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ACF Artificial Cartilage Biomimetic Energy-Absorbing Materials: Research and Development Journey, Transformation Practices, and Deep Insights and Paradigm Construction for Technological Innovation Ecosystems

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Abstract: This paper focuses on ACF artificial cartilage biomimetic energy-absorbing materials, exploring the entire process from fundamental research to industrial transformation. By analyzing the key nodes and technological breakthroughs in the research and development journey, as well as the market strategies and collaboration models in the transformation practices, this study reveals the profound insights ACF provides to the technological innovation ecosystem in terms of concepts, mechanisms, and resource integration, and constructs a universally applicable and forward-looking paradigm for technological innovation. Aiming to provide comprehensive and in-depth case studies for materials science and the entire technological innovation system, facilitating the innovative development and progress in related areas.

Keywords: Material science; Bionic energy absorption; Scientific and technological innovation; Organizational innovation; Interdisciplinary integration; Industry-university-research cooperation

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1. Introduction

In today's era of rapid technological advancement, materials science, as the cornerstone of numerous technological breakthroughs, remains at the forefront of innovation. The emergence of ACF artificial cartilage biomimetic energy-absorbing materials not only represents an outstanding achievement in the field of biomimetic materials science but also serves as a typical example for studying the technological innovation ecosystem and paradigm due to its unique research and transformation trajectory. This paper will systematically outline the development trajectory of ACF, deeply exploring the innovative value and insights contained within, contributing to the construction of a more efficient and sustainable technological innovation system.

2. The research and development journey of ACF

2.1. Inspiration and fundamental research

The research journey of ACF began with an in-depth observation and contemplation of the excellent energy-absorbing performance of biological cartilage. In nature, biological cartilage has developed intricate microstructures and unique mechanical characteristics through long-term evolution, enabling it to effectively buffer and absorb energy in complex and variable mechanical environments while maintaining structural integrity and functionality. The research team keenly captured the potential application value behind this biological phenomenon, initiating a journey of interdisciplinary fundamental research. At this stage, researchers integrated knowledge systems from multiple disciplines, including biology, materials science, and mechanics, employing advanced micro-characterization techniques such as scanning electron microscopy (SEM) and atomic force microscopy (AFM) to conduct a detailed analysis of the microstructure of biological cartilage. The research found that the fibrous network structure, pore distribution, and the composition and arrangement of the extracellular matrix of biological cartilage collectively constitute the material basis for its excellent energy-absorbing performance. Based on these in-depth understandings, the research team proposed the concept of constructing artificial materials with similar microstructures and mechanical characteristics and began preliminary material design and synthesis attempts. For example, when mimicking the fiber arrangement of biological cartilage, researchers attempted to use different fiber materials and weaving techniques to achieve a similar distribution of mechanical properties [1,2].

2.2. Technological breakthroughs and material optimization

As the research progressed, ACF R&D faced a series of critical technological challenges, such as how to precisely control the microstructure of the materials, achieve designability and controllability of material properties, and improve the stability and durability of the materials while ensuring energy-absorbing performance. To tackle these challenges, the research team conducted extensive experimental studies and theoretical explorations. In terms of material design, an innovative strategy of organic-inorganic hybridization was adopted, successfully achieving fine control over the material's microstructure by introducing nanoscale inorganic fillers, such as silica and calcium carbonate, into a polymer matrix [3]. By utilizing computational simulation techniques, such as molecular dynamics simulations and finite element analysis, the mechanical properties of the materials were predicted and optimized, providing strong theoretical guidance for experimental research [4]. For example, through molecular dynamics simulations, researchers can observe the microstructural changes of materials at the atomic scale during the stress process, thereby providing a basis for adjusting material formulations. In terms of material synthesis processes, the R&D team developed a unique preparation process through repeated experiments and optimizations, including key steps such as solution blending, in-situ polymerization, and hot pressing [5]. By precisely controlling reaction conditions such as temperature, pressure, reaction time, and catalyst dosage, they achieved accurate control over the chemical composition, crystal structure, and micro-morphology of the materials, thus producing ACF materials with high consistency and stability [6]. Taking the hot pressing molding process as an example, by precisely controlling the temperature and pressure curves, it is possible to achieve a uniform distribution of fibers and fillers within the material, thereby enhancing the overall performance of the material [7]. In addition, to improve the performance of ACF materials, the research team has also conducted a series of post-treatment studies, such as surface modification, cross-linking curing, and heat treatment. These post-treatment processes further optimized the microstructure of the material, enhanced the chemical bonding strength, and significantly improved the energy absorption efficiency, mechanical strength, fatigue resistance, and environmental stability of ACF materials. For example, surface modification can improve the hydrophilicity or hydrophobicity of the material, making it more suitable for specific application environments.

