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BENCHMARKING OF INNOVATION-ORIENTED FINANCIAL POLICIES IN THE CONTEXT OF GLOBAL INSTABILITY

Introduction. *In a period of profound geopolitical transformation, innovative development increasingly determines the resilience and competitiveness of national economies, thereby intensifying the role of financial policy in supporting scientific and technological progress and the commercialization of innovation. In this context, benchmarking serves as an effective instrument for comparative analysis and for adapting advanced international experience in shaping mechanisms of financial stimulation of innovation.*

Problem Statement. *Escalating global turbulence and the methodological incompleteness of tools for assessing the effectiveness of financial policy necessitate systematic benchmarking of international practices in order to conceptualize and identify efficient mechanisms for supporting innovation.*

Purpose. *To conduct benchmarking of innovation-oriented financial policies in advanced economies in order to identify effective policy instruments and substantiate recommendations for their implementation within Ukraine's financial system.*

Materials and Methods. *The study has employed system analysis and a multi-level research framework, as well as empirical methods (observation, comparison) and logical-methodological approaches (formalization, analysis, synthesis, induction, and deduction) to systematize approaches to stimulating innovation under conditions of instability.*

Results. *The genesis of financial mechanisms for stimulating innovation has been examined, and American, European, and Asian models for 2022—2024 have been benchmarked. Based on the systematization of policy instruments and institutional and managerial approaches in advanced economies, recommendations for intensifying Ukraine's innovation-driven development have been substantiated. The study has demonstrated that the effectiveness of financial policy under conditions of instability is*

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determined by the integration of budgetary and tax levers within a comprehensive institutional architecture. A synergistic effect from combining flexible financial instruments with specific governance models has been identified. It accelerates the commercialization of innovation and supports R&D potential in the face of systemic challenges.

Conclusions. *The results of the global benchmarking assessment have formed the framework for practical recommendations on innovation-oriented financial policy in Ukraine, aimed at overcoming financing imbalances and intensifying innovation-driven development.*

Keywords: financial technology (FinTech), innovation-oriented financial policy, benchmarking, innovation financing, global instability.

At the beginning of the 21st century, the system of applied and fundamental R&D integrated with innovative processes and technologies contributed to the emergence of an innovative type of economy, in which innovation is a strategic factor of economic growth. The use of knowledge and high technology, as well as their effective combination, is reflected in new integrated forms of financial provision and regulation, such as innovative financial policies, regulatory sandboxes, venture capital funds, crowdfunding platforms, and central bank digital currencies. These forms differ in terms of the prerequisites for their formation, the content of their activities, functions, purpose, and other features. According to the World Intellectual Property Organization [1] more than 60% of global innovation in the financial sector over the past five years have been related to digitalization and the development of new FinTech products, which was a response to the challenges posed by COVID-19 and other global shocks. Among these forms, innovation-oriented financial policy occupies a special place as the most effective tool for forming an adaptive and sustainable innovation structure of the country. It ensures the organization of the financial and regulatory process, rapid implementation and introduction of R&D — innovation, especially in the context of growing global economic instability, as illustrated by the war in Ukraine and the energy crisis in Europe. In this context, benchmarking is a key analytical tool for comparative assessment and implementation of international best practices, which creates the preconditions for improving the national financial policy focused on innovation.

The study of benchmarking of innovative financial policy in the context of global economic instability has been the subject of research by both Ukrainian and foreign authors. Thus, in the publications of A. Belgibayeva, A. Samoilikova, T. Vasylieva and S. Leonov [2] the influence of monetary instruments and indicators on the dynamics of innovation financing, which is an important component of innovation-oriented financial policy, is analyzed T. Radchuk [3] reviewed the theoretical and methodological foundations of the formation and development of Ukraine's financial policy in the context of the information and innovation economy, laying the groundwork for the adaptation of modern financial approaches. H. Krasnostanova and I. Yatskevych [4] investigated the current trends in reforming the global financial system, including the impact of digitalization and exogenous factors, which directly affects the formation of financial policies focused on innovation in the face of global shocks. L. Milman and T. Kuchmiyova [5] focused on the role of the state's financial policy in the context of the digitalization of the economy, emphasizing its importance for ensuring the stability of the financial sector in times of global turmoil. M. Zhytar [6] focused on the features and prospects of the FinTech market in Ukraine, which is an example of the transformation of financial innovation. For example, according to the World Intellectual Property Organization [1], Ukraine showed some volatility, ranking 55th in 2023 and falling to 60th in 2024, which emphasizes the need to strengthen financial policies to support innovation. Domestic researchers have carefully outlined and systematized the challenges that arise in

the process of forming mechanisms for financial support for innovation and optimizing the interaction of business entities with R&D and educational institutions in the face of global shocks. The researchers identify the systemic problems of the state in developing effective innovative forms of financial cooperation and analyze the determinants that affect their functioning and serve as a prerequisite for effective benchmarking.

Among the works of foreign scholars, it is necessary to note the research of E. Bacchiocchi and C. Dragomirescu-Gaina [7], who considered the mechanisms of interaction between political uncertainty and financial markets, which is directly related to the conditions of global instability. V. Stefanelli, F. Manta and P. Toma [8] analyzed digital financial services and open banking innovation, providing practical cases for benchmarking of financial policy. P. Kruglov and C. Shaw [9] studied the relationship between financial efficiency and innovation on the example of the United States, which serves as a basis for a comparative analysis of best practices. According to [10], in 2022, total R&D expenditures in the United States amounted to about 3.5% of GDP, while in Germany this figure was about 3.1%, illustrating the significant level of investment in innovation and differences in their structure. In their works, M. Fenwick, E. Vermeulen and M. Compagnucci [11] investigated regulatory approaches to the introduction of artificial intelligence in the context of the development of innovation ecosystems, which is key to understanding of current trends in innovation-oriented financial policy. B. Saha, N. Rani and S. Shukla [12] conducted a global study of the opportunities, threats, and regulation of generative artificial intelligence in financial institutions, which outlines future benchmarking of innovation-oriented financial policy. However, despite the undoubted value of R&D, the topic of a comprehensive and systematic study of benchmarking of innovation-oriented financial policy in the context of global crisis challenges remains insufficiently developed, which is why it was chosen.

The concept of benchmarking first appeared in the field of management and production in the mid-20th century, gaining widespread use in the 1970s thanks to Xerox, whose management, faced with fierce competition from Japanese manufacturers, began to analyze their production processes and methods of work. This process of comparative analysis of best practices in order to improve one's own performance is called benchmarking. In particular, Xerox reduced its production costs by more than 10% over three years, which is a classic example of successful benchmarking implementation. The goal was not just to copy, but to systematically study and adapt best practices to achieve leadership positions.

The benchmarking methodology has gradually evolved from a purely production tool to a universal management concept that has found wide application in various industries, including finance and public policy. Since the 1980s, the "benchmarking wave" has spread to virtually all advanced economies and major international organizations, including the Organization for Economic Cooperation and Development (OECD), which still uses benchmarking to assess the effectiveness of policies, processes, and strategies in its member countries. This evolution and adaptation of benchmarking in the public and financial sectors is a key tool for comparing international practices in response to global challenges [13].

