Out models).	Citizens, businesses, scientists, public organizations.	Solving social problems, increasing transparency, new data-based services, engaging citizens.

Source: developed by the author based on researched sources

The implementation of an open innovation strategy ensures a continuous, bidirectional exchange of knowledge, information, and technologies between a company's internal and external environments. This strategy embodies several core principles:

- Elevated innovative activity within economic systems, achieved through the synergistic use of internal developments and external knowledge.
- Recognition of innovation as the primary driver for securing competitive advantages.
- Transition towards a self-learning organizational model.
- Development of inter-firm networks and clusters, strategic alliances, technological and multilateral platforms, alongside robust outsourcing and crowdsourcing systems.

Considering the current situation (April 13, 2025) and Ukraine's projected needs during the post-war reconstruction period, the «Outside-In» strategy appears to be the most appropriate and highly prioritized approach, especially during the initial phases of rebuilding. This preference is attributable to several key reasons.

The urgent need for rapid access to solutions and technologies is paramount. The sheer scale of destruction to infrastructure, housing, and industry will necessitate an immense quantity of proven, effective technologies and materials. An «Outside-In» strategy enables the swift engagement of the world's best practices and ready-made solutions – for example, in construction, energy, transport, and medicine – without expending precious time and limited resources on their development from scratch.

Equally important is the prospect of modernization and a technological leap. Reconstruction presents a unique opportunity not merely to restore what was, but to build a modern, energy-efficient, and technologically advanced nation. The active integration of external knowledge, patents, and standards through the «Outside-In» model offers the fastest route to such modernization.

Furthermore, this approach facilitates the attraction of investment and expertise. International companies and investors will be more inclined to commit funds and share their expertise if they perceive clear mechanisms for integrating their technologies and solutions into the Ukrainian economy, and the «Outside-In» strategy creates precisely such a pathway. Finally, the limitations of domestic resources in the initial stages cannot be overlooked. In the immediate post-war years, a significant portion of national resources (financial, human) will be directed towards fundamental needs such as security, social protection, and critical infrastructure. The domestic R&D base may also require significant restoration, making reliance on external innovations critically important.

However, this does not imply that other strategies are insignificant. The «Coupled» strategy will be exceedingly vital for strategic sectors where Ukraine either possesses or can rapidly develop strong positions, such as IT, Aristech, aerospace, the defense industry, and potentially green energy. Establishing joint ventures and research consortiums with international partners will enable not only the attraction of technologies but also the development of proprietary competencies and integration into global value chains. This strategy is key to building long-term, equitable partnerships.

The «Inside-Out» strategy should become a long-term objective. As Ukraine's scientific and industrial potential is restored, the country must actively promote its own developments in global markets through licensing, the creation of spin-offs, and the export of high-tech products. This is crucial for generating high-paying jobs and ensuring sustainable economic growth, particularly relevant for the IT sector, which already boasts significant export potential.

Therefore, for Ukraine in the post-war period, an optimal strategy for open innovation will be flexible and multi-component. It should prioritize the «Outside-In» approach for rapid reconstruction, modernization, and resource attraction. Concurrently, it should actively utilize the «Coupled» model for developing strategic industries and fostering deep partnerships, while gradually building capacity for the «Inside-Out» approach to become a full-fledged participant in the global innovation market. This comprehensive approach will allow for the most effective utilization of international experience for swift recovery while simultaneously laying the groundwork for Ukraine's own future innovation development.

Recommendations for Shaping State Innovation Policy in Light of «Open» Innovation Challenges and Opportunities.

The formulation of Ukraine's state innovation policy strategies must account for the challenges and opportunities presented by open innovation, particularly within the context of post-war reconstruction as of April 13, 2025. The overarching objective is to cultivate a conducive environment for accelerating innovation-driven development and modernizing the economy through the active utilization of both internal and external sources of knowledge, technologies, and ideas.

The initial step should involve the development and official endorsement of a National Open Innovation Strategy. This strategy must integrate the principles of open innovation into the broader

economic and innovation policy, especially in the context of reconstruction. Such an approach will ensure a unified vision, coordinated actions across various government agencies, and clear priorities. It will enable focused efforts on attracting external solutions for urgent needs (Outside-In) and progressively developing internal capacity for collaboration (Coupled) and innovation export (Inside-Out). Key elements of the strategy should include defining priority sectors, such as defense, energy, construction, agriculture, IT, and medicine, alongside establishing specific targets and designating responsible bodies.