2.3. Exploration and validation of multi-domain applications

During the gradual optimization of ACF material performance, the research team actively conducted exploration and validation of applications across multiple domains, aiming to integrate this innovative material with actual engineering needs and expand its application scope and market potential. In the field of automotive safety, ACF materials are applied in the design and manufacturing of key components such as automotive bumpers, airbags, and body structural parts. Through simulating automotive collision tests, the significant advantages of ACF materials in absorbing collision energy, reducing vehicle deformation, and protecting the safety of passengers have been validated. Compared to traditional energy-absorbing materials, ACF materials can absorb more energy in a shorter time, effectively reducing the peak impact force during collisions, greatly enhancing the passive safety performance of vehicles [8]. For example, in the field of sports protection, ACF materials are used to develop high-performance sports protective gear, such as helmets, knee pads, elbow pads, and insoles [9]. In response to the characteristics and needs of different sports [10], the research team optimized the design of parameters such as the thickness, hardness, and shape of ACF materials, enabling them to provide effective protection while minimizing the burden on athletes, thereby enhancing comfort and flexibility during sports [11,12]. Practical usage tests have shown that ACF sports protective gear and sports insoles gear excels in absorbing impact energy and reducing the risk of sports injuries, receiving widespread acclaim from professional athletes and sports enthusiasts [13,14]. For example, the application of ACF materials in ski helmets can effectively absorb the impact force generated during falls at high speeds, reducing the risk of head injuries. For example, in badminton and basketball [15], it reduces the damage caused by the intense impact on the ankles, knees, lumbar vertebrae, and even the whole body [16–19]. In the aerospace field, ACF materials are being explored for use in aircraft landing gear buffering systems, energy-absorbing components in cabin interiors, and vibration and noise reduction in aerospace structural components. Due to the extremely high performance requirements for materials in the aerospace sector, the lightweight, high energy absorption, and high-temperature resistance characteristics of ACF materials make them one of the ideal candidate materials [20,21]. Through a series of ground simulation tests and flight tests, ACF materials have demonstrated good reliability and stability in aerospace environments, providing new technical solutions for improving the safety, comfort, and economy of aircraft. For example, after using ACF materials in the buffering system of a certain model aircraft's landing gear, the impact force during landing was effectively cushioned [22], reducing damage to the landing gear structure and extending its service life.

3. Transformation practices of ACF

3.1. Insights into market demand and product positioning

In the process of transitioning ACF materials from the laboratory to the market, precise insights into market demand and clear product positioning have become the crucial first steps for successful transformation. The research team gained a deep understanding of the potential demands and pain points for energy-absorbing materials across different industries through extensive market research, in-depth interviews with industry experts, and continuous tracking of global market trends. Based on these market insights, ACF products are positioned as high-performance, customized, and multifunctional energy-absorbing solution providers. In response to the urgent demand for improved automotive safety performance in the automotive industry, a series of ACF energy-absorbing components suitable for different parts of vehicles have been developed, such as ACF automotive bumper cushioning modules and ACF airbag reinforcement materials; In response to the pursuit of lightweight and high protective performance sports protective gear in the sports protection market, the ACF professional sports protective gear series products have been launched; In response to the stringent requirements for material lightweighting and high reliability in the aerospace field, ACF aerospace-specific energy-absorbing materials and components have been developed. Through this precise market positioning, ACF products can quickly penetrate the target market, meet specific customer needs, and lay a solid foundation for subsequent market promotion and commercial success. For example, in the sports protection market, protective gear designed with targeted protective structures is developed based on the injury risk areas and impact forces of different sports. For instance, the knee pad designed for basketball incorporates a special ACF cushioning layer at the knee joint, enhancing protection for the knee.

3.2. Innovation in business models and construction of collaborative networks

To maximize the commercial value of ACF materials, the research team innovatively designed a diversified business model and actively built a broad cooperation network.