The economic literature presents a significant number of definitions of the concept of "benchmarking," especially in the context of its application in the field of innovation-oriented financial policy. In this regard, it is advisable to first define the content of the concept of "benchmarking of innovation-oriented financial policy" and its difference from other types of benchmarking (in particular, functional and competitive). Benchmarking innovation-oriented financial policy, involves the systematic study, comparison, and adaptation of international best practices in the formation, implementation, and evaluation of financial mechanisms to support innovation. In contrast to functional benchmarking, which focuses on comparing individual business processes regardless of industry, and competitive benchmarking, which

is focused on analyzing the practices of direct competitors, innovation-oriented financial policy benchmarking has a macroeconomic focus and serves as a tool for strategic assessment of the effectiveness of public funding for innovation.

M. López and R. Pérez [14], well as A. Kovács and A. Tóth [15], in their works, analyzing the comparison of financial policies of different countries in response to global crises, emphasize that the determining feature of its effectiveness is the ability to generate and support innovation. For example, financial policies that provided rapid government support to the IT sector during the COVID-19 pandemic enabled the creation of new digital services, which subsequently boosted economic growth and increased resilience. This statement is key for benchmarking innovation-oriented financial policies, as it sets the benchmark against which the ability of financial policies to generate and support innovation can be compared. Other researchers emphasize that benchmarking innovation-oriented financial policies is distinguished by a focus on the adaptability of policy decisions to changes in the global environment, as well as their ability to stimulate the digital transformation of the economy to increase its competitiveness. This position is supported by S. Miller and X. Chen [16], researching how the focus of financial policy on innovation can increase national competitiveness in times of global crises, as well as P. Santos and J. Silva [17], analyzing the impact of digital transformations on the financial policies of developing countries. At the same time, some authors, such as A. Benedetti and A. Gallo [4], do not distinguish benchmarking of innovation-oriented financial policy as an independent category, considering it in the context of broader approaches to benchmarking public policy or financial regulation. In their opinion, the key criterion for such benchmarking is to identify best practices that ensure synergy between financial mechanisms and innovation processes in response to the challenges of global instability. These researchers state that the driving force behind the benchmarking of innovation-oriented financial policy is to increase the competitiveness of the national economy and ensure its stability through the implementation of effective innovative solutions.

In order to systematize and deepen the analysis of the concept of "innovation-oriented financial policy," Table 1 presents the key interpretations of this concept that have been covered in the modern scholarly research literature of recent years.

Summarizing the above definitions, we can state that innovation-oriented financial policy should be considered, in our opinion, as a multifaceted and dynamic set of public and private sector measures aimed at efficient financing of innovation activities, ensuring financial security and stability in the context of global economic instability, as well as creating a favorable investment environment for accelerated economic growth.

Taking into account the above definitions of innovation-oriented financial policy and the specifics of its functioning in the context of global instability, its main characteristics include:

- adaptability and flexibility: the ability to respond quickly to changing external conditions, such as economic crises, geopolitical conflicts, and rapid technological transformations, by adjusting financial instruments and mechanisms. For example, during the COVID-19 pandemic, many governments urgently introduced tax breaks and government grants to support high-tech startups [18];
- proactivity: focusing on anticipating future challenges and opportunities, not just current problems, by creating incentives for the development of promising technologies and industries;
- digitalization and technology: active implementation of FinTech, RegTech, SupTech and other digital solutions to improve the efficiency of financial transactions, market transparency and risk management;
- stimulating investment: creating a favorable investment climate and developing mechanisms to attract capital (including risk capital) to high-tech and innovative projects, including public-private partnerships;
- ensuring financial security: taking into account and minimizing systemic risks arising from the

introduction of new financial products and technologies to maintain the stability of the entire financial system;
- sustainability focus: integrating the principles of green finance and socially responsible investment to support innovation that contribute to the achievement of sustainable development goals and the formation of an environmentally friendly economy.

An analysis of the definitions of the concept of "innovation-oriented financial policy" in Table 1 also allows us to identify key criteria for benchmarking innovation-oriented financial policy:
- impact on innovation financing: the ability of policies to stimulate and provide financial resources for innovation;
- promoting digitalization and fintech innovation: supporting the development of digital financial services and advanced financial technologies;
- increasing national competitiveness: the impact of policy on strengthening the country's economic position in the global market through innovation;
- adaptability to global instability: the ability of financial policy to respond quickly and adapt to crises and uncertainty;
- efficiency of regulatory mechanisms: the existence and effectiveness of legal and institutional frameworks that promote innovation without creating excessive barriers.

In the context of the identified benchmarking criteria for innovation-oriented financial policy, it is advisable to further analyze the leading models and tools for implementing financial policy, the main purpose of which is to stimulate innovative development, in the context of modern transformations of the global financial and economic environment.

Foreign practice shows that there are several conceptual approaches to organizing financial support for innovation, reflecting the specifics of national economies, the level of development of financial systems and strategic priorities (Fig. 1).

Thus, the European model of innovation-oriented financial policy implementation represents an integrated systemic approach that synthesizes budgetary and programmatic financing with the in-

Table 1. **Definitions of the Concept of "Innovation-Oriented Financial Policy"**

Author	Identification
Zaika S., Gridin O., Zaika O. [19]	Is a set of measures at the state and corporate levels aimed at ensuring effective financing of innovative projects, creating a favorable environment for investment and stimulating the development of the innovation sector
Liskova L, Podzigun S. [20]	Is a set of instruments and mechanisms that provide financial support for innovation activities, based on the resource potential, goals and level of development of the country
Rudevska V., Riznyk D., Tanase V., Rak R., Yatsenko O. [21]	Is a set of measures aimed at harmonizing investment in innovation and financial stability of business, which ensures both innovation-driven development and financial security
Angelini P. [22]	Is a policy that focuses on bridging the innovation gap and improving the financing of innovation in Europe, in particular through the development of larger capital markets and integration to mobilize large-scale high-risk financing
Morozova L., Mykytyuk I., Gusarevych N. [23]	Is a system of state measures aimed at mobilizing, distributing and efficiently using financial resources to stimulate innovation
Khalina O., Sydorenko Y. [24]	Is an adaptive system for managing financial processes under conditions of uncertainty, based on the introduction of digital technologies, intelligent solutions (AI, blockchain) and a proactive approach to strategic development to increase the sustainability and efficiency of the economy

