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**Explore the New Mechanism of the Global Development Fund and Cultivate an
Engineering Ecosystem for Industrial Transformation**

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Summary: Under the vision of a community with a shared future for mankind, the support mechanism of government-industry funds has become a crucial factor in promoting the global industrial revolution and cultivating an engineering ecosystem. The Industrial Revolution involved industrial transformation, industrial derivatives, and industrial upgrading, which shaped a new engineering ecosystem with diverse participants, including governments, social intermediaries, financial institutions, innovators, and operators. In this context, the Global Development Fund plays a role in leading the formation of the engineering ecosystem of the Industrial Revolution and provides funding and incentive mechanisms to facilitate its development. This includes not only technological research and innovation incubation but also community participation and inclusive design, ensuring that projects meet the needs and expectations of society. The support mechanism of the Global Development Fund is key to nurturing the engineering ecosystem of the Industrial Revolution, and it can achieve more sustainable and forward-looking development through diversified funding leadership and multi-faceted cooperation.

1、 The Engineering Ecology of Industrial Transformation: New Concepts and Structures

Industrial transformation is divided into industrial revolution (0-1 industry), industrial derivation (1-100 industry), and industrial upgrade (100-10,000 industry), which involves fundamental changes in the "engineering ecosystem." It refers to the innovation in industries that disrupts the traditional engineering ecosystem and shapes new ones. The "industrial transformation engineering" includes industrial revolution engineering (innovation from 0 to 1 industry), industrial derivation engineering (innovation from 1 to 100 industry), and industrial upgrade engineering (innovation from 100 to 10,000 industry). "Industrial ecology" refers to the complex industrial ecosystem formed through industrial innovation, while "engineering ecological system of industrial transformation" refers to the analysis and research of industrial innovation using a new paradigm of engineering ecology.

The main components of the engineering ecological system of industrial transformation are as follows^[1]: Engineering subjects include government, intermediary organizations, finance, innovative entrepreneurs, and operators. The development model of the engineering system consists of seven elements: government, industry, university, scientific research, finance, technology intermediaries, and market applications. These elements constitute an innovation system with "learning" and "governance" as the foundation, "research" as the starting point, and the collaborative support of "production, finance, and intermediaries," ultimately achieving the goal of "application." Industrial ecological position refers to the functional role and status of the industry itself in its community^[2], with higher ecological positions for industries in the 0-1 range and lower positions for industries in the 100-10,000 range.

The engineering ecological system of industrial transformation is a complex and multi-level system, including original concepts, key common technologies, physical foundations, ecological cultivation mechanisms, future scenario ecologies, benchmark demonstrations, global networks, etc. The architectural hierarchy of the industrial innovation engineering ecosystem can be viewed as a complex system consisting of multiple interrelated subsystems^[3]. The main system (engineering ecological system of industrial transformation) comprises all entities, resources, relationships, and processes related to industrial innovation. It is a complete entity with specific goals and functions, such as promoting innovation and fostering cooperation. Subsystems include the technical innovation subsystem involving technology research and development and the transformation of innovative achievements, the resource sharing subsystem involving resource sharing and partnership relationships, the market expansion subsystem involving market analysis and product promotion, and the

[1] [Zhang Yufei, Yuan Changhong, Wang Tao, et al. Analysis of the Evolutionary Path of In-depth Integration of Industry, University and Research: A Vertical Case Study of Zhejiang Tsinghua Yangtze River Delta Research Institute. China Science and Technology Forum, 2020(07): 87-98. DOI: 10.13580/j.cnki.fstc.2020.07.016.]

[2] [Hannan, M. T, Freeman, J. Structural inertia and organizational change. American Sociological Review, 1984, (49):149-164.]

[3] [Gomes L A D V, Facin A L, Salern M S, et al, 2018. Unpacking the innovation ecosystem construct: Evolution, gaps and trends [J]. Technological Forecasting and Social Change, 136:30-48.]

international cooperation subsystem involving international collaboration and global resource integration, among others. These subsystems interact within the entire industrial innovation engineering ecosystem, forming a complex and coordinated whole. This hierarchical and collaborative relationship promotes innovation and industrial development more effectively. Additionally, the industrial innovation engineering ecosystem has the functions of compatibility with history, dynamic integration, resource integration, iterative innovation, and service support system.

