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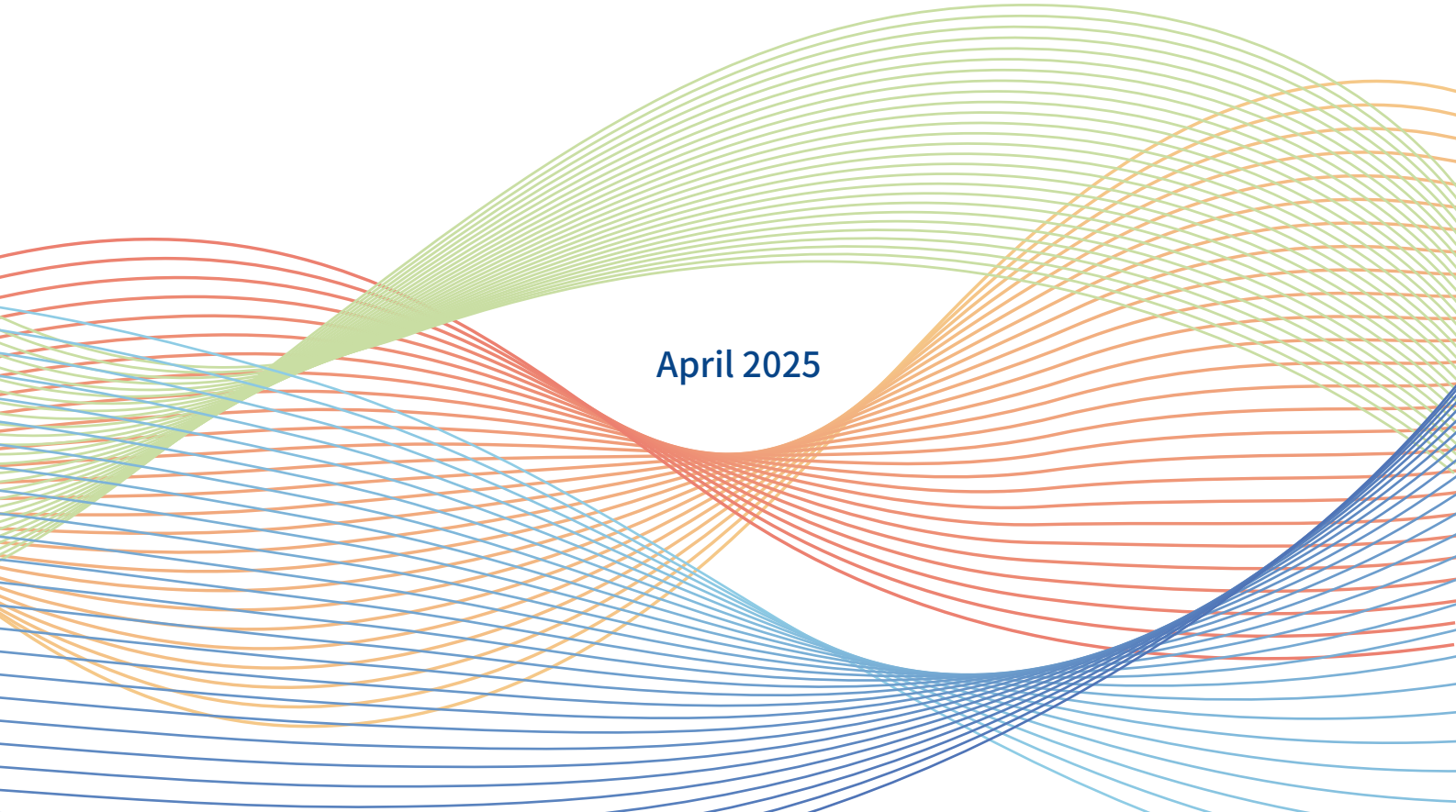
Outcomes of World Internet Conference Think Tank Cooperation Program

Research Report on AI-Empowered Integrated Development of Real and Digital Economies

China Mobile Think Tank(CMTT)



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Preface

The integration of real and digital economies leverages the widespread use of digital technologies to drive the digital transformation and upgrading of traditional industries and promote revolutions in the quality, efficiency and drivers of economic growth. In 2023, the scale of the global digital economy topped US$40 trillion, to which China contributed over 17%. The integration of real and digital economies is crucial to promoting industrial transformation and upgrading, fueling economic recovery and steady growth, improving social services, and enhancing international competitiveness.