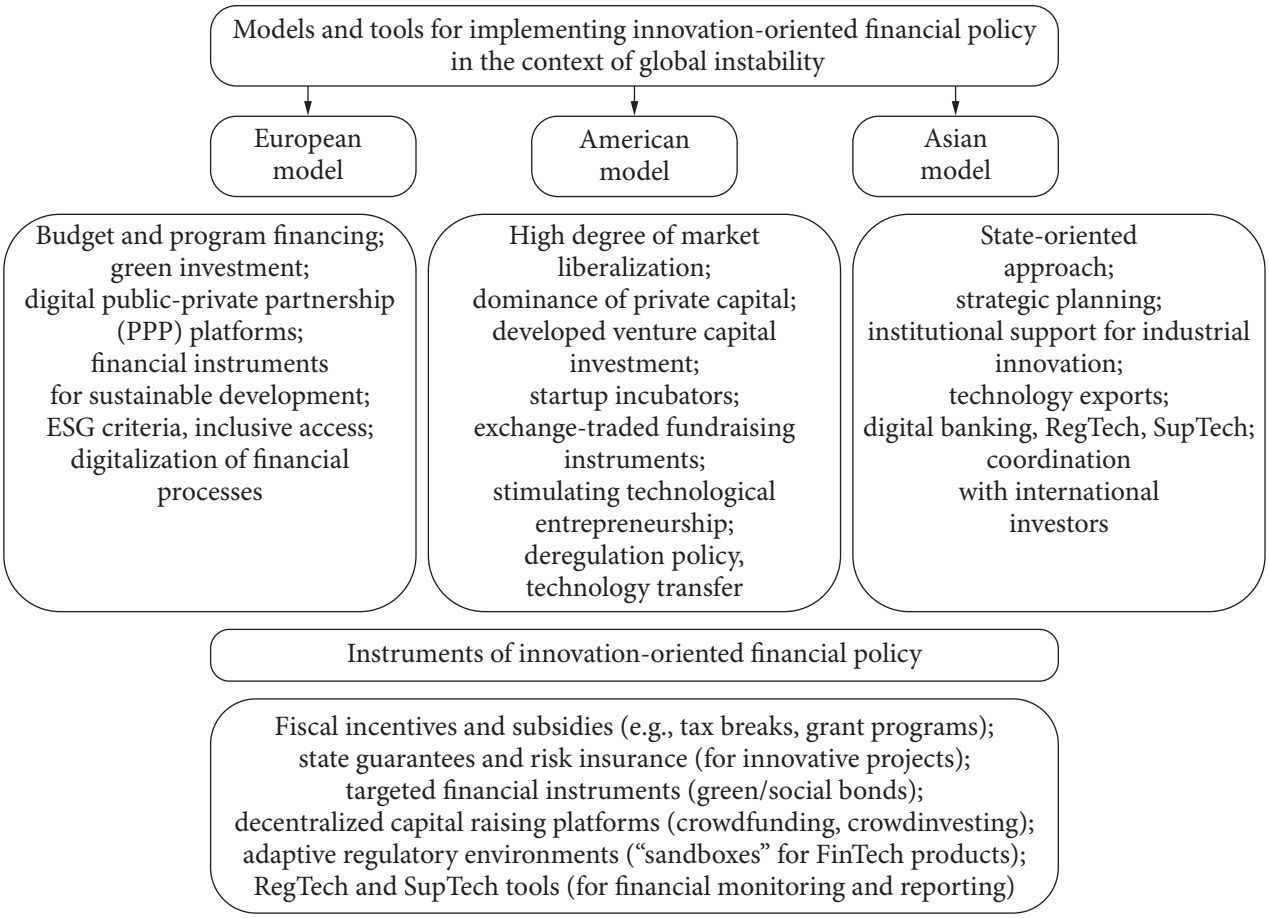

Fig. 1. Conceptual models and tools for implementing an innovation-oriented financial policy in the context of global instability
Source: compiled by authors.

depth implementation of the sustainable development paradigm. It operates green investment mechanisms, develops digital platforms for public-private partnerships, and expands the use of ESG finance instruments, focusing on inclusive access to financial resources and comprehensive digitalization of financial processes. For example, according to the BMBF [25], in Germany, public funding for R&D is more than 1% of GDP, and programs such as the European Green Deal are actively developing to support renewable energy innovations. The American model, by contrast, demonstrates a high degree of market liberalization, with private capital playing a key role in financing innovation. Its dynamism is based on a developed ecosystem of venture capital investment, startup incubators, and deep stock exchange instruments, which determines the focus on stimulating technological entrepreneurship in a deregulated environment. According to estimates [10], the United States is the world leader in terms of venture capital investment, which illustrates the dominance of the private sector in financing innovation.

The Asian model implements a state-oriented approach, in which stimulation of innovation development is the result of strategic planning and institutional support for industrial innovation focused on technology exports. For example, in South

Korea, according to an analysis by Rude Baguette [26], public spending on R&D exceeds 4% of GDP, which is one of the highest in the world and reflects the government's strategic priority to finance technological breakthroughs.

The priority vectors of its development are digital banking, implementation of regulatory (RegTech) and supervisory (SupTech) technologies, as well as active coordination with international investors. According to an analysis [12], in 2024, about 70% of global financial institutions have already tested or implemented technologies based on generative artificial intelligence to optimize processes, which emphasizes the global dynamics of digitalization.

The innovation-oriented financial policy toolkit, formed within the framework of the conceptual models discussed, is an integrated arsenal of strategic levers that can optimize the financing of the innovation ecosystem by:

- state intervention and derisking: includes fiscal incentives (for example, as in the United States, where the R&D tax credit is up to 20% of qualified expenses), subsidy programs, as well as systemic mechanisms of state guarantees and insurance of innovation risks that minimize investment barriers;
- diversified capital mobilization: includes instruments of targeted financing for sustainable development (in particular, green and social bonds, the global market for which exceeded $1 trillion in 2023) and decentralized digital platforms (such as crowdfunding, crowdinvesting) that provide a broader investment base;
- adaptive regulatory and supervisory policy: implemented through "regulatory sandboxes" for controlled testing of FinTech innovations, as well as the implementation of RegTech and SupTech technologies aimed at digitalizing financial monitoring and enhancing systemic resilience. For example, in Europe alone, more than 100 sandboxes have been created over the past three years, which has accelerated the introduction of new financial products [13].

These conceptual models and their tools form the methodological basis for developing the architectonics of the national innovation-oriented financial policy in Ukraine. Given the specifics of transformation processes in the economy, the impact of military operations and global challenges, it is a strategic imperative to adapt and implement successful international practices, taking into account domestic institutional and resource constraints. The results of a comprehensive comparative analysis of the dominant concepts of innovation-oriented financial policy according to the defined criteria are summarized in Table 2. In order to thoroughly understand the evolution and adaptive capacity of the conceptual models under consideration, a retrospective analysis of the dynamics of the development of financial mechanisms for stimulating innovation is of paramount importance. This approach makes it possible to identify the crucial periods of their formation and transformation in the context of global economic changes and challenges. Table 3 systematizes the key aspects of these dynamics for each dominant concept, which clearly reflects the regional differentiation in the evolution of financial mechanisms for stimulating innovation and their formation under the influence of specific historical periods and dominant driving factors in the European, American, and Asian models. Thus, the effectiveness of the approaches used is determined by unique national and supranational characteristics and strategic priorities.

Based on the identified evolutionary trajectories and key determinants, further analysis will focus on the specifics of the creation and functioning of effective financial instruments to support innovation abroad.

This will allow us to verify and systematize specific tools that ensure the optimal functioning of innovation ecosystems in the international context.

Table 4 demonstrates the differentiated approach to the formation and implementation of financial mechanisms to stimulate innovation in the world's leading models.