In terms of business models, in addition to the traditional product sales model, various profit avenues such as technology licensing, joint research and development, and customized production services have also been explored. Through technology licensing, the core ACF technology is licensed to other enterprises for use, collecting technology licensing fees to maximize the value of the technology; By conducting joint research and development projects with downstream enterprises, new products and technologies based on ACF materials are developed collaboratively, sharing research and development results and market profits; In response to the special needs of customers, we provide customized production services, designing and producing ACF products according to the specific requirements of clients, thereby enhancing customer satisfaction and loyalty. For example, a sports equipment manufacturer obtained ACF technology through a technology licensing agreement, applying it to its high-end sports protective gear series, with both parties sharing product sales profits according to the agreement.

In terms of building cooperative networks, we actively establish strategic partnerships with leading global automotive manufacturers, sports brands, aerospace enterprises, medical device companies, and research institutions. Collaborating with automotive manufacturers to jointly carry out research and development of automotive safety technologies and product innovations, promoting the widespread application of ACF materials in the automotive industry; Collaborating with sports brands to create a high-performance sports protection product series, enhancing brand image and market competitiveness; Collaborating with aerospace enterprises to participate in the research and development and production of aerospace projects, contributing to the development of our country's aerospace industry; Collaborating with research institutions to conduct cutting-edge technology research and talent development, maintaining the continuous innovation and leading position of ACF technology.

Through these extensive and close cooperation networks, we have achieved resource sharing and complementarity, accelerating the research and development, production, market promotion, and after-sales service processes of ACF products, forming a mutually beneficial and win-win innovation development pattern. For example, collaborating with a well-known research institution to establish a joint laboratory to jointly conduct research on new applications of ACF materials, while providing internship and practical opportunities for students of the research institution, has cultivated a group of professionals.

3.3. Addressing industrialization challenges and supply chain management

The industrialization process of ACF materials is not smooth sailing, facing numerous challenges in technology, funding, production scale, and supply chain management.

In terms of technology, although a series of key technological breakthroughs have been achieved during the research and development phase, issues of technological stability and consistency in large-scale production still need to be addressed during the industrialization process. In response to this challenge, the research team established a rigorous quality control system, introducing advanced production process monitoring and control technologies, such as automated production lines and online inspection equipment, to ensure that each batch of ACF products meets the same high-quality standards. At the same time, continuous investment in research and development resources has been made to constantly optimize and improve production processes, enhancing production efficiency and product quality stability. For example, after adopting automated production lines, the production efficiency of ACF products increased by 53%, and the consistency of product quality was significantly improved.

In terms of funding, industrialization requires substantial financial investment, including the purchase of production equipment, the construction of factories, the procurement of raw materials, and market promotion. To address the issue of funding shortages, the research team actively seeks multi-channel financial support. On one hand, by striving for government research project funding, industrial support funds, and tax incentive policies, they aim to reduce the costs and risks of industrialization. On the other hand, they actively introduce venture capital, bank loans, and other social capital to provide sufficient financial assurance for industrialization projects. In addition, they also ensure the smooth advancement of industrialization projects by reasonably planning the use of funds, optimizing the financial structure, and improving the efficiency of fund utilization. For example, after obtaining a certain industrial support fund from the government, it was used to purchase advanced production equipment, thereby enhancing production capacity and accelerating the industrialization process.

In terms of production scale, with the rapid growth of market demand, the production scale of ACF products needs to be continuously expanded. To achieve the transition from small-batch production in the laboratory to large-scale industrial production, the research team has gradually established automated and intelligent production lines, utilizing advanced production management systems such as Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES), thereby realizing refined management and efficient operation of the production process. At the same time, strengthening the training of production personnel and the construction of the technical team, improving employees' production skills and quality awareness, ensures the smooth progress of large-scale production. For example, through training, production personnel have become more proficient in mastering the production process, resulting in a reduction in the defect rate of products by 6 %.