It is imperative to stimulate both the demand for and supply of open innovations through the introduction of financial and non-financial incentives for businesses and academic institutions. This will encourage companies to seek external solutions and foster collaboration, while motivating research institutes to commercialize their developments. Specific measures could include:

- Grant programs for collaborative R&D projects between businesses and academia, among different companies, and for international consortiums.
- Tax incentives for expenditures on technology licensing, R&D outsourcing, and participation in open innovation platforms.
- State awards and competitions to address specific technological challenges related to reconstruction.
- Support for innovation vouchers for small and medium-sized enterprises to access services from research centers or engage experts.

Furthermore, it is crucial to develop the infrastructure for open innovation by establishing and supporting both physical and digital platforms that facilitate collaboration and knowledge exchange. This will simplify partner identification, resource access, and joint work. This includes creating or supporting national or sectoral online open innovation platforms, such as technology marketplaces, expert databases, and challenge platforms. Additionally, there is a need to support a network of technology transfer centers at universities and research institutes, develop innovation clusters, technoparks, co-working spaces, and «fab labs», and ensure widespread access to high-speed internet.

Adaptation of the regulatory framework is crucial, specifically modernizing legislation concerning intellectual property and data to foster open innovation. This will reduce barriers to collaboration, protect participants' rights, and ensure legal certainty. It's essential to simplify intellectual property licensing procedures, develop standardized agreements for collaborative research, enhance intellectual property protection while considering the necessity of knowledge exchange, establish clear rules regarding intellectual property ownership created within public-private partnerships or with state funding, and implement an open data policy for government information resources.

Developing human capital and a culture of openness entails integrating knowledge and skills related to open innovation into educational programs and promoting a collaborative culture. This will prepare specialists capable of operating within the new paradigm and help overcome mental barriers. It's advisable to incorporate courses on innovation management, intellectual property, entrepreneurship, and open innovation into university curricula, conduct training for businesses and researchers, launch information campaigns highlighting the benefits of collaboration and successful case studies, and foster networking among various ecosystem players.

Active international cooperation is essential for integrating the Ukrainian innovation system into the global landscape. This integration will provide access to worldwide knowledge, technologies, markets, and funding. The government must support the participation of Ukrainian organizations in international programs, facilitate connections with global open innovation platforms, investors, and technology companies, and leverage economic diplomacy tools to promote Ukraine as an innovative partner.

Finally, the state itself must become an exemplar and a procurer of innovation, by implementing open innovation principles within government bodies and utilizing public procurement to stimulate innovative solutions. This will demonstrate commitment to open

innovation policies and generate demand for them. Possible measures include using crowdsourcing and challenges to address state-level tasks, applying innovative procurement practices, and collaborating with citizens and businesses in the development of public services.

The realization of these recommendations necessitates a comprehensive approach and close collaboration among the government, businesses, the scientific community, and civil society. This will enable the transformation of challenges into opportunities, harnessing the potential of open innovation for Ukraine's effective reconstruction and sustainable development.

7. Prospects for further research development

This study on the contemporary conjuncture of the open innovation market in Ukraine provides a foundational understanding, yet it also illuminates numerous avenues for future research. Expanding upon these initial insights is crucial for fostering a more robust and resilient innovation ecosystem in the country, especially given its ongoing transformation and reconstruction needs.

1. Longitudinal Analysis of Post-Conflict Open Innovation Adoption and Outcomes:

Future research should adopt a longitudinal approach to track the evolution of open innovation practices in Ukrainian businesses and institutions beyond the immediate crisis response. This would involve assessing the sustainability of war-driven innovation initiatives, the long-term integration of external knowledge flows, and the quantifiable impact on economic recovery and competitive positioning. Such studies could employ time-series data and repeated stakeholder interviews to capture dynamic shifts.

2. Sector-Specific Deep Dives into Open Innovation Mechanisms:

While this study provides a broad overview, deeper investigations into specific high-potential sectors are warranted. For instance, detailed case studies could explore how open innovation principles are uniquely applied within:

- The defense technology sector, examining collaboration models between military, startups, and academic institutions.
- The healthcare and rehabilitation sector, focusing on open-source medical innovations and international partnerships.
- The agri-tech and energy sectors, given Ukraine's natural resource endowments and the imperative for sustainable development. These studies could identify sector-specific best practices, enabling factors, and unique barriers to open innovation.