Thus, the European model is characterized by the systematic use of grants, subsidies, targeted bonds, and public-private partnerships that ope-

rate on the basis of sustainable development, inclusiveness, and risk sharing between sectors. For example, the Horizon Europe program (2021—2027) with a budget of more than €95.5 billion is a prime example of systemic funding for research and innovation [28]. In contrast, the American model is dominated by deeply developed private venture capital, an expanded range of exchange-traded instruments, and angel investments, with mechanisms focused on maximum flexibility, rapid commercialization, and exit strategies while minimizing regulatory barriers. At the same time, venture capital investment in the United States accounted for about 70% of total global investment in 2023 [10].

The Asian model, in particular, implements financial instruments through state funds, targeted programs, and soft loans, emphasizing centralized coordination, support for large-scale industrial projects, and export orientation under state control. In particular, state funds, such as the China Investment Corporation, are actively investing in key technology sectors to achieve strategic leadership [16].

Thus, the choice and effectiveness of financial mechanisms for stimulating innovation directly de-

Table 2. **Comparative Analysis of the Dominant Concepts of Innovation-Oriented Financial Policy by Key Criteria for 2022—2024 [1, 13, 15, 25, 27]**

Benchmarking criterion	European model	American model	Asian model
1. Impact on innovation financing	Combining budget and program financing with green and sustainable investments. Emphasis on inclusiveness	Dominance of private capital (venture capital, exchange-traded instruments). High level of risky financing	State-oriented financing, strategic planning, industrial innovation
2. Promoting digitalization and fintech innovation	Digital PPP platforms, digitalization of financial processes. Active use of digital tools for sustainable development	Dynamic development of FinTech on a market basis. Startup incubators	Active development of digital banking, government support FinTech, RegTech, SupTech
3. Increasing national competitiveness	Through sustainable development, ESG criteria, and socially responsible innovation	Through technological leadership, entrepreneurship, commercialization R&D	Through technology exports, strategic industry industrial leadership
4. Adaptability to global instability	Focus on sustainability, sustainable development, ESG. Flexibility through regulatory adaptations	Fast market response, deregulation, high investment mobility	State strategic planning, rapid implementation of government initiatives
5. Effectiveness of regulatory mechanisms	Harmonization, inclusiveness, attention to ESG regulation, FinTech sandboxes	Deregulation, minimization of barriers, liberalized market, self-regulation	State regulation, active implementation of RegTech / SupTech, coordination
6. Legal and regulatory framework	Harmonized EU regulation (directives), support for PPPs and green finance; emphasis on ESG criteria	Liberalized legislation (securities, antitrust), incentives for M&A and technology transfer; deregulation policy	State-oriented regulation (strategic plans, state programs); emphasis on industrial innovation and digital banking (RegTech, SupTech)
7. State support (key programs / programs) features)	(E.g. Horizon Europe, EIB, EIF, national grant programs)	(E.g. SBIR/STTR programs, DARPA, government grants through universities, tax incentives)	(For example, industrial funds, state investment corporations, strategic state investments in Hi-Tech)

pends on their integration into the unique architecture of the national innovation system. Each model of the three global ones — European, American, and Asian — demonstrates that the success of financial instruments is determined not only by economic conditions, but also by the country's strategic priorities. While the European model is focused on systematic, inclusive and risk-sharing, the American model is focused on flexibility, commercialization and quick exits from investments, and the Asian model is focused on centralized support and export orientation. This suggests that effective benchmarking cannot be reduced to blindly copying instruments, but requires an in-depth analysis of the context and adaptation of the best international practices to national strategic goals and institutional features. The key task is not just to identify successful instruments, but to understand their integration into a coherent financial policy system that allows achieving specific macroeconomic goals, such as increased competitiveness and financial sustainability.

Differences in financial mechanisms of the world's leading models are illustrated in Table 5, which presents a comparative analysis of key instruments and mechanisms of state support for innovation.

Based on the analysis of financial instruments that form the basis of state support for innovation in the world's leading economies, it becomes clear that the effectiveness of these mechanisms directly depends on the organizational, institutional and managerial structure in which they operate. It is this structure that determines how financial resources are allocated, who manages them, how cooperation between different sectors is established, and how accountability is ensured. So, to truly understand the state innovation policy, it is necessary to first reveal its fundamental structural components. To illustrate these differences, Table 6 summarizes the institutional and managerial models of state support for innovation in the world's leading economies for 2022—2024. These models serve as representative global benchmarks for comparison. Based on Table 6, it can be argued that the institutional and managerial models of innovation support in advanced economies differ significantly, based on unique paradigms.

Table 3. **Retrospective Analysis of the Dynamics of Financial Mechanisms for Stimulating Innovation [4, 17, 18, 23]**

Aspect / Model	European model	The American model	Asian model
Evolution of approaches and periods	Until the 1980s: mainly national budget allocations; 1980s — 1990s: launch of pan-European R&D programs (ESPRIT, FP); 2000s: increasing role of the EIB/EIF, focus on PPPs; 2010s — present: strengthening of green and sustainable finance (ESG), digitalization, inclusiveness	Until the 1970s: significant public investment in basic research (military-industrial complex, space programs); 1970s — 1980s: heyday of venture capital after deregulation (e.g, ERISA 1979); 1990s — present: dominance of private capital, expansion of exchange-traded instruments, dynamic development of FinTech	Until the 1980s: rigid state strategic planning and direct investment in key industries; 1980s — 1990s: creation of state investment corporations, focus on technology exports; 2000s — present: development of digital banking, active implementation of RegTech/SupTech, focus on IT and AI
Key drivers	Integration processes, environmental challenges, social responsibility, and the need for balanced development	Market efficiency, technological breakthroughs, deregulation, high risk tolerance, entrepreneurial culture	State leadership, national development priorities, competition in global markets, rapid adaptation of technologies

For example, the European approach emphasizes complex multi-level interaction, transparency, and sustainable development. The American model focuses on decentralization, market mechanisms, and rapid scaling. The Asian model is characterized by high centralization, state control and strategic planning to achieve global competitiveness. Despite these differences, each model has its advantages and disadvantages in the context of global instability.

Diagnosing these aspects is critical for benchmarking and adapting successful practices. To better understand their effectiveness and feasibility, Fig. 2 presents a comparative analysis of the advantages and disadvantages of each innovation-oriented financial policy model. As can be seen

Table 4. **Analysis of the Specifics of Creating and Implementing Effective Financial Mechanisms to Stimulate Innovation in International Practice for 2022—2024 [8, 12, 27, 29]**

