



# Science and Technology Daily

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## Innovation Pathway

### China Unlocks Bold Tech Transfer Efforts

Edited by WANG Xiaoxia

As China accelerates its pursuit of high-quality development, the transformation of scientific and technological achievements has become a strategic priority.

During this year's Two Sessions, the Jiangsu delegation emphasized the need to explore new pathways for integrating innovation, industry, capital, and human resources — which would address bottlenecks in turning lab breakthroughs into real productive forces.

#### Enterprises take the lead

To bridge the gap between research and industrial demand, China is strengthening the principal role of enterprises in innovation. Rather than leaving new technologies on the drawing board, enterprises are enabled to take the lead in decision-making, R&D investment, and application.

This has led to Beijing launching an "open competition" mechanism to select the best performers for key tech tasks, resulting in 169 locally made automotive-grade chips. Meanwhile, in the Yangtze River Delta, 24 innovation consortia led by tech giants have been established, uniting enterprises across the entire industrial chain and universities to tackle shared challenges. These model examples are reorienting research toward market pain points and real-world applications.

#### Financial support deepened

Given the high costs, risks, and long cycles of tech innovation, targeted financial support is critical. Policymakers are calling for robust sci-tech finance that directs capital toward early-stage, small-scale, and long-term "hard tech" ventures.

The relending quota for technological innovation and equipment upgrades has been increased to 1.2 trillion RMB, now covering private small and medium-sized enterprises with relatively high levels of R&D investment.

New tools have also been launched to share risks for corporate bonds for tech and private firms, backed by central bank relending. In addition, a policy framework for tech insurance is being developed, enriching product offerings and stabilizing innovation-driven growth.

#### Talent development reshaped

Recognizing that human resources are the most essential part of technological transformation, China is advancing integrated education, science, and talent strategies. *See page 3*



A dynamic positioning pile-driving vessel, with a pile frame height of 156 meters, is delivered in Nantong city, east China's Jiangsu province. (PHOTO: XINHUA)

## STI Frontier

### HEPS: Super Microscope for Micro World

By LU Zijian & LU Chengkuan

From above, it looks like a giant magnifying glass. The High Energy Photon Source (HEPS), located in Huairou district, Beijing, is China's first high-energy synchrotron light source and Asia's first fourth-generation synchrotron light source, according to Pan Weimin, director of the HEPS project and researcher at the Institute of High Energy Physics (IHEP), Chinese Academy of Sciences (CAS).

Since December 2025, HEPS has been under trial operation and by mid-February, it had supported 222 project experiments from 91 institutions, providing nearly 5,000 hours of user computing time. On the back of this, HEPS recently launched its first official call for proposals.

#### How HEPS works

"Like a large microscope in the hands of scientists, HEPS can help us to see the experiment samples clearly and analyze the microstructure and evolving

process of materials," Pan said.

For example, HEPS can observe the changes of atomic structure of metal materials under extreme conditions, helping scientists design stronger alloys. It can also inspect chip circuits — which are a thousand times thinner than a human hair — for defects, making sure that smartphones and computers operate more efficiently.

In the HEPS storage ring, electrons travel at close to the speed of light. As they pass through bending magnets, they emit extremely bright synchrotron radiation along the tangent of their orbit. This radiation is directed to beamline stations, where it "illuminates" experimental samples like a spotlight, allowing researchers to uncover the secrets of the microscopic world.

"This process is similar to when we spin an umbrella quickly on a rainy day: droplets of water fly off along the tangent to the edge of the umbrella," Pan said. The accelerator for the light source acts

like this umbrella, and the flying droplets are the X-rays, called synchrotron light.

Compared with the third-generation synchrotron light source, HEPS can "see" samples more clearly and faster, according to Pan. The electron beam has an energy of six billion electron volts, enabling it to emit X-rays of 300 kilovolt-electron volts or higher, allowing for the clear visualization of thicker samples.

Meanwhile, its brightness is one trillion times that of sunlight, making it capable of capturing molecular motion at the scale of one-ten-billionth of a second.

#### Tackling key tech bottlenecks

The overall performance of HEPS has reached a "leading level" among similar international facilities, with a source brightness nearly 100 times higher than that of third-generation facilities, enabling a continuous supply of high-quality X-rays, according to Dong Yuhui, deputy director of the HEPS project and researcher at IHEP.

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### Largest Observation Network Empowers Agriculture

By LU Zijian & FU Lili

China has built the world's largest agrometeorological observation network, according to the China Meteorological Administration (CMA). Latest data from the CMA shows that the meteorological authorities have established a modern agrometeorological observation system, comprising 642 manual observation stations, 738 automatic observation stations, 15 specialized service centers and 91 experimental stations.

Under this system, manual and automatic observation complement each other, and observation and experimentation are conducted in a coordinated manner. This structure strengthens the weak

links in operations in core agricultural areas and extends the vision several hundred kilometers in the sky through remote sensing satellite monitoring.

In major crop production areas like Henan province in central China, products can be monitored with a resolution ratio of 10 meters with the help of 48 sets of phenological observation systems and data from the Fengyun satellites and unmanned aerial vehicles (UAVs).

The most salient feature of this observation network is the combination of intelligence and accuracy, Wu Dongli, deputy head of the system division of the CMA Meteorological Observation Center, said.

Empowered by cutting-edge technol-

ogies like AI, laser and hyperspectral technology, China has become the only country to possess a complete set of automated observational data on crop growth stages, with the accuracy of core data exceeding 90 percent.

The intelligence of the observation network is transforming into a productive force against natural disasters.

In pest and disease control, the meteorological authorities have developed innovative monitoring and identification technologies for insects and birds based on multi-band radars. These can precisely detect and follow the trajectory of migratory pests, providing accurate decision-making support for agricultural authorities. *See page 3*

## International Cooperation

### Chinese Project Boosts Water Access in Angola

Edited by WANG Xiaoxia

A major water supply project constructed by China Railway 20th Bureau Group (CR20G) Angola International has significantly improved access to clean water for more than 600,000 residents across Angola's northern Cabinda province, marking a milestone in Sino-Angolan infrastructure cooperation.