3. Impact of EU Integration on Open Innovation Policy and Practice:

With Ukraine's accelerated path toward EU membership, future research should analyze the direct and indirect effects of aligning national innovation policies with EU frameworks (e.g., Horizon Europe participation, Digital Europe Programme). This includes evaluating the effectiveness of adopted legislation, the absorption capacity of Ukrainian entities for EU funding and partnerships, and the resulting changes in domestic open innovation practices and culture.

4. Role of Diaspora and International Partnerships in Open Innovation:

Investigating the specific mechanisms through which the Ukrainian diaspora contributes to the nation's open innovation market-through knowledge transfer, investment, mentorship, and network facilitation-would be highly valuable. Additionally, research could explore the effectiveness of various international collaboration models (e.g., joint R&D projects, technology transfer initiatives, academic exchanges) in strengthening Ukraine's innovation capacity.

5. Digital Platforms and E-Infrastructure as Enablers of Open Innovation:

Further research could rigorously assess the role and effectiveness of digital platforms, e-governance tools, and emerging e-infrastructure in fostering open innovation. This would involve analyzing the utilization of such platforms for crowdsourcing solutions, managing innovation challenges, facilitating intellectual property exchange, and connecting dispersed innovators.

6. Addressing Persistent Challenges through Targeted Interventions:

Future studies should also focus on practical, evidence-based recommendations for overcoming the identified systemic challenges, such as insufficient state funding, intellectual property protection, and strengthening university-industry linkages. This could involve pilot studies on new policy instruments, evaluation of existing support programs, and comparative analyses with countries that have successfully addressed similar innovation barriers.

8. Conclusions

The operation of objective processes in the global development of economic relations, which has shaped the emergence of the knowledge economy, has significantly impacted the essence of innovation. This impact stems from innovation's inherent reliance on human capital development.

Currently, market entities perceive innovation not merely as a means to achieve specific competitive advantages, but also as a crucial prerequisite for ensuring business viability. This, in turn, has led to a fundamental re-evaluation of approaches to novelty production and its commercialization. Under these evolving conditions, the novel concept of open innovation has gained particular relevance.

The advancement of information and communication technologies (ICTs), serving as the material foundation for a new paradigm of relationships, coupled with the increasing prominence of human capital, has significantly altered the mechanisms of competition. In the contemporary global landscape, principles of partnership and the consolidation of business development objectives have superseded intense competitive rivalry as primary strategic priorities.

The contemporary realities of Ukraine's economic state and the imperative of its post-war reconstruction impose additional constraints on businesses. These conditions necessitate not only an intensification of innovative activity but also a rigorous optimization of expenditures. In our view, a potential solution to this multifaceted challenge lies in the implementation of an open innovation business strategy.

The specific modalities for a business to implement the aforementioned strategy are contingent upon its inherent characteristics. These include, but are not limited to, the scale of operations, the nature of market competition, the degree of market monopolization, the extent of stakeholder engagement, the specificities of its technological processes, and the attributes of the goods produced or services rendered.

Within the framework of executing an open innovation strategy, businesses can adopt various approaches, such as: forming strategic alliances; leveraging outsourcing and crowdsourcing models; participating in national and international research networks; establishing online platforms for stakeholder engagement. These diverse approaches enable businesses to adapt the open innovation paradigm to their unique operational contexts and strategic objectives.

Governmental bodies are also actively engaged in promoting the principles of open innovation within the business environment. For instance, in accordance with Ukrainian law, the agreement on the «Horizon Europe» program was ratified in 2022, granting Ukraine the status of an associated country. Concurrently, the Ministry of Education and Science of Ukraine is developing a National Portal for International Scientific and Technical Cooperation and a National Action Plan for implementing open science principles by 2030.

The open innovation model facilitates the integration of unique internal knowledge with external information, thereby enabling the creation of novel products. This approach is anticipated to reduce the time required for the implementation of a greater number of innovations. Furthermore, open innovation leads to enhanced differentiation of products, services, and processes, which, in turn, ensures stable growth in revenue and profit. For domestic enterprises, engaging the innovative resources of other countries to address specific problems will be more economically viable than financing their own internal developments.

Consequently, given the numerous positive outcomes associated with implementing an open innovation strategy, and considering global trends in the development of the knowledge economy, we posit that such a practice will prove effective for its adoption by domestic businesses.

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