Analytical aspect / Model	European model	American model	Asian model
Typical financial instruments	*grants:* multi-level funding through EU programs (in particular, Horizon Europe); *subsidies:* national programs to support research and development (R&D); *targeted bonds*: "green" and "social" bonds issued, in particular, by the European Investment Bank (EIB Green Bonds); *warranty mechanisms*: InnovFin program, guarantees from EIF, EIB; *public-private partnerships* (PPP): financing innovation through InvestEU mechanisms, digital platforms, and co-investment	*venture capital:* leading venture capital funds (Sequoia Capital, Andreessen Horowitz), that finance high-risk startups; *exchange instruments*: initial public offering of shares (IPO), special companies for mergers and acquisitions (SPACs), mainly on the platform NASDAQ; *"Angel" investments*: private investors at the early stages of financing (Band of Angels); *crowdfunding platforms:* raising funds from a wide range of individuals (Kickstarter, GoFundMe); *direct private investment*: through investment funds, family offices, corporate venture capital funds	*state investment funds*: (China Investment Corporation, Korea Investment Corporation), investing in strategically important industries; *investment state corporations:* (Development Bank of Japan, Korea Development Bank) as direct financing instruments; *targeted government programs:* in particular, "Made in China 2025", which provides for subsidies, tax breaks, and soft loans; *preferential lending*: through export and import banks (Exim Bank of China, Japan Bank for International Cooperation)
Key mechanisms of functioning	focus on sustainable development, social inclusiveness, and environmental responsibility; prevalence of mixed financing with risk sharing between the state and the private sector; implementation of ESG-oriented standards in financial products	high market dynamics and efficiency of financing; focus on rapid commercialization, scaling innovation, and achieving profitability; "exit-oriented" model: the expected exit of an investor through an IPO or merger (M&A); minimizing regulatory restrictions for innovative companies	centralized strategic planning of innovation development; active state intervention in financial flows for the purpose of control and strategic coordination; prioritizing large-scale industrial projects and export-oriented technologies; accelerated implementation of digital regulation technologies (RegTech, SupTech)

from Fig. 2, each innovation policy model has its own strengths and weaknesses. The European model (Germany, France, Sweden) demonstrates a systematic approach to innovation policy with a focus on ESG standards and high inclusiveness, while facing challenges of bureaucracy and slow decision-making. The American model (the United States, Canada, and the United Kingdom), with its dynamic market and strong private capital involvement, contains potential risks of financial bubbles and unequal access to finance. The Asian model (China, Japan, South Korea), despite rapid resource mobilization and strong government leadership, may be less adaptable to market changes and may carry risks of monopolization.

In order to fully understand the financial aspects of innovation-oriented financial policies of leading innovative countries and to confirm the differences in their models, it is advisable to analyze the dynamics of gross domestic expenditures on research and development (GDERD) and the share of public funding in these expenditures, as shown in Fig. 3.

Despite the significant amount of gross expenditures on research and development, as shown in Fig. 3, the role of the state in financing innovation remains a key aspect of innovation-oriented financial policy. An analysis of the dynamics of gross domestic expenditures on research and development (GDERD) in the leading innovative countries in 2022—2024 (Fig. 3) shows significant differences in financial priorities and models.

- leaders in innovation financing: the countries with the highest GERD are Israel and South Korea. Israel's figure of more than 5.5% of GDP indicates the deep integration of innovation into the country's economic structure. South Korea's high expenditures (over 4.5%) confirm its strategic focus on technological development [1, 26];

Table 5. **Financial Instruments and Mechanisms of Government Support for Innovation: Experience of Europe, the USA and Asia in 2022—2024 [10, 22, 23, 29, 30]**

Aspect / Model	European model	American model	Asian model
Forms of financial support	*Grant programs*: Horizon Europe (2021—2027: €95.5 billion). *Financing EIB/EIF*: loans, guarantees, investments in funds. *Tax incentives*: for R&D (e.g., tax credits in France). *State risk guarantees:* (InnovFin)	*Programs SBIR/STTR*: (Small Business Innovation Research/ Technology Transfer, $4 billion/ year). *Financing DARPA/NIH:* direct grants for basic research. *Tax credits for R&D*: (e.g., up to 15% in the United States). *Public procurement of innovations*	*Direct public investment*: in strategic industries (e.g., the AI sector in China). *State development funds:* Sovereign Wealth Funds. Soft loans and subsidies: for national champions. *Industrial parks and zones*
Strategic priorities	*Sustainable development*: green technologies, digitalization. *Inclusiveness*: SME support, regional cohesion	*Basic research*: defense, biotechnology, IT. *Commercialization*: stimulating small business	*Strategic industries:* IT, AI, biotechnology, quantum technologies. *Global competitiveness*: export of technologies, formation of "national champions"
Implementation mechanisms	*Integration of policies*: National/EU strategies (PPPs). *Digital infrastructure:* management platforms. *Long-term orientation*: for sustainable development	*Decentralization:* market mechanisms, competition. *Low barriers*: minimal regulation; fast scaling: focus on exit strategies	*Centralized control*: state planning, monitoring. *State funds*: Targeted support for technological sovereignty. *Export model*: formation of global leaders