Since OpenAI released ChatGPT at the end of 2022, the global AI sector has ushered in an unprecedented wave of development. Taking a significant step towards smarter and more flexible general intelligence from special-purpose intelligence that focuses on single tasks, AI has become a key pillar of economic and social transformation. At present, global AI technology is permeating all areas of the digital economy at a faster pace, and have been widely used in many parts of agriculture, industry and services, and increasingly been able to empower high-value scenarios, making them the core driving force for the integration of real and digital economies.

This report analyzes the mechanisms through which AI technology empowers the integration of real and digital economies. It innovatively proposes the DANT-KIF Model, a "S-D Dual Four-Dimensional Resonance" Model for the Diffusion and Application of New Technologies, summarizes breakthrough progress in AI-empowered integration of real and digital economies from both supply-side and application-side perspectives, examines challenges in deepening integration of real and digital economies, and presents future prospects focusing on strengthening technological innovation, consolidating data infrastructure, enhancing governance capabilities, and jointly building application ecosystems.

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I.AI Becomes the Core Driving Force for Integrated Development of Real and Digital Economies

(i) AI is the signature technology and a key driving force of the Fourth Industrial Revolution

Digital technology-empowered integrated development of real and digital economies represents a defining feature of the current industrial revolution. Examining the development trajectory of industrial revolutions - from the steam engine of the First Industrial Revolution, through electric motors and electrification in the Second Industrial Revolution, to breakthroughs in information technology during the Third Industrial Revolution,each industrial revolution has originated in disruptive technological innovations that catalyzed leaps in productivity. Marx's theory of three elements of productive forces profoundly[1] reveals the significant impact of technological advancements on laborers, means of labor and objects of labor. Famous Chinese economist Hong Yinxing pointed out that scientific and technological innovation is a core element in the development of new productive forces, and that the key to the development of new productive forces lies in the development and application of new technologies[2]. At each stage, new productive forces need to be applied more extensively, and in particular, their application scenarios should be expanded, so that their vitality can be fully unleashed[3]. The integration of real and digital economies is, by nature, a process of embedding cutting-edge digital technologies into all parts of real economy development to break down the physical boundaries and efficiency bottlenecks of traditional factors of production. Therefore, digital technology empowers the integrated development of real and digital economies by propelling quantum leaps in the three factors of production, thereby accelerating the progress of the new industrial revolution.

AI fosters new productive configurations, generates new growth drivers, leverages new vectors, and creates new value, providing a long-term mechanism and endogenous power for the integration of real and digital economies. First, fostering new productive configurations. In the laborer dimension, AI introduces novel labor entities that transcend physical and cognitive limitation, redefining human capital valuation. In terms of labor objects, by processing digital production factors including data, information, and knowledge, AI technology expands labor objects from natural resources and raw materials to digital domains, thereby overcoming traditional scarcity constraints of production elements and unlocking new frontiers for value creation and industrial development. Regarding means of labor, AI technology gives rise to intelligent terminal devices, software applications, and platforms, enriching the forms of production instruments while enhancing the usability, reusability, and versatility of intelligent production tools. **Second, generating new growth drivers.** While propelling quantum leaps in the three factors of production, AI brings forth four types of "new growth drivers" - new products, new models, new capabilities, and new business forms - thereby facilitating the transition between traditional and new growth drivers. **Third, leveraging new vectors.** AI-empowered integration of real and digital economies materializes through two primary vectors: AI-empowered traditional industries and AI-catalyzed emerging industries[4]. **Fourth, creating new value.** Through cost reduction and quality enhancement, business innovation, and safety assurance, AI drives the transformation and upgrading of

[1] Source: Focusing on Learning to Strengthen Theoretical Armament Deeply Understanding the Core Essence and Practical Requirements of Developing New Quality Productive Forces. June 11, 2024. https://mp.weixin.qq.com/s?__biz=Mzg5OTgzMDk5Ng%3D%3D&mid=2247490084&idx=1&sn=7baac3a0e4fc91eb836eb4920c487a13&chksm=c13bcafc9991f3c25ebfc2793c4d720c5021f20868efb0f13eff327cb7950fc743c9bd557a57&scene=27.

[2] Source: Hong Yinxing, New Quality Productive Forces Deepen the Material and Technological Foundation for Chinese Modernization. March 25, 2024. https://baijiahao.baidu.com/s?id=1794477093581997825&wfr=spider&for=pc.

[3] Source: Hong Yinxing, Gao Peiyong, et al. Introduction to the book "New Quality Productive Forces: New Drivers of Development". Jiangsu People's Publishing House. 2024. https://www.thepaper.cn/newsDetail_forward_26910231.