The project, the largest of its kind in Angola, was built to Chinese standards and features a fully integrated water supply network designed to serve approximately 92 percent of Cabinda's population. With a daily treatment capacity of 50,000 cubic meters, the system includes 80 kilometers of pipelines and 74 public water supply points.

The centerpiece of the project is the water treatment plant, a 19,200-square-meter facility that processes water drawn from the Chiloango River. The treatment process includes mechanical rapid mixing, flocculation, sedimentation, filtration and storage, ensuring consistent water quality before distribution to communities.

The construction posed significant technical and logistical challenges. The river intake pump station required 64 cast-in-place piles, each 30 meters deep, to secure the structure on soft silt foundations.

Nearly 200 types of equipment and materials were sourced from China, Portugal, and neighboring countries, requiring complex coordination across long supply chains. The project team also carried out over 10 design adjustments to adapt to the region's prolonged rainy season.

Beyond infrastructure delivery, the project created substantial local employment opportunities. During construction, it provided an estimated 2,000 to 3,000 jobs and offered technical training to more than 500 Angolan workers, some of whom now contribute to ongoing operations and maintenance.

For local residents, the impact is tangible. The new supply points have replaced the former daily routine of walking up to two kilometers to the river.

The project stands as a model of how international engineering collaboration can address critical infrastructure needs while empowering local development.

## WEEKLY REVIEW

#### New World Record Set for Deepest Hot-Water Drilling

According to China's Ministry of Natural Resources, the 42nd Chinese Antarctic Expedition successfully completed the country's first hot-water drilling experiment in the ice-covered Qilin Subglacial Lake region of East Antarctica. The drill reached a depth of 3,413 meters, surpassing previous world record of 2,540 meters for polar hot-water drilling.

#### First Extragalactic Ultra-compact X-ray Binary Discovered

Researchers from China's Xiamen University and Nanjing University have discovered M31 UCXB-1, the first extragalactic ultra-compact X-ray binary. The binary system is located in the Andromeda Galaxy, about 2.5 million light-years from Earth. It is an extremely compact binary composed of a stellar-mass black hole and a white dwarf.

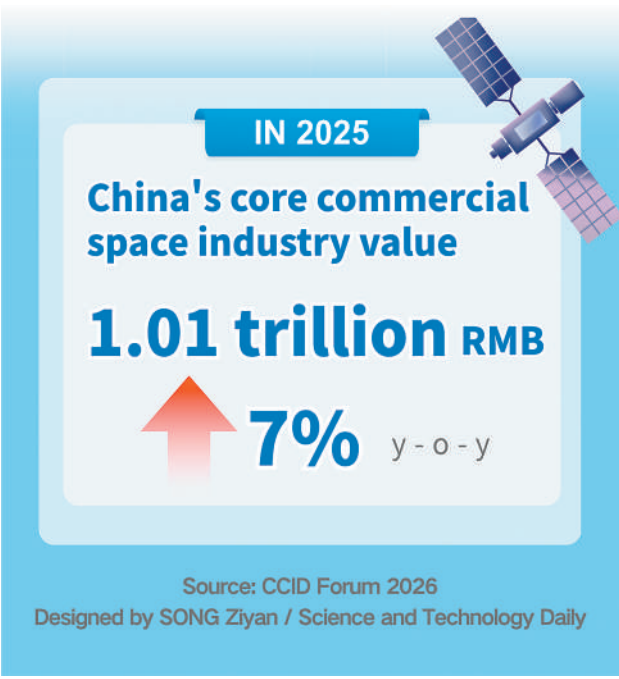
#### Bacterial Immunity Far More Extensive than Expected

Using machine learning and deep learning models, scientists from the U.S. and France unveiled the complexity and diversity of bacteria's immune systems that protect them from viral infections. The two mutually independent groups of researchers discovered a large number of new candidate antiphage families from bacterial genome data, offering resources for future biotechnology development.

#### Memory Device Surviving up to 700°C Developed

Researchers at the University of Southern California have developed a new type of memory device that continues to store data and perform calculations even at 700°C. Notably, 700°C is only the limit of the testing equipment, not the physical limit of the device itself.

## New Graphic



WECHAT ACCOUNT



E-PAPER



# AI Powers Shipping Industry's Action Plan

## Policy Express

By TANG Zhexiao

China has rolled out an action plan to accelerate the deep integration of cutting-edge technologies, such as artificial intelligence, into the shipping industry and foster the growth of new quality productive forces in the shipping sector.

The plan, jointly issued by the Ministry of Transport, the Ministry of Industry and Information Technology, the State-owned Assets Supervision and Administration Commission of the State Council and the State Administration for Market Regulation, outlines the general requirements, key tasks, and support measures for intelligent shipping development during the 15th Five-Year Plan period (2026-2030).

The plan lays out a two-phase development roadmap with clear targets:

By 2027, China aims to achieve deep integration of AI and the shipping sector, make breakthroughs in key technologies, establish over three comprehensive intelligent shipping pilot zones and more than five pilot routes, and put more than 100 intelligent ships into commercial operation.



The vessel SMC Rizhao departs from a berth at Qingdao Port, Shandong province. (PHOTO: XINHUA)

By 2030, the country is expected to fully incorporate core technologies, form a new coordinated development model covering technology, industry, and governance, and elevate China's intelligent shipping development to an internationally advanced level.

Industry insiders believe the release of the plan marks a new stage of systematic advancement in China's intelligent shipping sector. It not only provides systematic solutions to the bottle-

necks hindering development but also offers strong momentum and solid support for building China into a transportation powerhouse by 2035. Furthermore, it will enable China's shipping industry to transition from "keeping pace" to "taking the lead" in the global wave of intelligent transformation.

To achieve its goals, the plan systematically deploys 11 key tasks across four areas: technological equipment breakthroughs, empowering application

pilots, upgrading infrastructure, and enhancing regulatory governance.

In the future, regions such as the Yangtze River Delta, the Pinglu Canal, and the Beijing-Hangzhou Grand Canal will be selected for the key tasks, as well as typical transportation routes including north-south coastal routes and inland waterway network routes, according to Chen Deli, deputy director-general of the Maritime Safety Administration of the Ministry of Transport. Chen added that a batch of comprehensive pilot zones, pilot routes, and pilot ships will also be designated for remote control and autonomous navigation applications, to promote the large-scale development of intelligent shipping.