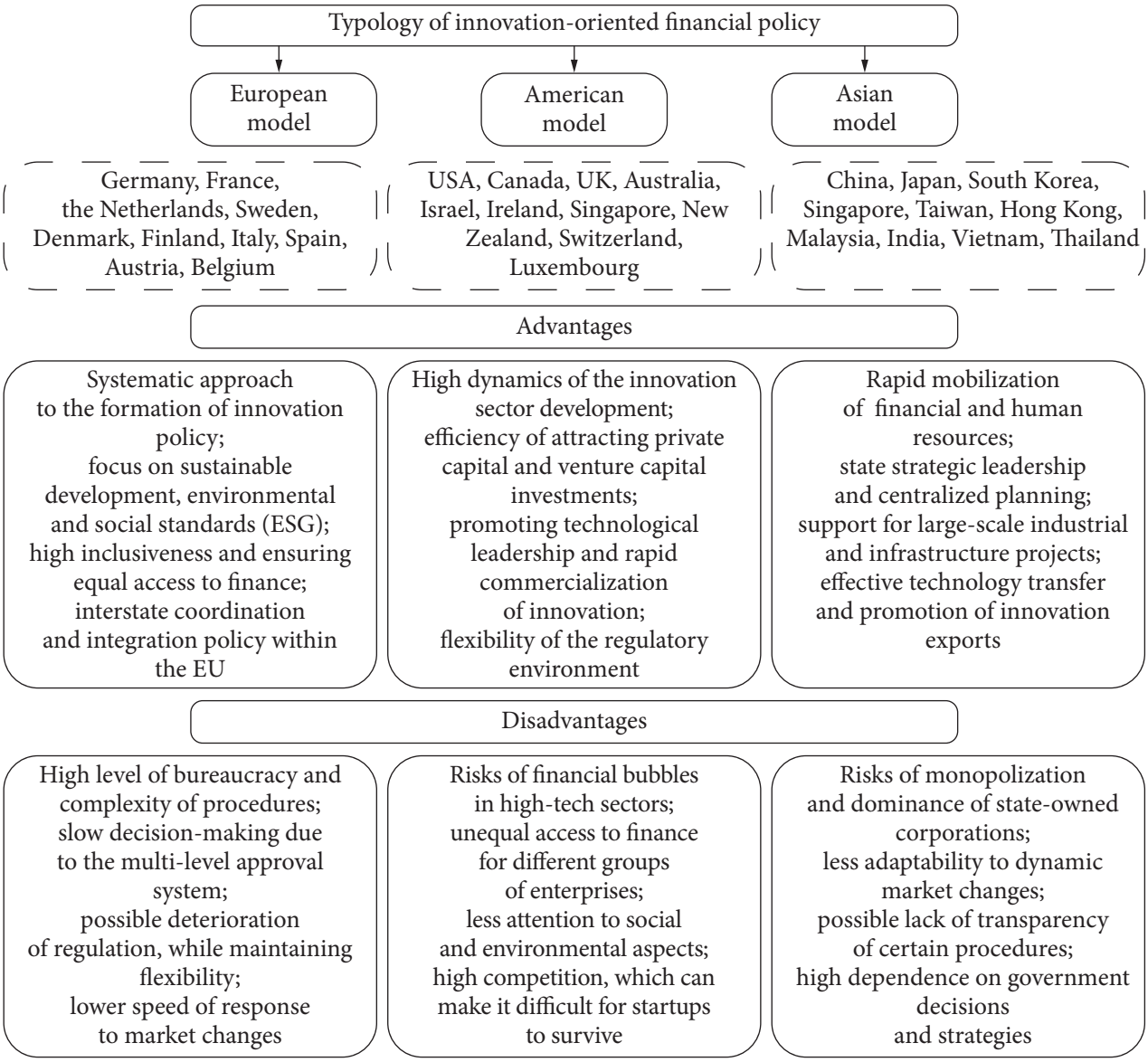

Fig. 2. Comparative analysis of the advantages and disadvantages of conceptual models of innovation-oriented financial policy [1, 8, 11, 12, 13]

- sustainable innovation economies: countries such as the United States, Germany, Japan, and Sweden consistently maintain high GERD rates of 3—3.5% of GDP. This indicates the maturity of their innovation systems, where funding is stable, regardless of short-term fluctuations [25, 30];
- countries with potential: France, the United Kingdom, and Canada, although they have lower rates (in the range of 1.5—2.5%), still invest significant resources in R&D. This indicates the presence of strong innovation potential, which, however, may require additional incentives to reach the level of leaders [1, 10].

The empirical analysis shows that the key factor in the effectiveness of innovation policy is not only the amount of financial investment, but also a balanced

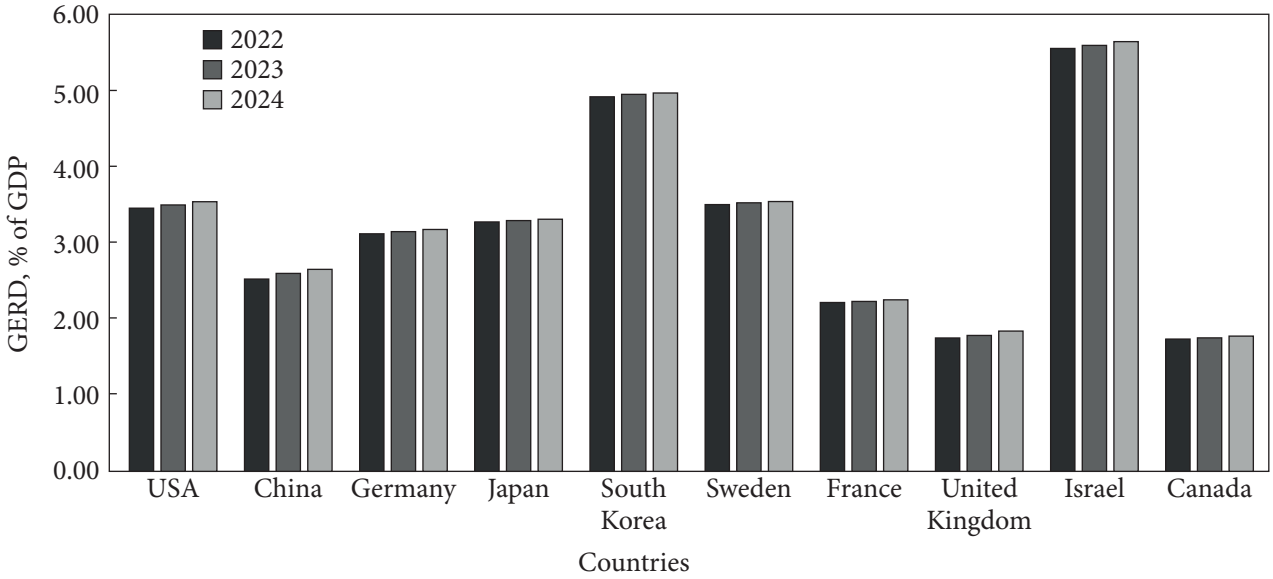

Fig. 3. Dynamics of Gross Domestic Expenditures on Research and Development (GERD) in the leading innovative countries in 2022—2024 [1, 10, 25, 26, 30]

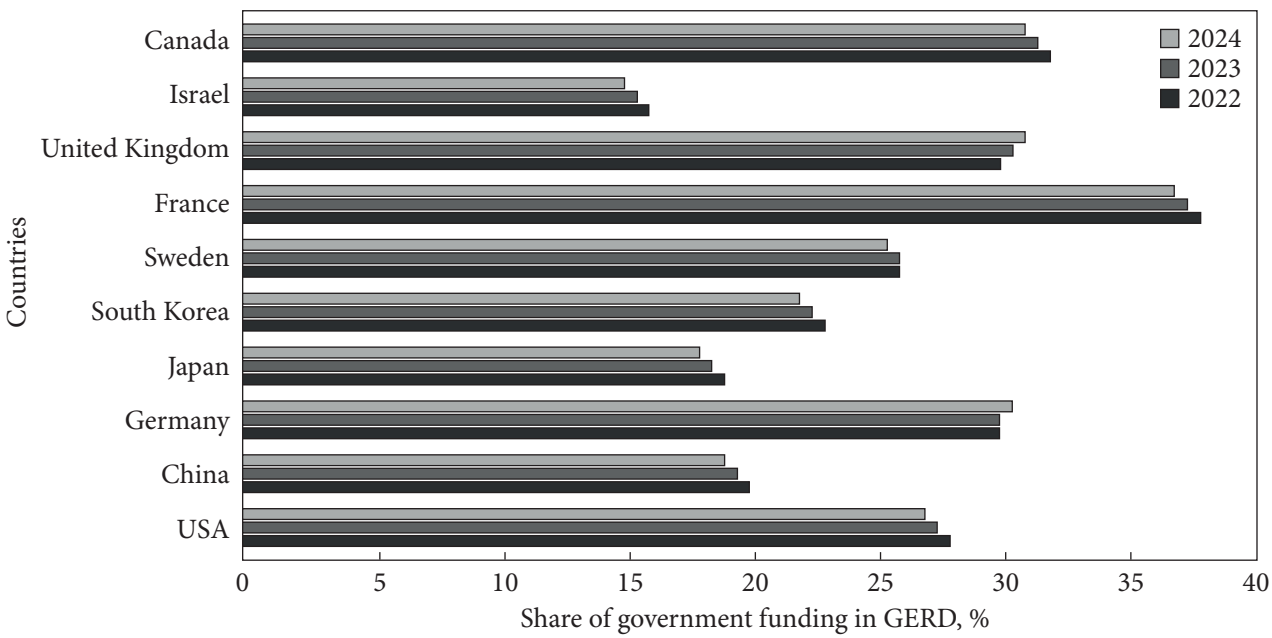

Fig. 4. Dynamics of the share of the public sector in financing gross domestic expenditure on research and development (GDERD) in individual countries-leaders in innovation-driven development for 2022—2024 [1, 10, 25, 26, 30]

approach to their distribution and effective management. The details of public sector participation in WSS in these leading countries are shown in Fig. 4.