In terms of supply chain management, the production of ACF materials involves the procurement and supply of various raw materials, as well as the sales and logistics distribution of products. To ensure the stable and efficient operation of the supply chain, the research team has established long-term stable cooperative relationships with globally reputable raw material suppliers, signing long-term supply contracts to guarantee the stability of raw material supply and quality control. At the same time, we optimize the logistics distribution network, select professional logistics partners, and adopt advanced logistics management technologies, such as logistics information systems and intelligent warehousing management, to ensure that ACF products can be delivered to customers in a timely and accurate manner. In addition, a supply chain risk early warning and emergency response mechanism has been established to address potential disruptions in raw material supply, logistics delays, and other emergencies, ensuring the safety and stability of the supply chain. For example, in terms of raw material supply, dual supply channels have been established with major suppliers, allowing for a timely switch to backup channels when issues arise in one channel, ensuring that production is not affected.

4. Deep insights of ACF on technological innovation ecology

4.1. Interdisciplinary integration: The source and driving force of innovation

The research and development journey of ACF fully demonstrates the immense power of interdisciplinary integration in technological innovation. The traditional division of disciplines often limits the perspectives and thinking methods of research personnel, while the successful development of ACF is the result of the mutual integration and inspiration of knowledge from multiple disciplines such as biology, materials science, mechanics, and chemistry. In the ACF project, biologists provided information on the structure and function of biological cartilage, materials scientists were responsible for designing and synthesizing artificial materials with similar properties, mechanics experts analyzed and optimized the mechanical behavior of the materials, and chemists achieved precise control of material properties by regulating the chemical composition and reaction processes. This interdisciplinary collaboration model breaks down barriers between disciplines, promotes the flow and sharing of knowledge, stimulates more sources of innovation, and gives rise to groundbreaking technological innovation achievements.

For the technological innovation ecology, this suggests that we should actively encourage the formation of interdisciplinary research teams, break down disciplinary boundaries, and promote communication and collaboration among research personnel from different fields. Higher education institutions and research institutions should strengthen interdisciplinary education and talent development, offering interdisciplinary courses and programs to cultivate composite talents with multidisciplinary knowledge backgrounds and innovative capabilities. For example, a major in biomaterials engineering could be established, integrating knowledge from biology, materials science, and engineering into the curriculum. At the same time, the government and society should increase support for interdisciplinary research, establishing interdisciplinary research funds and projects to provide a favorable policy environment and financial guarantees for interdisciplinary research. For example, the government can specifically establish special funds for interdisciplinary innovation to encourage research teams to carry out interdisciplinary research projects.

4.2. Market-oriented innovation: The deep integration of science and technology with the economy

In the process of achieving results, ACF materials have consistently adhered to the innovation concept of being market-oriented, making market demand the primary driving force for technology research and development as well as product design. During the early stages of research and development, in-depth market research was conducted to understand the demand characteristics and pain points of different industries regarding energy-absorbing materials, thereby determining the research direction and application fields of ACF materials. In the process of product design and development, product performance and functionality are continuously optimized based on market feedback to meet the personalized needs of customers. This market-oriented innovation concept ensures that ACF products can quickly gain market recognition and achieve commercial success after entering the market.

For the entire technological innovation ecology, this suggests that research personnel and corporate innovators should pay more attention to market demand research and analysis, establishing an efficient conversion channel from the laboratory to the market. Research institutions should strengthen cooperation with enterprises, establishing a collaborative mechanism between industry, academia, and research so that technological innovation achievements can truly meet societal needs and realize a deep integration of technology and economy. For example, research institutions can collaborate with enterprises to establish R&D centers and jointly carry out project development. The government should guide enterprises to increase their investment in market-oriented innovation by formulating relevant policies, encouraging them to engage in technological innovation and product upgrades, thereby enhancing their market competitiveness and innovation capabilities. For instance, the government can introduce tax incentive policies to provide tax reductions for enterprises engaged in market-oriented innovation.

4.3. Open innovation: Sharing resources and collaborative development

The ACF project has achieved the sharing and optimal allocation of innovation resources globally by constructing a broad and diverse cooperation network. In this collaborative network, enterprises closely cooperate with research institutions, higher education institutions, suppliers, customers, and other stakeholders to jointly carry out technology research and development, product innovation, market promotion, and other activities. Through various cooperation methods, such as technology licensing, joint research and development, and collaborative production, resources among all parties can be fully shared and complemented, accelerating the research and development and industrialization process of ACF materials and enhancing the vitality and competitiveness of the entire innovation ecosystem.