Currently, there are 60 automated ports in China, with the country maintaining a global lead in smart port construction. In addition, construction of smart waterways is accelerating, with national electronic navigational charts coverage now exceeding 10,000 kilometers.

Meanwhile, the application of blockchain technology in port electronic cargo release and maritime electronic bills of lading is continuously expanding, laying a strong foundation for the future development of intelligent shipping.



# Guidelines to Advance High-quality E-commerce Development

By LI Linxu

To better serve the real economy, China has rolled out a policy document to advance high-quality development of the e-commerce sector.

The document was jointly released by six government bodies, including the Ministry of Commerce (MOFCOM), the Ministry of Industry and Information Technology, and the Ministry of Agriculture and Rural Affairs.

In recent years, China's e-commerce sector has experienced robust growth, maintaining its position as the world's largest online retail market for 13 consecutive years, according to an of-

ficial from MOFCOM.

Currently, it covers 26 million domestic businesses and serves 3.2 billion consumers worldwide. The accelerating integration of online and offline channels has played an increasingly prominent role in driving the high-quality development of the real economy.

The document outlines a series of guidelines to deepen the integration of the digital and real economies, empowering small and medium-sized enterprises and rural areas through e-commerce, and cultivating industrial e-commerce.

More efforts will be made to accelerate the application of technological innovation, develop quality consumption,

and build integration platforms, so as to achieve a higher-level dynamic balance between supply and demand.

In 2025, the R&D intensity of major e-commerce platforms exceeded eight percent. China's revenue from cloud computing and big data services grew by 13.6 percent, emerging as a new engine for cultivating new quality productive forces, according to the official.

The policy urges promoting high-standard opening up by advancing cross-border e-commerce and expanding the Silk Road e-commerce initiative, while accelerating institutional opening up and pushing for greater alignment with international rules in areas such as

digital trade.

To date, China has established Silk Road E-Commerce partnerships with 36 countries, with cross-border e-commerce accounting for more than six percent of the total foreign trade in goods.

To foster a sound ecosystem, it also highlights efforts to clarify the responsibilities of platforms, enhance regulation, and guide compliant overseas expansion.

The document also puts forward a series of support measures, including optimizing the supply of financial products, unlocking the value of data elements, and strengthening targeted talent cultivation.



# Digital Human Information Services Regulated

By TANG Zhexiao

China's cyberspace regulator has released a draft regulation to strengthen oversight of digital human services, and is now soliciting public opinion.

The Cyberspace Administration of China announced the draft, which is open for public comment until May 6. It aims to foster healthy development and standardized application of digital human information services.

The draft defines digital humans as virtual digital figures that exist in non-physical environments, employ technologies including graphics, digital image processing and artificial intelligence, simulate human appearance through re-

al-human or algorithm driving modes, and feature voice, behavior, interaction capability and personality.

It stipulates that no organization or individual may use digital humans with identifiable traits of specific natural persons without their consent, or use digital human services to infringe upon others' personality rights in any form such as defamation or insult.

Notably, the draft prohibits inducing minors to become addicted to digital humans through virtual services. It bans offering virtual intimate relationships such as virtual relatives or partners to minors, as well as services that encourage excessive consumption, promote religious indoctrination, or contain content

that may cause or encourage minors to imitate unsafe behaviors.

Any organization or individual that uses an individual's sensitive personal information for modeling, image generation or scenario construction must obtain that the person's explicit informed consent, and disclose relevant details truthfully, accurately and completely in a prominent and easily understandable manner.

From the commencement of digital human services, the document requires service providers offering interactive digital human services (including voice chat) to display a prominent "digital human" label continuously alongside related content.

Huang Yongfeng, an expert and researcher at Zhongguancun Laboratory, said the draft provides important institutional support for high-quality development of the digital economy and building China's cyber strength.

"From a national perspective, it improves the institutional system for cyberspace security governance. For the industry, it sets clear compliance boundaries for the digital human sector and safeguards technological innovation. Globally, it offers a Chinese solution for digital virtual human governance and advances the building of a community with a shared future in cyberspace," Huang said.



## Case Study

# Nanjing's Solution-driven Innovation Practice

By TANG Zhexiao, ZHANG Ye & HU Zeyan

Nanjing achieved two milestones in 2025: its software business revenue topped one trillion RMB for the first time with a 16.7 percent year-on-year growth, and it secured 5th place nationwide in innovation capacity, according to official data from the Ministry of Industry and Information Technology and the Ministry of Science and Technology.

From biomedicine to intelligent manufacturing, and from addressing industrial bottlenecks to meeting people's livelihood needs, innovative achievements in the capital of east China's Jiangsu province are continuously being put into practice to solve practical problems, "weaving" a symbiotic network connecting talent, universities, enterprises, and the government through solution-oriented innovation.

**Breaking innovation constraints**

Nitric oxide is widely used in the clinical treatment of various cardiopulmonary diseases in newborns, children and adults, serving as a crucial therapeutic tool. However, its storage and transport rely mostly on bulky, risky and highly inconvenient traditional steel cylinders.

A Nanjing-based biotechnology company targeted this urgent clinical demand and set up an R&D program. After years of research, the world's first portable nitric oxide therapeutic device, based on electrochemical catalysis, was developed in Nanjing, opening a convenient facility for patients in need.

Another biotech enterprise, Nanjing Leads Biolabs Co., Ltd., focuses on oncology and autoimmune diseases. Its independently developed Opamistomig (LBL-024) is the world's first 4-1BB-targeted drug to enter pivotal clinical trials. Opamistomig is a uniquely engineered bispecific antibody which has the potential to deliver more potent and durable anti-tumor activity particularly in difficult-to-treat and immunotherapy-resistant tumors. On March 6, the company announced that the first patient had been successfully dosed in a Phase II clinical study evaluating Opamistomig.

Targeted policy support has provided a strong impetus for industrial, scientific and technological innovation. Besides establishing an office for promoting such breakthroughs, Nanjing

has issued several policies on accelerating the cultivation of new quality productive forces and promoting high-quality development in 2026, rolling out a series of special measures for the biomedical industry.