Thus, the empirical analysis of the GERD dynamics and the share of public funding complements the analysis of institutional models by demonst-

Table 6. **Architectonics of Institutional and Managerial Models of Government Support for Innovation in Advanced Economies in 2022—2024 [1, 11, 12, 13, 15]**

Analytical aspect / Model	European model	American model	Asian model
1	2	3	4
Key institutions	*Integrated multi-level system*: European Commission (via DG R&I), European Investment Bank (EIB), European Investment Fund (EIF), national innovation agencies (e.g. Fraunhofer Society, Fraunhofer-Gesellschaft) and clusters. *Focus on integration*	*Rosgaluzhna merizha of federal agencies:* NSF, NIH, DARPA (as key drivers of basic research), SBA, National Laboratories, powerful regional innovation hubs (e.g., Silicon Valley). *Emphasis on specialization*	*Centralized state structures:* Ministries of science and industry (e.g., MIIT in China), state-owned investment corporations (e.g., China Investment Corporation), sovereign wealth funds, technology agencies (e.g., KAIST South Korea). *Emphasis on state control*
Mechanisms of cross-sectoral cooperation	*Integrated cooperation: developed system of public-private partnerships (PPP)* as the main instrument (e.g., InvestEU attracts ~€372 billion of private investment). Active consortia, networks between universities, business and government for synergy	*Dynamic innovation ecosystems:* formation of clusters, accelerators, and incubators. Close partnerships with universities (e.g., through grant funds) and large corporations. *The private sector is a key driver*	*State coordination:* strategic alliances and integration of research institutions with large businesses under state leadership. Development of intergovernmental technology platforms. *Priority of national interests*
Monitoring and evaluation tools	*Comprehensive performance evaluation:* independent project review systems, regular audits (e.g., through the European Court of Auditors), multidisciplinary supervisory boards, and strict ESG reporting. *Focus on transparency and sustainability*	Evaluation through market indicators: focus on performance through commercialization indicators, number of patents created by startups, amount of private investment attracted. *Focus on commercial success*	Centralized state control: strict monitoring of strategic programs, periodic review and adjustment of targets, integrated state reporting system. *Prioritizing alignment with strategic goals*
Approaches to regional development	*Differentiated support:* emphasis on regional innovation clusters (Smart Specialization Strategy), special funds for less developed regions to reduce the innovation gap	*Local innovation hubs:* support for university cities (e.g., Boston, Stanford) that generate startups, regional grants and tax incentives for local development	*Creation of mega-zones:* special economic and technological zones, industrial parks, state funding of infrastructure for innovation hubs (e.g., Shenzhen, China). *The goal is to attract massive investments*
International integration	*Active cooperation:* participation in joint European programs (Horizon Europe, EUREKA), transnational projects, harmonization of standards and legislation to facilitate integration	*Global expansion:* attracting foreign investors through transnational venture capital funds, supporting startups' entry into global markets through global startup platforms	*Strategic expansion:* state support for export of innovations, integration into global value chains, formation of interstate technological alliances (e.g., the Belt and Road Initiative)

End of Table 6

1	2	3	4
Features of SME incentives	*System support:* Separate grant lines for SMEs, advisory support, special financial instruments for startups (e.g., through the EIF), simplified access to finance	*Supporting growth:* acceleration programs, access to venture capital financing, government guarantees for small innovative companies with high growth potential	*Priority of "national champions":* targeted financing and subsidies for SMEs with the potential to become leaders, especially export-oriented startups
Digital transformation tools	*Digital management platforms:* development of digital platforms for submitting applications, monitoring projects, using Big Data and AI to analyze innovation processes and make decisions	*Cloud solutions and fintech support:* use of cloud services to manage innovative programs, intensive support for digital startups, and development of financial technologies	*Large-scale implementation RegTech / SupTech:* active use of AI-based regulation and supervision technologies in public administration, development of digital banking for innovative enterprises

rating specific financial indicators of innovation development leaders.

This data confirms the importance of a balanced approach to financing innovation, where public investment acts as a catalyst for attracting private capital in the face of global instability.

These financial indicators and institutional models are the key elements for benchmarking. They allow not only comparing overall costs, but also analyzing how government support affects the innovation ecosystem. Thus, benchmarking is transformed from a simple comparison of numbers into a comprehensive diagnosis that helps identify best practices and adapt them to national conditions. Comparing this data with national indicators allows us to identify funding gaps and set strategic priorities for an effective innovation-oriented financial policy.

Based on the benchmarking analysis, key recommendations for optimizing innovation-oriented financial policy in the context of global instability are formulated:

1. Optimization of the financing structure. Create conditions for stable and sufficient financing of innovative projects by harmoniously combining direct government instruments (grants, subsidies) with incentives to attract private capital (venture capital funds, tax incentives). For example, implementing mechanisms similar to public-private funds used in European and Asian models.

2. Mitigation of innovation risks. Creation and implementation of mechanisms for state guarantees, investment insurance, and joint public-private financial programs. The key is to introduce instruments similar to the SBIR/STTR program in the United States to finance high-risk but promising early-stage startups.

3. Creating an inclusive and adaptive innovation environment: promoting equal access to finance for small and medium-sized businesses (SMEs) and startups, regardless of their size or region, to avoid concentration of resources. This can be achieved through the development of decentralized capital raising platforms (crowdfunding), which are a key element of the Asian model.

4. Stimulating networking and international cooperation: developing financial instruments that encourage cross-sectoral cooperation (science-business-state) and integration into global innovation chains. For example, financial support for participation in international programs such as Horizon Europe for integration into the European innovation ecosystem.

5. Increase the efficiency and transparency of public funding. Implementation of advanced mo-

nitoring, evaluation and audit systems focused on results and compliance with ESG principles, as well as the use of digital platforms to ensure maximum transparency and accountability in the process of financing innovation. This is an important element of the Asian model.

6. Developing flexible mechanisms for responding to instability. Formation of tools that allow a quick adaptation of innovation-oriented financial policy to new challenges of global instability. It is extremely valuable to use the experience of benchmark countries in developing special financial packages to support R&D during geopolitical conflicts and economic crises.

The empirical analysis of the share of public funding (Fig. 4) has shown that, despite the significant amount of GERD, the role of the state in financing innovation varies significantly. For example, in the countries that are leaders in terms of GERD (Israel and South Korea), the share of public funding is relatively low (15—25%), which confirms the dominance of private capital. At the same time, in countries such as the United States and Germany, the share of the state is consistently high (~30%), indicating its direct and systemic support for innovation.

Thus, the study of GERD dynamics and the share of public funding complements the analysis of institutional models by demonstrating specific financial indicators of innovation development leaders. This data confirms the importance of a balanced approach to financing innovation, where public investment acts as a catalyst for attracting private capital in the face of global instability. These financial indicators and institutional models are key elements for benchmarking, which helps to identify best practices and adapt them to national conditions.