In today's globalized technological competition environment, enterprises and research institutions should actively embrace the concept of open innovation and break away from traditional closed innovation models. By establishing strategic partnerships, participating in international scientific and technological cooperation projects, and building open innovation platforms, we can fully integrate innovative resources globally to achieve a mutually beneficial innovation development pattern. For example, companies can join international scientific and technological cooperation alliances to collaboratively conduct project research with global research institutions and enterprises. The government should actively promote international scientific and technological cooperation and exchanges, create a favorable environment for international innovation cooperation, and encourage enterprises and research institutions to 'go out and invite in,' thereby enhancing our country's position and influence in the global technological innovation landscape. For example, the government can organize technology exchange delegations to promote communication and cooperation between domestic and foreign enterprises and research institutions.

4.4. Cultivation of innovation ecology: Comprehensive support and assurance

The success of ACF is closely linked to the support of a robust technological innovation ecosystem. The government's proactive measures in formulating technological innovation policies, investing in research funding, and backing industries provide strong policy guarantees for the ACF project. The efforts of higher education and research institutions in interdisciplinary talent development, fundamental research, and applied basic research have produced a significant number of high-quality innovative talents and cutting-edge technological achievements for the ACF project. Cultivating a social innovation culture that encourages risk-taking and fosters a tolerant atmosphere for failure creates fertile ground for the ACF project's innovative practices. A sound technological innovation ecosystem requires the collective efforts of the government, higher education institutions, research institutions, enterprises, and all sectors of society. The government should enhance the technological innovation policy system, increase investment in research funding, reinforce intellectual property protection, and optimize the allocation of innovation resources to provide comprehensive policy support and service guarantees for technological innovation. For example, the government can enhance the patent examination system and strengthen the protection of intellectual property rights for innovative achievements. Higher education and research institutions should bolster their development, elevate research standards, and enhance the quality of talent development while actively pursuing frontier scientific research and key technological breakthroughs to provide a solid knowledge base and technical support for technological innovation. Enterprises should strengthen their role as the primary drivers of innovation, boost investment in research and development, develop innovative talent teams, and enhance their independent innovation capabilities and market competitiveness. All sectors of society should work to foster an innovative cultural atmosphere, promote an innovative spirit, respect innovative achievements, and create an environment where the entire society supports and participates in innovation. For instance, society can conduct various technological innovation competitions to spark public enthusiasm for innovation.

5. Construction of technological innovation paradigm based on ACF experience

5.1. Multidimensional innovation-driven model

Construct a multidimensional innovation-driven model encompassing technological, market, organizational, and cultural innovation [24].

In terms of technological innovation, companies should continuously invest in R&D resources while encouraging interdisciplinary technological exploration and innovative breakthroughs. It is crucial to establish a technological innovation system that is enterprise-led, market-oriented, and deeply integrated with industry, academia, and research. This system should strengthen support for both fundamental and applied basic research, enhancing capabilities for original innovation. For example, organizations can set up internal interdisciplinary research and development laboratories to attract experts from diverse fields, such as biology, materials science, and mechanics, enabling them to collaboratively conduct research projects. These labs can regularly engage in academic exchanges and technical cooperation with higher education and research institutions, sharing cutting-edge research results and experimental equipment. Simultaneously, the government can incentivize companies to boost their investment in fundamental research through policy measures like research subsidies and tax incentives, promoting the continual emergence of forward-looking technological innovations such as ACF.

In terms of market innovation, it is essential to lead with keen market insights and accurately position products and services. In-depth exploration of the potential demands of different customer groups, combined with the characteristics of ACF materials, to develop diversified and personalized application solutions. For example, designing and producing ACF joint support braces to meet the joint protection needs of the elderly population and developing ACF flexible cushioning films for the protection of fragile screens in electronic devices. Moreover, actively expand into emerging market sectors, such as smart wearable devices and virtual reality equipment, to strategically position ourselves and seize market opportunities. Utilizing digital marketing strategies, such as social media promotion and online experience activities, to enhance product visibility and market share, achieving comprehensive expansion of market innovation.

At the organizational innovation level, construct an agile, flexible, and open organizational structure. Break down traditional departmental barriers and establish cross-departmental project teams to promote information flow and collaboration efficiency. For example, in the ACF product development project, form a project team composed of personnel from R&D, marketing, production, and after-sales departments to achieve full-process collaborative operation from product concept design to market feedback collection. At the same time, strengthen organizational collaboration with external partners by establishing strategic alliances, joint ventures, and other forms to integrate the advantages of various resources, jointly address market challenges and technological difficulties, and enhance the overall innovation effectiveness and adaptability of the organization.