From the perspective of the essence and form of industrial innovation engineering ecology, platform networks are the essence of the ecosystem. This network is a system composed of "nodes" and "connections," where "nodes" represent participants or entities, and "connections" represent their relationships or interactions. The evolution process of the network form follows the pattern of point-line-network-stereoscopic-immersive embedding. Each industrial innovation corresponds to a stage and a specific form.

Looking at the genes of the industrial innovation engineering ecosystem, technology, skills, and creativity are the three core genes that determine the system's functionality. Technology is a core driving force of industrial innovation, while the cultivation and enhancement of skills are indispensable. y is an important factor that drives industrial innovation and development.

2、 The New Direction of Global Industrial Transformation and Development Fund under the Vision of a Community with a Shared Future for Humanity

Since the beginning of the 21st century, the global economy has entered an unprecedentedly intensive and active period of innovation. A new round of technological revolution and industrial transformation will be the main force to reshape the global competitive landscape. The new round of technological revolution and industrial transformation, with artificial intelligence, big data, internet of things, cloud computing, edge computing and other technologies as its core, will enter an expansion period, which will have an unprecedented impact on the global supply chain, industrial chain, and value chain. Currently, human beings are in the era of the Fourth Industrial Revolution.^[4] This era is characterized by big data, artificial intelligence, the internet of things (IoT), and intelligent technology, and shows new characteristics such as technology-driven, green and sustainable, personalized demand, global competition and win-win cooperation, the improvement of human well-being, global security and stability, the transformation of the global governance system, and the exchange and mutual learning of human civilization. General Secretary Xi Jinping's proposal for the vision of a community with a shared future for mankind responds to the historical question, the question of the times, and the question of the people about where human beings are heading under the background of new technological revolution and industrial transformation. ^[5]"A community with a shared future for mankind" is also an international extension of China's people-centered concept and a new governance

^[4] [Schwab, Klaus. The Fourth Industrial Revolution. Beijing: CITIC Press Group, 2016]

^[5] [Xi Jinping. Working together to eliminate poverty and promote common development. People's Daily, October 17, 2015 (002).]

solution that China offers to the world in response to the unity and division, cooperation and confrontation, peace and conflict, cooperation and decoupling, fairness and bullying, openness and closure, and two forces and trends in the international community under the intertwining of variables. It contains insight into the changes of the times and a forward-looking concern for the goal of human social development.

As an important guiding fund leading social progress and economic development, the Global Development Fund should shoulder the important historical task of promoting and generating the industrial transformation and is an important force in the construction of the engineering ecology of the industrial transformation.^[6] In the tide of anti-globalization, protectionism and unilateralism, innovating the support mechanism of the Global Development Fund and constructing an inclusive and open support system for the Global Development Fund are important innovative measures to implement the vision of a community with a shared future for mankind at the level of industrial transformation and development.

Looking back on the past, the Global Development Fund should aim at constructing a human development knowledge library and generating an engineering ecosystem evolution map for industrial transformation, achieving the accumulation, reconstruction, and fission innovation of development experience and theory. The new stage of global industrial transformation has the biggest characteristic of having new functions compatible with history, and the knowledge library of human development is the cornerstone of global development. Therefore, recording history is creating history. In the process of promoting industrial innovation, it is necessary to respect and use the accumulated experience and resources of history, integrate these experiences and theories, construct a comprehensive and systematic human development knowledge library, avoid duplication of labor and waste of resources, achieve organic continuity and development, and smoothly promote industrial transformation. At the same time, by studying and analyzing the industrial transformation paths of various countries, generating the engineering ecological evolution map of global industrial transformation, providing the direction of industrial transformation for the world, and better adapting to the new challenges faced by globalization. Based on the present, the Global Development Fund should eliminate the world development gap and promote win-win sharing by fostering industrial derivatives, upgrading industries, and enabling endogenous growth systems in developing countries. For a long time, the Global Development Fund has generally lacked the construction of an engineering ecosystem while focusing on project investments, and the world development gap has not only failed to narrow down but also tends to expand during the process of globalization.^[7] Developing countries have fallen into the "catch-up" trap, and the development model of "feeding-investment" led by developed countries is prevailing. Therefore, the Global Development Fund should shape the engineering ecosystem concept, transform the Development Fund from project investment to ecological system construction, help