Currently, Nanjing's biomedical industry has formed a full-cycle ecosystem covering basic research, clinical trials and industrialization. In 2025, the annual operating revenue of the city's biomedical industry exceeded 225 billion RMB.

**Supporting intelligent upgrading**

In the workshop of an intelligent manufacturing company in Nanjing, a collaborative robot performs welding operations with a repeat positioning accuracy of  $\pm 0.02$  millimeters. By parameterizing and software-encoding the skills and experience of veteran welders, the collaborative welding robot can effectively replicate skilled labor tasks and iterable digital process packages, solving any shortage of trained workers.

To address industry-wide challenges such as rising labor costs and an aging workforce, intelligent harvesting robots, equipped with vision and large language models, can identify ripe fruit in complex branch and leaf environments, with a single-arm picking cycle of about five to eight seconds, providing intelligent solutions for agricultural production.

In recent years, using the symbiotic network of government, enterprises, universities, research institutes and capital, Nanjing has championed the shift of artificial intelligence from technological concepts to industrial application.

An action plan promoting the innovative development of AI, along with several policies formulated to accelerate the industrial application of large models, aims to develop industrial application large models and build more than 20 application scenarios.

The revenue of the city's intelligent manufacturing equipment industry exceeded 300 billion RMB in 2025, a year-on-year increase of about six percent. This has seen the software and information service industry incorporating more than 3,600 key software-related enterprises, forming a complete industrial chain.

Nanjing's AI products and services now cover all links of the industrial chain, including the basic layer, technology layer and application layer.



The AI·Mirror World — Nanjing Artificial Intelligence Ecological Street in Yuhuatai District. (PHOTO: XINHUA)

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The perimeter of HEPS's accelerator is 1.36 kilometers, and the area within the circle is as large as 20 football fields, Dong said. The high energy electron beam, which can accelerate to six billion electron volts and travel at a speed close to that of light, radiates a synchrotron light source.

To help the electron beams travel more steadily and generate brighter light, the research team tackled a series of world-class technological challenges.

They implemented a world-first recirculating in-axis replacement injection scheme, enabling stable operation of a single-beam group with high charge den-

sity. They also innovatively adopted a 48-cell hybrid seven-bend achromat magnetic focusing structure.

"By increasing the number of bending magnets and optimizing their layout, we have reduced the natural emittance of the electron beam to below 60 pm·rad," said Dong.

"A picometer describes the transverse size of the electron beam, while a radian refers to its divergence angle during motion. The smaller the product of the two, the more tightly the

beam remains focused at high speed, with less spread," Dong explained. "This value means that the electrons maintain a compact 'formation' as they travel, with a divergence of only a few micrometers."

The R&D team has overcome several other key core technological challenges. For example, small-aperture magnet technology has reduced the magnet aperture to approximately 25 millimeters, resulting in a magnetic field gradient four times that of third-generation light

sources, thereby enabling more precise control of the electron beam.

**Trial operation beyond expectation**

On October 29, 2025, HEPS passed the technical acceptance inspection organized by CAS, and began trial operation in December. Now, the facility operates in an alternating cycle of "user trials + performance optimization."

The research covers cutting-edge fields such as defect and fatigue assessment of aerospace components, in-situ studies of power battery charging and

discharging, ultrafast 3D printing processes, brain and organ imaging and semiconductor testing.

In the aerospace sector, HEPS utilizes its high penetration capability to detect defects in aerospace components at deeper levels, thereby contributing to aerospace safety; in life sciences, it advances brain research by characterizing neuronal networks in primate brains.

"User feedback indicates that the trial results have far exceeded expectations. Some samples that cannot be ob-

served clearly by other light sources can be distinguished by HEPS," Li Gang, researcher at IHEP, said. While advancing the facility towards acceptance after meeting performance targets, the research team is also actively communicating with research institutes and leading enterprises to address their critical needs, Li said.

"We plan to add several new beamlines and supporting accelerator equipment to further enhance our user service capabilities," Pan said, adding that the next-generation light source is expected to reduce the beam divergence to the diffraction limit, truly enabling scientists to "see every atom."

Overplaying Security Risks Stalls UK's Wind Energy Development



By LIANG Yilian & HU Dingkun

Recently, *the Financial Times* and other international media outlets reported that the British government has rejected a 1.5 billion GBP investment plan by Chinese turbine maker Mingyang Smart Energy Group to build a wind turbine manufacturing plant in Scotland, citing national security concerns.

At the same time, the government announced that Danish wind turbine manufacturer Vestas plans to invest 250 million EUR in a Scottish factory — seemingly positioning it as an alternative to the Mingyang Smart Energy Group project.

The episode is yet another example of the UK government overstretching the concept of national security to impose discriminatory restrictions on Chinese technology companies. The so-called "security risks" appear to exist largely in the imagination of certain politicians. London has failed to clearly explain what specific risks Mingyang's investment would pose, nor has it provided any credible evidence.

In fact, according to multiple international media reports, Mingyang has repeatedly expressed its willingness to work with the British government on issues such as turbine cybersecurity. The company has also reached a cooperation agreement with Octopus Energy — the UK's largest electricity and gas supplier — to jointly establish what the partners describe as "the highest levels of data protection and cyber security."

Far from threatening Britain's national security, Mingyang's investment



On March 28, a cargo ship loaded with wind power equipment for export to Austria sets sail from Yantai port, Shandong province. (PHOTO: XINHUA)

would bring significant benefits. The UK ranks second globally in installed offshore wind capacity, behind only China, and the government has identified offshore wind expansion as a central pillar of its long-term energy strategy. Yet the country's domestic wind power supply chain suffers from structural weaknesses. Manufacturing of complete turbines and many key components relies heavily on imports, leaving the supply chain vulnerable and costs elevated.

Mingyang planned to build the UK's largest wind turbine manufacturing base in Scotland, as well as the country's first fully integrated wind turbine industrial complex. Turbines produced at the facility would not only have served the British market but could also be exported to Europe and beyond. The project would have significantly

strengthened the resilience of the UK's wind power supply chain while enhancing its energy security.

By contrast, the facility planned by Vestas would focus only on producing turbine hubs and nacelles. In terms of both investment scale and industrial chain coverage, it falls far short of Mingyang's proposed project.