[4] Source: China Development Forum 2025 | China Mobile General Manager He Biao: Jointly Igniting the Engine of Innovation to Forge a High-Quality Future. https://mp.weixin.qq.com/s/uLZj3_cJA8K7onbutKC2fQ.

traditional industries, while fostering the cultivation and expansion of emerging industries via interdisciplinary technology cross-innovation and business model innovation.

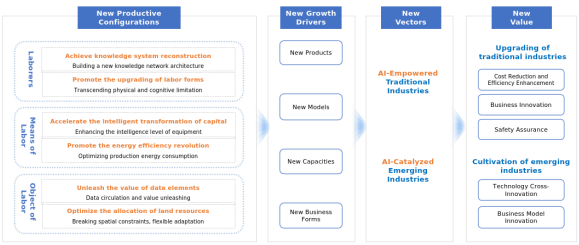

Fig. 1: AI Becomes the Key Driving Core for Integrated Development of Real and Digital Economies

(ii) The mechanisms through which AI empowers the integrated development of real and digital economies

The process of digital technology-empowered integration of real and digital economies essentially constitutes the dual progression of technological diffusion and market acceptance, influenced by multiple factors from both technology providers and applicants. CMTT has been conducting tracking research on new technology diffusion mechanisms, pathways, and outcomes for multiple years. Through the synthesis of theoretical frameworks and accumulated research findings, we have developed the S-D DANT-KIF Model (Diffusion and Application of New Technologies-Key Influencing Factors Model), a "Dual Four-Dimensional Resonance" Model for the Diffusion and Application of New Technologies, which systematically analyzes critical elements and root causes affecting technology diffusion across 4 dimensions from both supply and demand sides. From the supply-side perspective, the key influencing factors encompass Comparative Advantage, Complexity, Compatibility, and Observability[1]. "Comparative Advantage" denotes the extent to which new technologies surpass existing alternatives, as exemplified by electricity's superiority over steam power in energy conversion efficiency and environmental sustainability; "Complexity" refers to the difficulty for users to learn and adopt new technologies, illustrated by iPhone's intuitive touchscreen interface replacing physical keyboards; "Compatibility" measures the degree to which new technologies align with the existing systems, environments, and experiences of potential users, exemplified by industrial internet technologies requiring adaptation to enterprise production ecosystems; "Observability" indicates the extent to which the effectiveness of new technologies can be observed by users, demonstrated by electric bulbs' invention bringing obvious convenience to human life. From the demand-side perspective, key influencing factors comprise Expected Costs, Anticipated Benefits, Social Impact, and Facilitating Conditions[2]. "Expected Costs" encompass the costs of new technology adoption, learning costs, and risk costs; "Anticipated Benefits" refer to the gains brought by new technologies; "Social Impact" refers to the impact of external organizations or individuals on enterprise technology adoption; "Facilitating Conditions" refers to the degree of support from enterprises for adopting new technologies, such as funding and talents.

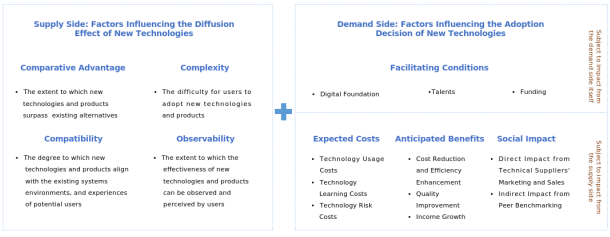

Fig. 2: "S-D Dual Four-Dimensional Resonance" Model for the Diffusion and Application of New Technologies (DANT-KIF Model)

[1] Referencing the innovation diffusion theory by American scholar Everett Rogers.
[2] Referencing Venkatesh and Davis' Unified Theory of Acceptance and Use of Technology (UTAUT).

The rapid advancement of AI has created unprecedented opportunities for deepening the diffusion and application of digital technologies across industries. Quantum leaps in algorithmic modeling, coupled with scale expansion in computing power and data infrastructure, are driving broader and deeper integration between the real economy and digital economy. While AI brings breakthrough advancements to integration of real and digital economies, unresolved legacy issues from digital transformation now pose intensified challenges during intelligent upgrading processes.

II.AI Brings Breakthrough Advancements to Integration of Real and Digital Economies

Empowered by AI technology, the integrated development of real and digital economies has entered the "fast lane". On the technology supply side, innovative breakthroughs in algorithm models and accelerated deployment of digital infrastructure have jointly consolidated the development foundation for integration of real and digital economies. On the technology application side, the comprehensive penetration of technology across primary, secondary, and tertiary industries and the continuous emergence of high-value scenarios have brought new opportunities and tangible outcomes to integration of real and digital economies.