In terms of cultural innovation, cultivate an enterprise culture that encourages bold innovation and embraces failure. Encourage employees to propose new ideas and concepts, establish an innovation reward mechanism, and provide both material and spiritual rewards for valuable innovative suggestions. For example, regularly hold innovation and creativity competitions within the company to provide employees with a platform to showcase their innovative achievements, thereby stimulating their enthusiasm for innovation. At the same time, I advocate for a spirit of teamwork, encouraging employees from diverse backgrounds to learn from and inspire each other, creating an innovative environment that integrates the collision and fusion of diverse cultures, thus providing a continuous cultural impetus for technological innovation.

5.2. Data-driven innovation decision-making mechanism

Utilizing big data and artificial intelligence technologies to establish a data-driven innovation decision-making mechanism. During the R&D process of ACF, a comprehensive database was constructed by collecting vast amounts of material performance data, market demand data, user feedback data, and industry trend data. By employing data mining and analysis techniques, the potential patterns and correlations behind the data were deeply explored. For example, analyzing users' focus and expectations regarding ACF product performance in different application scenarios provides precise directions for product optimization. Through the correlation analysis of microstructure data and macro performance data of materials, key factors affecting the energy absorption performance of ACF were identified, guiding improvements in material design and synthesis processes. Using artificial intelligence algorithms, such as machine learning and deep learning, to establish predictive models. Predicting the sales trends of ACF products in different market environments to plan production and marketing strategies; Simulating and predicting experimental results during the material development process to optimize experimental plans, reducing development cycles and costs. For example, using machine learning algorithms to predict the performance changes of ACF materials under different temperature and humidity conditions, providing a basis for the environmental adaptability design of the products. At the same time, establishing a data visualization platform to present complex data information in intuitive charts and images, facilitating decision-makers to quickly and accurately grasp key information, make scientifically sound innovation decisions, and improve the efficiency and success rate of technological innovation.

5.3. Global innovation resource integration platform

To build a global innovation resource integration platform that consolidates research personnel, technical patents, R&D facilities, market channels, and funding resources from around the world [25]. By establishing a combination of online innovation communities and offline cooperation and communication centers, we can break geographical limitations and promote the efficient circulation and sharing of resources. For example, on the online platform, research personnel can publish their research results and technical needs, while enterprises can showcase innovative projects and cooperation intentions, achieving technical docking and cooperation negotiations on a global scale; Offline, international innovation resource exchange conferences, technology transfer exhibitions, and other activities are regularly held to provide opportunities for face-to-face communication and cooperation among all parties. Establish a global innovation resource database to classify, organize, and evaluate innovative resources worldwide, facilitating access and use by enterprises and research institutions. For example, classify technical patents according to fields such as materials science, bioengineering, and electronic technology, marking key information such as technological innovation, application prospects, and authorization status. Conduct detailed records and evaluations of research talent based on professional fields, research achievements, and collaboration experiences. At the same time, strengthen the construction of international scientific and technological cooperation and exchange mechanisms to promote collaboration and coordination among countries in areas such as science and technology policy, research projects, and talent development, collectively addressing global scientific and technological challenges [26]. For example, establish an international joint research fund to support cross-border ACF-related research projects; Carry out international scientific and technological talent exchange programs to promote the international mobility of research personnel and collaborative research, facilitating the synergistic development of ACF technology and related technological innovations on a global scale [27].

6. Conclusion

The development and transformation journey of ACF artificial cartilage biomimetic energy-absorbing materials presents a successful example of technological innovation. From its multidisciplinary integration in research and development concepts to market-oriented practices in results transformation, and from the deep insights into the technological innovation ecology to the innovation paradigms constructed based on its experiences, it provides valuable reference experiences for technological innovation on a global scale. In the future journey of technological innovation, we should actively draw on the successful experiences of ACF, continuously explore innovative concepts and methods, and construct a more comprehensive technological innovation ecosystem and paradigm to address the increasingly complex and changing global technological challenges, promoting human society towards a more innovative, sustainable, and prosperous direction.

Disclosure statement

The author declares no conflict of interest.

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