Cooperation with Mingyang would have been an opportunity for Britain to accelerate the development of its wind power industry. Instead, the government's fixation on national security risks is causing the country to miss out — and potentially at a considerable cost.

In February, Greg Jackson, founder and chief executive of Octopus Energy, said in a media interview that China has taken the global lead in many fields thanks to sustained investment in re-

search and development. Chinese wind turbine technology is about 30 percent cheaper than its European counterparts. Cooperating with China and introducing its technology represents a "golden opportunity," Jackson said, warning that refusing to engage could see the UK "left behind."

The government's decision has raised concerns not only in the business community but also drawn sharp criticism from some political leaders, particularly in Scotland.

John Swinney, Scotland's first minister, said he was "blindsided" by the move. According to Swinney, the decision effectively deprives Scotland of 1.5 billion GBP in investment and around 1,500 jobs, while also undermining the region's transition from oil and gas to renewable energy.

In a recent response, Mingyang urged the British government to clearly outline any remaining national security concerns and relevant compliance requirements. The company also expressed its hope to continue working with the UK government and partners such as Octopus Energy to advance the country's renewable energy sector.

It is not too late for the UK government to reconsider. By abandoning its overextended national security narrative and returning to pragmatic cooperation with Chinese companies, Britain could still turn this missed opportunity into a mutually beneficial partnership.

Comment

Anthropic Case Shows Two Contrary Visions for Governing AI

By LIANG Yilian & ZHANG Mengran

U.S. AI company Anthropic has obtained a restraining order from a California court, which temporarily blocks a ban by the U.S. Department of Defense over claims that the firm poses a "supply chain risk."

The dispute centers on Anthropic's refusal to allow its AI technology to be used in autonomous lethal weapons systems without human oversight. The judge observed that the government's action appeared to be "unconstitutional retaliation" against the company's ethical position.

This case is far more than a commercial dispute. It exposes a fundamental tension of the AI era: Should the development of frontier technologies be guided by shared human ethics and the well-being of humanity, or be reduced to tools serving the strategic ambitions and security anxieties of a single state?

The U.S. government's response reveals a logic that treats technology primarily as an instrument of power. A company, motivated by concerns for humanity's future, attempts to draw ethical boundaries around the military use of its innovations. But the result is not recognition of those concerns. Instead, the government swiftly places it on a "risk" list followed by administrative pressure that threatens to disrupt its business.

This approach — "those who comply will prosper, those who resist suffer" — expands the notion of "national security" without limit, allowing it to suppress independent voices that challenge the trajectory of military and surveillance applications.

This reality stands in stark contrast to the U.S.' frequent advocacy of "responsible AI" in international forums. The gap between rhetoric and practice highlights a deeper contradiction: technological nationalism dressed in the language of ethics.

In contrast, China has proposed and advanced a governance philosophy with a "people-centered approach in developing AI for good." This is no slogan; the concept has been developed into a systematic framework that spans both domestic policy design and international cooperation.

In October 2023, China released the Global AI Governance Initiative, which for the first time outlined at the international level a vision of an open, fair and inclusive AI governance system, opposing technological monopolies and hegemonic practices.

In July 2025, the Global AI Governance Action Plan translated these principles into 13 measures, emphasizing respect for national sovereignty, secure and controllable development, and international cooperation to help developing countries build computing infrastructure and narrow the digital divide.

These principles are increasingly reflected in practical cooperation projects. In Southeast Asia, a China-Laos AI innovation cooperation center is helping Laos systematically enhance its technological capabilities for the intelligent era. Malaysia's national AI infrastructure strategy, launched in 2025, adopted Chinese AI chips and open-source models, enabling data to be stored domestically and operated locally — strengthening what policymakers there describe as "AI sovereignty."

In Africa, the Tanzania National ICT Broadband Backbone project, built with Chinese assistance, has significantly reduced telecommunications costs and expanded connectivity in remote regions, enabling more people to access the digital economy. Such initiatives demonstrate that the ideas of "sovereign AI" and equitable technological development can translate into tangible benefits.

The White Paper on the Development of Global Sovereign Large Models, released at the 2026 Zhongguancun Forum Annual Conference on March 27, furthers this cooperative pathway. The report proposes an open, collaborative, controllable and inclusive framework, offering technical architectures ranging from open-source foundation models to full-stack solutions.

The goal is to enable countries to build AI capabilities aligned with their own languages, cultures and development priorities — providing an alternative path for the Global South to avoid technological monopolies and potential forms of digital colonialism.

Seen in this broader context, the Anthropic case is significant. The fact that a company must turn to the courts to defend its refusal to build "autonomous killing machines" is a striking commentary on one model of technological governance.

The approach China advocates — from international initiatives to concrete projects — illustrates a different possibility. AI need not become another instrument of geopolitical rivalry or technological domination. Instead, it can be a force for shared development, enabling countries to pursue innovation while respecting sovereignty and promoting global well-being.

China's Greater Role in Global Sci-tech Landscape

Opinion

By QI Liming, LIU Yuanyuan & DAI Xiaopei

The World Data Organization (WDO) was officially established in Beijing on March 30, with Chinese Academy of Sciences academician Tan Tieniu appointed as chairman. This marks a clear

reflection of the international recognition of China's data development and governance capabilities, as well as recognition of Tan's academic achievements.

It also demonstrates that both the country and its scientists add value to the global discourse on international sci-tech governance.

In recent years, Chinese scientists have accelerated their progress on the international scientific stage. Zhu Yongguan has been elected vice president for

membership of the International Science Council, Wu Weiren has been appointed as the first chairman of the International Deep Space Exploration Association, and Lu Chaoyang is president of the World Association of Young Scientists.

From the ecological environment, and deep space exploration, to youth science, an increasing number of Chinese sci-tech workers have assumed key positions in international sci-tech organizations. As of February 2025, the organizational system of the China Association for Science and Technology had over 2,000 experts serving in international organizations.

China has always promoted openness and cooperation, supporting scientists in their active integration into the global innovation network to jointly address global sci-tech challenges. This trend shows China's steady rise as a sci-tech power and international influencer, as well as sending a positive message for optimization of global sci-tech governance.