Implementation of the above recommendations requires specific tools and mechanisms. Therefore, in order to achieve strategic goals, it is necessary to detail the applied aspects of innovation-oriented financial policy. Their practical implementation in the context of global instability, taking into account the principles of benchmarking, covers the following areas:

- introduction of adaptive tax instruments: flexible tax credits for R&D, accelerated depreciation of innovative equipment, and special tax regimes for innovative startups and venture capital funds, similar to the practices successfully used in the United States and the European Union [10, 25, 30];
- launch of targeted benchmarking funding programs: development of national or sectoral grant programs that integrate best practices of innovation funding from leading countries (e.g., Horizon Europe or SBIR/STTR models), especially in strategic areas (AI, biotechnology, green technologies) [1, 25, 26];
- strengthening the infrastructure of innovation financing: development and support of a network of venture and private equity funds, business incubators, accelerators, industrial and technology parks that provide comprehensive financial and non-financial services, contributing to the creation of sustainable innovation ecosystems following the example of the Israeli model, where private capital plays a key role [10, 26];
- maximizing the use of digital technologies in financial management: integrating Big Data, artificial intelligence (AI), and blockchain to analyze innovation trends, optimize financing processes, automate applications, and monitor project performance, which is the basis of the Asian model of efficiency and transparency [1, 10];
- expansion of public-private partnership (PPP) mechanisms: active implementation of instruments for joint financing of high-risk innovation projects, where the state acts as a catalyst and partner, reducing risks for private investors, following successful models of international cooperation (e.g., German "funds of funds") [26, 30];
- development of a flexible and transparent regulatory framework: creation of an effective legal framework for the functioning of innovative financial instruments, protection of intellectual property rights, and minimization of

administrative barriers, which will allow for rapid adaptation to the challenges of global instability, using the experience of benchmark countries [1, 25].

Effective adaptation of innovation-oriented financial policy to the conditions of global instability requires systematic implementation of applied mechanisms. This involves flexible transformation of tax and grant instruments, strengthening of financial infrastructure, integration of advanced digital solutions and expansion of public-private partnerships. Such a vector will not only ensure the sustainable development of the country's innovation potential, but will also allow for the efficient use of limited resources, as evidenced by the positive dynamics of the indicators presented in Fig. 3 and Fig. 4. These empirical data demonstrate that countries with such a balanced approach have more sustainable innovation development even in the face of global economic challenges.

Based on the results of a comprehensive theoretical substantiation, empirical analysis and comparative study aimed at benchmarking innovation-oriented financial policy in the context of global instability, it can be stated that the main points of the paper are as follows:

1. The conceptual significance of an effective innovation-oriented financial policy as a key factor of sustainable development in the context of growing global instability and structural transformations is substantiated. It is determined that it is the basis of innovation infrastructure, which ensures a continuous cycle of development, commercialization and successful implementation of innovative solutions into the economic system for the long term.

2. A retrospective analysis of the dynamics of the development of financial mechanisms for stimulating innovation was conducted, which allowed us to identify the defining periods of their genesis and transformation from initial state subsidies to modern complex ecosystems of venture and hybrid financing.

3. A comparative analysis of the dominant models of innovation-oriented financial policy (American, European and Asian models) for 2022—2024 is carried out. It is found that they differ significantly in the architectonics of institutional and managerial approaches, the degree of centralization, the role of private and public capital, and development priorities, which is the basis for further benchmarking.

4. The specifics of the creation and effective functioning of various financial instruments to support innovation in international practice are revealed, including a comprehensive consideration of their typology (direct financing, tax breaks, venture capital, grants, crowdfunding) and key implementation mechanisms that ensure their effectiveness in the face of global economic challenges.

5. The forms and strategic priorities of state support for innovation activities in leading innovative countries are detailed. Based on the results of benchmarking, the advantages and disadvantages of each analyzed institutional and management model (European, American, Asian) were comparatively assessed, in particular with regard to their adaptability, resource efficiency, and ability to generate sustainable innovation-driven development in the face of external shocks.

6. An empirical analysis of the dynamics of gross domestic expenditure on research and development (GDERD) and the share of the public sector in their financing in leading innovative countries for the period 2022—2024 was carried out. The results of this analysis systematically complemented the conceptual study of institutional models, demonstrating specific financial indicators and confirming the critical importance of a balanced approach, where public investment acts as a catalyst for the effective attraction of private capital in the face of global instability.

7. It is summarized that the success of financial support for innovation largely depends on the synergistic effect that arises from the integration of various financial instruments and institutions within a clearly defined innovation-oriented financial policy. The optimal combinations of these elements are identified, which contribute to leve-

ling imbalances in financing and efficient risk distribution in a turbulent external environment.

8. Key recommendations are formulated and applied aspects of innovation-oriented financial policy formation are identified, aimed at addressing the identified problem areas and strengthening the potential for innovation-driven development, given global benchmarks and the specifics of functioning in conditions of global instability.

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БЕНЧМАРКІНГ ФІНАНСОВОЇ ПОЛІТИКИ, ОРІЄНТОВАНОЇ НА ІННОВАЦІЇ В УМОВАХ ГЛОБАЛЬНОЇ НЕСТАБІЛЬНОСТІ

Вступ. У період геополітичних трансформацій інноваційний розвиток визначає стійкість національних економік, що актуалізує роль фінансової політики у підтримці науково-технічного прогресу та комерціалізації розробок. Так, бенчмаркінг постає дієвим інструментом порівняльного аналізу та імплементації передового міжнародного досвіду формування механізмів фінансового стимулювання інновацій.

Проблематика. Посилення глобальної турбулентності та методична незавершеність інструментарію оцінювання результативності фінансової політики детермінують необхідність у системному бенчмаркінгу міжнародних практик для концептуалізації та ідентифікації ефективних механізмів підтримки інновацій.

Мета. Здійснити бенчмаркінг фінансової політики, орієнтованої на інновації розвинених країн, для ідентифікації дієвих інструментів її формування та обґрунтування рекомендацій щодо їх імплементації у фінансову систему України.

Матеріали й методи. Застосовано системний аналіз та багаторівневу концепцію дослідження, емпіричні (спостереження, порівняння) та логіко-методологічні методи (формалізація, аналіз, синтез, індукція, дедукція) для систематизації підходів до стимулювання інновацій в умовах нестабільності.

Результати. Проаналізовано генезис фінансових механізмів стимулювання інновацій та проведено бенчмаркінг американської, європейської та азійської моделей за 2022—2024 рр. Після систематизації інструментарію та інституційно-управлінських підходів розвинених країн обґрунтовано рекомендації щодо інтенсифікації інноваційного розвитку України. Доведено, що результативність фінансової політики в умовах нестабільності визначається інтеграцією бюджетних і податкових важелів у межах цілісної інституційної архітектури. Виявлено синергетичний ефект від поєднання гнучких фінансових інструментів зі специфічними управлінськими моделями, що забезпечує прискорення комерціалізації розробок та підтримку науково-технічного потенціалу в умовах системних викликів.

Висновки. Результати оцінювання глобальних бенчмарків, сформували підґрунтя для формулювання практичних рекомендацій щодо фінансової політики орієнтованої на інновації в Україні, спрямованої на подолання дисбалансів у фінансуванні та інтенсифікацію інноваційного розвитку.

Ключові слова: FinTech, інноваційно-орієнтована фінансова політика, бенчмаркінг, фінансування інновацій, глобальна нестабільність.