^[6] [Brander, J., Du, Q., Hellmann, T. The effects of government-sponsored venture capital: International evidence [J]. *Review of Finance*, 2014:1 - 48]

^[7] [Xi Jinping. Firm Confidence, Perseverance, and Jointly Create a Better World for the Post-Pandemic Era. *People's Daily*, January 18, 2022 (002).]

developing countries form endogenous growth systems for industrial derivatives and industrial upgrading, and promote win-win sharing across the globe. Looking forward to the future, the Global Development Fund should achieve the leap of human development through continuous promotion of industrial revolution. Currently, the world is facing multiple challenges such as energy crisis, climate change, environmental pollution, and economic cyclic fatigue. The original industrial transformation brought about by major theoretical and technological breakthroughs is the fundamental driving force to help humanity break out of the law of development cycles, and this rule has been revealed in all previous industrial revolutions.^[8] As humanity enters the era of digital civilization, global development is embedded in a deeply nested interweaving system, with the characteristics of innovation theory, key technology, scene application, and industry breeding highlighted in the globalized exchange and cooperation. In this context, the Global Development Fund has the responsibility and necessity to construct an engineering ecosystem system for industrial revolution with global value orientation for human development in the future, and to achieve the evolution of industrial revolution from "point, line, network, 3D" to "immersive interlocking" direction, manifesting the originality of industrial multi-threading, large-scale emergence from 0 to 1.

Innovate the support mechanism of the Global Development Fund under the vision of a community with a shared future for mankind. On the one hand, we should adhere to a global vision and strategic positioning. By promoting cross-border cooperation, we jointly solve global problems such as climate change and poverty. The fund operation should adhere to a long-term vision and determine the industries that have a global impact. On the other hand, we should innovate fund management and operation mechanisms. Establish a transparent fund management and operation system to ensure the reasonable use of funds and effective supervision. Strengthen risk control and management to ensure the safe and stable operation of the fund.^[9] In addition, we should regulate the international legal and policy environment system. Connect with international standard systems, optimize legal and policy environments, and provide a fair and just development environment for enterprises. Strengthen the protection of intellectual property rights, promote global recognition of intellectual property rights, and hold violators accountable indiscriminately to safeguard the legitimate rights and interests of enterprises.

3、Diversified Fund Leadership: Innovative Engineering Ecological Cultivation Model for the Future of Humanity

Diversified funds refer to investment funds that cover multiple fields and types, including government funds, private funds, venture capital funds, and public welfare funds, among others. In the vision of globalization and the community of shared future for mankind, diversified funds serve as a core tool for cultivating and leading an

^[8] [Bai Chunli. Technological revolution and industrial transformation: trends and inspirations [J]. Science and Technology Review, 2021,39(02):11-14.]

^[9] [Cumming D. Government policy toward entrepreneurial finance: innovation investment funds [J]. Journal of Business Venturing, 2007,22(2):193-235.]

innovative and sustainable engineering ecosystem. This ecosystem is not only a technological or economic phenomenon, but rather a complex structure with multiple dimensions, levels, and participants. Its goal is to achieve a more prosperous, equitable, and sustainable future. From the perspective of fundraising, various development funds should be integrated, and a global industrial transformation promotion guidance fund should be established. The relevant parts related to promoting industrial development in various development funds should be separated at the level of the United Nations or the World Bank, and resources should be integrated. Major countries and innovation powerhouses should actively contribute a proportionate amount of funding, aiming to reconstruct platform forms and jointly create a global industrial transformation promotion guidance fund. Efforts should also be made to actively expand the scope and methods of fundraising, such as through innovative industry chain cooperation financing, technology-driven financing, green and social responsibility investments, and intellectual property financing, among other mechanisms^[10]. In terms of fund allocation, a "project + ecosystem" investment value system should be shaped, with project investment as the priority, to promote the construction of an industrial transformation engineering ecology. Fundamental investments should follow the principles of originality and key core technology investments, while entity infrastructure investments combining both software and hardware serve as the foundation. The goal is to foster modern industrial ecosystem systems [11]. Regarding investments related to originality and technological advancements, a new technological domain and industry chain system should be formed through the integration and catalytic fusion of technologies such as the Internet of Things, big data, cloud computing, blockchain, quantum technology, and artificial intelligence. By using data as the driving force at the foundational level, these investments aim to influence and change social production and lifestyles, promoting the vigorous rise of the Fourth Industrial Revolution [12]. Investments in entity infrastructure, which combines both software and hardware, should focus on promoting investments in technological innovation applications, institutional environmental restructuring, innovative management practices, and the construction of an open cultural system. This will enable various elements to interact and connect with each other, forming an organic whole and continuously advancing the new industrial revolution [13]. Investments aimed at fostering modern industrial ecosystem systems should adopt differentiated investment strategies. Specifically, investments targeting industry coexistence, parasitism, and mutual growth should vary. For investments focused on industry coexistence, investment strategies should be forward-looking, flexible, and comprehensive. Attention should be given not only to the development of emerging industries but also to the opportunities associated with