While Chinese scientists proactively improve their capabilities in international sci-tech organizations, an increasing

number of international organizations are choosing to establish their headquarters in China. This demonstrates that China is taking on more responsibilities in the international community and contributing to the progress of humanity.

As the second international organization to be established in Beijing after the International Bamboo and Rattan Organization, the decision to locate the WDO's headquarters in the capital not only marks a significant milestone for China's participation in global data governance, but also reflects the profound changes in the global data governance landscape, attracting global attention.

"Data have no borders; they flow in the cloud. However, at the same time, they can also become a threat that creates divisions. Therefore, we must join hands. I find that China is addressing the issues head-on and seeking solutions to make the fruits of the digital economy more inclusive," said Jack Perry Jr., chairman of the UK's 48 Group Club, which is a member of the WDO.



(PHOTO: VCG)



Visitors explore the "AI+" exhibition area at the Zhongguancun Exhibition Center in Beijing. (PHOTO: XINHUA)

Largest Observation Network Empowers Agriculture

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In terms of crop monitoring, researchers can quantitatively monitor the chlorophyll content and physiological changes of crops through the integration of hyperspectral and multi-modal data. This has enabled a change from relying on the weather for a good harvest to taking proactive action by knowing how the weather works.

This year's spring planting and efforts to increase crop yields per unit area vividly demonstrated the effective-

ness of the observation network.

In China's major rice-producing regions in the south, the newly built high-standard field meteorological observation stations in Hunan province play an effective role as sentinels.

They monitor the temperature and humidity in the seedling sheds in real time and automatically issue alerts for risks like heat damage so that farmers can ventilate the sheds in time.

The observation data is not only used for warnings, but also for regulating

agricultural production standards. With the growing use of UAVs for spraying pesticides, the meteorological authorities took the lead in formulating industrial standards for meteorological classification for such operations.

In Jiangsu province in the east China, a smart agrometeorological service system provides real-time forecasts about the suitability levels for aerial crop protection operations. This assists large-scale growers in precisely planning their operational windows, thereby not only shorten-

ing the pest and disease control cycle by 30 percent, but also generating substantial annual savings on pesticide costs.

Experts say that from the data transmitted via the Fengyun meteorological satellite network to minute-level disaster alerts delivered directly to the fields, a chain of precise data is enabling this agrometeorological observation network to embed cloud-based technologies deep into farmland — providing robust meteorological support for safeguarding China's food security.

China Unlocks Bold Tech Transfer Efforts

From page 1

In Xi'an, northwest China's Shaanxi province, universities and innovation platforms jointly teach graduate students to convert academic strengths into industrial advantages. In Chengdu, southwest China's Sichuan province, tech experts play a central role in the R&D within enterprises.

Meanwhile, a new evaluation system, focusing on innovation value, transfer outcomes, and market feedback, is developing closer collaboration between

universities, institutions and enterprises. To address mismatches between personnel skills and industrial needs, reforms are underway to facilitate the flow of specialists between universities, labs, and business,

The 15th Five-Year Plan period (2026-2030) aims to further remove blockages in tech transfer, enabling a virtuous cycle where innovation drives industry, industry attracts capital, capital gathers talent, and talent powers innovation.

4

LIFE IN CHINA

# AI Hunts Down Cancer 'Shape Shifting' Cells

## Dialogue

By LONG Yun & BI Weizi

In the fight against cancer, the primary tumor is rarely the deadliest threat. Rather, it is metastasis — the spreading of cancer cells. This lethal process begins with "escapers," or Circulating Tumor Cells (CTCs), that break away from the original tumor.

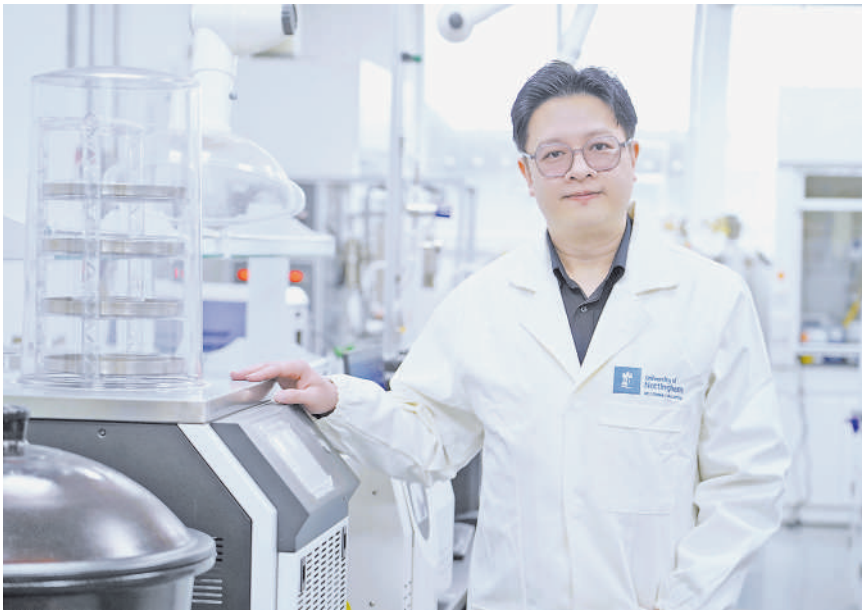
While capturing these "escapers" has long been a technical nightmare, a new frontier has been breached. Professor Learn-Han Lee of the University of Nottingham Ningbo, China, a scientist and director of the Asia Pacific Microbiome and Biomedical Research Network (AMBeR), is leading this charge. His team's recent work, which systematically reviews strategies using single-cell ribonucleic acid (RNA) sequencing (scRNA-seq), offers a blueprint for intercepting these cells before they spread.

By combining molecular biology with AI, Lee and his team are turning the tide in the battle against metastasis.

**The shape-shifting disguise**  
The first challenge in catching a CTC is recognizing it. These cells are masters of deception, often hiding in plain sight among billions of normal blood cells. When asked how these cells manage to evade detection, Lee described them as biological "shape-shifters." He acknowledged that the cells employ a dual strategy of disguise and dormancy.

"The CTCs use a process called Epithelial-Mesenchymal Transition (EMT). Essentially, they shed their 'normal' cellular ID tags, like the EpCAM marker, which many of our standard detection tools look for," he said.

However, their survival strategy goes beyond molecular camouflage. Lee



Professor Learn-Han Lee. (COURTESY PHOTO)

noted that these cells are socially complex. Instead of traveling alone, they form clusters or even hide within the body's own immune cells, such as neutrophils and platelets, using them as shields. Furthermore, they possess the patience to wait. Lee explained that many CTCs will not immediately metastasize. Instead, they can remain dormant for long periods, quietly surviving until environmental signals, often from the tumor microenvironment, trigger them to "wake up" and seed metastases.

**AI as the molecular detective**  
To analyze the massive datasets generated by single-cell sequencing, Lee's team has turned to AI. In this context, AI is not merely a calculator but also a detective. Lee asserted that, "AI has absolutely become a detective, and a very sharp one." While scRNA-seq generates massive, complex datasets that are too large for manual analysis, AI, specifically machine learning, goes beyond just crunching numbers. From his perspective, researchers have successfully used AI to identify CTCs among millions of

blood cells. Furthermore, using an algorithm called CTC-Tracer, they can even predict which specific lesion or organ a CTC originated from. Lee explained that while a CT scan typically reveals a tumor only after it has grown, AI possesses the capability to analyze the transcriptomic profile of a single CTC to indicate that the cell carries a high risk of metastasizing to the bone or brain, thereby providing a molecular warning system.

This precision is vital because not all cancer cells are created equal. Lee emphasized that treating them as a monolith is a fatal error in precision medicine. He likened treating all CTCs as one group to assuming every person in a crowd has the same intention. If doctors treat all cancer cells with the same therapy, they might kill the majority but leave the dangerous, therapy-resistant subtypes behind to proliferate.

Lee pointed out that his recent article provides concrete examples, such as in non-small cell lung cancer, where one discovered CTC cluster was highly

proliferative while another was mesenchymal (cells that develop into connective tissue, blood vessels, and lymphatic tissue) with immune evasion properties. He noted that if researchers only examine the average, they would miss that immune evasion signature entirely.

By analyzing individual cells, researchers can spot critical differences that would be missed in bulk samples. Lee highlighted that they would also miss hybrid cells — fusions of tumor and immune cells — which are implicated in metastasis and resistance.

**Bridging the gap**  
Beyond the lab, Lee focused on the practical application of these technologies. He identified the biggest barrier to global health not as the cost of technology, but the lack of standardized workflows. He noted that while one could buy a sequencer, without a validated, step-by-step guide to handle rare CTCs from blood draw to data interpretation, the technology sits idle.

Lee observed that while the cost was decreasing and open-source bioinformatics tools were becoming available, the actual bottleneck lay in training and infrastructure to ensure consistency. He argued for the necessity of moving away from "bespoke" science in wealthy nations to create robust, simplified kits that could function effectively in labs with fewer resources.

To solve this, Lee advocated for international collaboration to create robust, simplified kits that can be used in labs with fewer resources. He stressed the need to tackle the "last mile" problem: ensuring that the data generated leads to an actionable clinical decision. Without that, he asserted, even the best scRNA-seq technology cannot fulfill its role.

*University of Nottingham Ningbo also contributed to this article.*

## Tech+Culture

# How Ancient Chinese Metallurgy Forged Civilization

By Staff Reporters

The development of ancient Chinese metallurgy stands as an important achievement in human civilization. It was a systematic process marked by a high degree of independent innovation, deeply intertwined with the social structure and intellectual culture of its time.

Although the earliest copper and iron smelting techniques did not originate in the lands that would become China, Chinese artisans eventually surpassed others through a series of original technological breakthroughs. From the piece-mold casting of the Bronze Age to the invention of pig iron smelting in the Iron Age, these innovations boosted productivity and provided the essential material foundation and technical support for the formation of early Chinese states and the construction of the ritual system.

**Piece-mold casting**  
The rise of China's Bronze Age marked the maturation of an independent and highly sophisticated technological system. Unlike early copper artisans in West Asia and the Mediterranean region, who primarily used lost-wax casting or forging, craftsmen in ancient China, beginning in the period of Erlitou culture (a Bronze Age culture in the Yellow River valley from approximately 1900 BCE to 1500 BCE), pioneered and developed the technique of piece-mold casting. This foundational method set the course for subsequent bronze production and even metalworking in China.

In essence, piece-mold casting uses multiple pre-made inner and outer molds to form a cavity into which molten metal is poured in a single operation. This process demanded a high level of systematic planning and precise process control.

The Houmuwu Ding from the late Shang Dynasty (1600 BCE-1046 BCE), a massive rectangular sacrificial vessel famed as the heaviest known ancient bronze artifact in the world, is a prime example.

Its casting required nearly 100 individual ceramic molds and integrated various technical elements, including composite clay molds, sectional casting, precise mold assembly, large-scale smelting and pouring, and scientific alloy ratios. These technical steps were tightly interlinked, forming a complex and meticulous engineering system.

Precisely because piece-mold casting enabled the mass production of bronze vessels with complex shapes, standardized forms, and intricate decorative patterns, bronze objects were able to transcend their purely practical functions to become the ultimate symbols of the ritual and musical systems. The innovation in metallurgical technology thus became the crucial material medium through which "ritual civilization" was established and expressed.

**Achieving breakthroughs**  
Another landmark contribution of ancient Chinese metallurgy to human

civilization was the invention and large-scale application of pig iron smelting. For a long period, the rest of the world primarily relied on the bloomery process, which reduced iron ore in a solid state to produce a spongy mass of wrought iron.

This method was inefficient and did not allow direct casting. In contrast, China had mastered the liquid smelting of pig iron through a series of technological innovations by the late Spring and Autumn Period (770 BCE-476 BCE) at the latest.

The key to this breakthrough was the advancement of bellows technology and the iron-smelting furnace. By raising the height of the shaft furnace, intensifying the air blast, and using fluxes, craftsmen were able to raise the internal temperature sufficiently to melt the iron ore, producing liquid pig iron that could be cast directly into shape.

The production efficiency of liquid pig iron smelting far surpassed that of the bloomery process. It also allowed for the casting of complex implements, including durable iron molds, which enabled the self-reinforcing crafting of production tools.