^[10] [GRILLI L, MURTINU S. Government, venture capital and the growth of European high-tech entrepreneurial firms j. Research policy, 2014 43(9):1523-1543]

^[11] [HOWELLST. Financing Innovation: evidence from R&D grants[J]. American Economic Review, 2017, 107(4):1136-1164]

^[12] [Perez, C., 2010, "Technological Revolutions and Techno-economic Paradigms", Cambridge Journal of Economics, 34(1), 185-202]

^[13] [Bertoni F, Tykova T. Does Governmental Venture Capital Spur Invention and Innovation? Evidence from Young European Biotech Companies. Research Policy, 2015, 44(4): 925-935]

traditional industries. By means of diversified investments, technological innovation, and cooperative alliances, stable investment returns can be achieved. Regarding investments in parasitic industries, investment strategies should aim to promote the rise of the creative class, strengthen the connection between new technologies and traditional industries, and explore and build new application scenarios. Investments should prioritize projects that can bring innovation and technological upgrades to traditional industries to help them improve and update their business models. For investments in mutually beneficial industries, investment strategies should focus on promoting knowledge integration in areas such as technology, management, and culture. By integrating the industrial chain, innovating technology, guiding the market, engaging in cross-border cooperation, and controlling risks, a high-end association and integration of innovation chains based on knowledge can be formed. From the perspective of fund operations, the design philosophy for future industrial innovation engineering ecosystems should follow the principles of defining new scenarios, refining new ecosystems, establishing new benchmarks, and forming a global network. Regarding the definition of new scenarios, it should be market-oriented and assist in the construction of an innovative industrial engineering ecosystem with predictive and insightful capabilities. This ecosystem should effectively recognize and understand the potential of new technologies and quickly respond to and meet the demands of these new scenarios^[14]. In terms of refining new ecosystems, appropriate industrial chains, ecosystems, and value networks should be established through guidance to attract and nurture new industry participants, partners, and innovators. Together, they can build a sustainable innovative ecosystem. In establishing new benchmarks, funds should focus on setting new standards and models to demonstrate innovative technologies and business models, inspiring others to follow and compete. The objective is to efficiently integrate supply chains, value chains, funding chains, policy chains, and cultural chains to form new benchmarks. In forming a global network, funds should target the construction of a highly interconnected global network, promoting the integration of global resource elements to create an open, collaborative, shared, and globally operated platform.

4、 Conclusion and Discussion

As an influential and authoritative international organization, the United Nations should play a leading role in global technological innovation. To achieve this, we suggest that the United Nations strengthen multilateral cooperation, actively organize international conferences of this nature, and strive for extensive participation from all countries to jointly form a roadmap that leads global technological innovation. Through such means, consensus and coordination can be achieved on the use, allocation, and processes of diversified funds at a global level, breaking down information barriers and limited thinking between countries, promoting the aggregation of global resource elements, and better facilitating the development of global technological innovation.

At the same time, the United Nations should also guide the practices of various

^[14] [LERNER J. When bureaucrats meet entrepreneurs: the design of effective "public venture capital" programmes[J]. *Economic Journal*, 2002, 112(477):73-84]

countries with the paradigm of engineering ecology and establish a global governance framework for technological innovation. Drawing on the concepts and experiences of diversified funds can help countries establish innovative governance frameworks and promote technological innovation governance globally. Such a framework is not merely a technological or economic phenomenon, but rather a complex structure with multiple dimensions, levels, and participants. It should encompass considerations from various aspects such as policies, laws, funds, and resources, in order to coordinate the collective efforts of governments, businesses, and societies, and advance the development of global technological innovation. Through this approach, we can lead technology towards goodness and benefit humanity.