Although pig iron was highly hard, its brittleness limited the range of its direct applications. To resolve this problem, Chinese craftsmen from the Warring States Period (475 BCE-221 BCE) to the Han Dynasty (202 BCE-220 CE) developed a comprehensive set of subsequent processing and reprocessing techniques, forming a complete iron and steel technological system.

Annealing involved subjecting cast iron objects to prolonged heat treatment to "soften" them, producing malleable cast iron with significantly improved strength and toughness. Puddling involved heating pig iron to a semi-molten state and stirring it in the air to decarburize it into steel or wrought iron.

The co-fusion process took advantage of the high carbon content of pig iron and the low carbon content of wrought iron by smelting them together, allowing the carbon from the pig iron to evenly diffuse into the wrought iron, thereby efficiently obtaining high-quality steel.

These technological innovations gave rise to a unique and distinct system of iron and steel technology in ancient China, enabling the country to lead the world in both the quantity and quality of iron and steel production for a considerable period. Iron and steel were thus widely applied in the manufacture of agricultural tools, implements, and weapons, greatly boosting agricultural productivity and advancing military technology, providing a solid material foundation for the economic development of ancient Chinese society.

*This is edited and translated from the article written by Qian Wei, dean and professor of the Institute for Cultural Heritage and History of Science & Technology, University of Science and Technology Beijing.*

# Token Surge Drives Chinese AI Models' Rise

## Science Outreach

By Staff Reporters

Chinese AI models are leading the pack after recording a weekly token usage of 7.359 trillion from March 16 to 22, a 56.9 percent increase from the previous week. That's in stark contrast to U.S. models, which saw a usage of 3.536 trillion tokens during the same period, with a modest weekly growth of 7.35 percent, according to the latest data from OpenRouter, the world's largest AI model API aggregation platform.

The data highlights a significant shift in the global AI landscape, with Chinese models demonstrating strong adoption and application at scale.

**What is a token?**  
To understand the significance of this metric, an understanding of "token" is essential.

"Tokens are the basic units of text processing for large language models, which can be understood as 'word chunks' from an AI's perspective," said Ma Zhiheng, an assistant professor at the School of Computing Microelectronics, Shenzhen Institute of Advanced Technology.

Before text is fed into a model, it is broken down into tokens and converted into vectors. For example, a single Chinese character typically corresponds to one or two tokens. Every user query and the AI's subsequent response consume a certain number of these tokens.

Ou Weijie, head of the Yashan LAB at the Shenzhen Academy of Computing Sciences, provided an analogy: "If

'computing power' is seen as 'electricity,' then tokens are the 'kilowatt-hours' consumed. They are a core indicator for measuring AI activity and processing scale."

**Why is China's token usage so high?**

The surge in token usage is driven by a combination of factors, primarily cost-effectiveness and widespread application.

Data from OpenRouter shows that the top four models by weekly usage are all from China, namely Xiaomi's Mi-Mo V2 Pro, StepFun's Step 3.5 Flash (free), MiniMax's M2.5, and DeepSeek's V3.2.

"In terms of pricing, domestic models represented by DeepSeek and MiniMax have significantly reduced API usage costs, stimulating demand from developers and enterprises," Ma said. Chinese companies have taken a

leading role in the open-source model space, narrowing the technological gap with top-tier global closed-source models to about three months, while offering them at a much lower price, he added.

Luo Jieping, executive director and chairman of the board of Yuexiu Port Holdings Co., Ltd., pointed to the vast user base in China as another key driver. "Chinese developers have contributed a substantial amount of token consumption. Applications like WeChat, DingTalk, and Feishu can reach billions of users. These users can access AI capabilities with a simple click, which undoubtedly generates massive demand for model calls."

This accessibility makes AI a practical tool for diverse users. As cost optimization continues in areas like inference and response speed, a large number of small and medium-sized enterprises and developers are integrating AI into their business processes, triggering a long-tail effect in token consumption.

# How Water Clocks Flowed with Time

## Traditional Eastern Wisdom

By BI Weizi

The water clock, also known as clepsydra (water thief in ancient Greek), is a device that measures time based on the controlled flow of liquid into or out of a container, with time indicated by the volume of liquid. It is one of the earliest timekeeping devices, believed to be in use around 1500 BCE.

The basic principle behind these clocks is Torricelli's law, a theorem in

fluid dynamics which relates the velocity of fluid exiting a hole to the height of the fluid above that opening.

There are two main types of water clocks: inflow and outflow. In an outflow water clock, a vessel is filled with water and the water is gradually and consistently released from the vessel. This container features lines that measure the passage of time. As the water drains, an observer can use the lines to determine how much time has elapsed.

An inflow water clock operates in a similar way, but instead of draining from the container, it is filled by the water. As the vessel fills, the observer can see

where the water level aligns with the lines to determine how much time has elapsed.

In ancient China and across East Asia, water clocks were crucial tools in the fields of astronomy and astrology. The earliest recorded mention of the water clock dates back to the 6th century BC in China. From around 200 BC onwards, the outflow clepsydra was widely replaced throughout China by the inflow clock, featuring a float-supported indicator rod.

Huan Tan (40 BC-AD 30), a Han Dynasty philosopher and politician, noted the necessity of comparing clepsydrae to sundials due to the impact of temperature

and humidity on their precision. This indicates that the influence of evaporation and temperature on the rate of water flow was already recognized during this period.

As the water in the clocks was prone to freezing, fire torches were used to keep the water in a liquid state, a problem that was solved in 976 by the Chinese astronomer and engineer Zhang Sixun. His invention utilized mercury instead of water. Mercury remains in a liquid state at room temperature and solidifies at  $-38.83^{\circ}\text{C}$ , which is lower than the typical air temperature found outside polar regions.

Independently, the Chinese developed their own sophisticated water clocks featuring gears, escapement systems and water wheels, passing their innovations on to Korea and Japan.



The photo shows the Houmuwu Ding (also known as Simuwu Ding). The bronze cauldron was cast using nearly 100 clay piece molds and integrating composite mold techniques, separate casting, precision mold joining, large-scale smelting and other technologies. (PHOTO: VCG)