(i) Innovative breakthroughs are achieved in algorithm models, injecting momentum for integrated and innovative development

1. AI technology capabilities are advancing rapidly, giving rise to diverse new forms of products and services.

The reasoning capabilities of large models have been significantly enhanced. First, the reasoning capabilities of large language models have been continuously enhanced. Leading AI developers from China and the United States, represented by OpenAI, Anthropic, Alibaba, and DeepSeek, have accelerated model iterations. This has propelled breakthroughs in mathematical computation, code generation, and natural language reasoning. OpenAI's o3 model, currently leading global performance benchmarks, achieved 96.7% accuracy in the AIME 2024 and 87.7% in the GPQA Diamond[1], approaching graduate-level proficiency. China Mobile's "Jiutian" base large model secured top-five rankings in OpenCompass's Chinese-English evaluations, and maintained domestic leadership in the C-Eval Chinese benchmark. **Second, multimodal large models are expanding capability boundaries.** Multimodal large models have achieved deep integration of multimodal data such as text, images, audio and video, demonstrating core competencies in multimodal perception/understanding, multimodal generation, cross-modal interaction, and logical reasoning. Google's Gemini series, leveraging native multimodal architectures, can process heterogeneous inputs (text, images, audio) simultaneously, achieving human-expert parity in the MMLU benchmark. In October 2024, China Mobile's Jiutian Multimodal Base Large Model demonstrated industry-leading performance in long-text analysis, full-duplex voice interaction, creative video/image generation, and structured data processing, with multiple technical metrics setting new standards.

[1]Source: OpenAI o3 model debuts as the grand finale, solving extremely difficult math problems. 2024. https://news.qq.com/rain/a/20241221A0726800.

Agents hold vast application prospects. As intelligent entities capable of autonomously perceiving environments, making decisions, and executing actions, agents can achieve an end-to-end closed loop from thought to action by integrating modules such as memory, planning, tool utilization, and execution, demonstrating strengths in complex task handling, cognitive coherence, and cross-scenario adaptability. In 2025, OpenAI pioneered the DeepResearch agent, leveraging the capabilities of its o3 model to execute complex multi-step research tasks, which can be applied to specialized scenarios such as market competition analysis, academic literature review retrieval, and stock investment research. Subsequently, China's Manus team launched the world's first general-purpose AI agent product, capable of independently handling complex tasks including resume screening and stock analysis.

Embodied intelligence is poised to lead the next wave of AI advancement. With core capabilities including multimodal perception and information fusion, autonomous decision-making, and dynamic adaptation, embodied intelligence relies on terminal hardware such as robots to interact with the physical world, establishing a perception-decision-action-feedback closed loop. Boston Dynamics' quadruped robots demonstrate exceptional agility and precision through agent technology. MICRO-INTELLIGENCE's embodied intelligent industrial robots, built on an "eye-hand-brain-cloud" architectural framework, integrate ultra-precision visual perception modules, industrial AI algorithms, and robotic intelligent control.

2. AI technology barriers have been dramatically reduced, accelerating market proliferation and broad-scale application

Large model training and inference require massive computing resources. Recently, DeepSeek has sparked a global application surge through model architecture innovations and core technological breakthroughs, achieving significant performance improvements while drastically reducing costs. **First, DeepSeek's technical approach offers critical references for global large model enterprises.** Breaking from Silicon Valley's traditional compute-intensive, capital-driven paradigm, DeepSeek completed training a GPT-4o-comparable model with merely $5.576 million and 2,048 NVIDIA H800 GPUs through innovative training techniques and algorithmic optimizations. The training cost represents only 1/10th of OpenAI's equivalent models, with the inference cost plunging to $0.14 per million tokens—1/53rd of OpenAI's inference expenses[1]. **Second, DeepSeek's open-source strategy accelerates market proliferation and application.** By enabling free commercial use, unrestricted modification, and derivative development, DeepSeek provides global developers with expansive innovation space while slashing R&D barriers and costs for high-performance models. Currently, in the B2B sector, enterprises have developed specialized industry large models using proprietary data and DeepSeek's open-source framework, effectively cutting R&D investments and trial costs. In the B2C sector, enterprises have utilized DeepSeek to rapidly enhance product performance. For instance, national-level applications like WeChat, Baidu Search, and Baidu Maps have already integrated DeepSeek, achieving upgrades in product performance and interactive experiences.

(ii) Digital infrastructure is being rapidly deployed, laying a solid foundation for the integrated development of real and digital economies

[1] Source: Special Report on the Tech Industry: DeepSeek—Technological Disruption or Collaborative Innovation. https://mp.weixin.qq.com/s/A-uTUD-DvYcFYpI8kmc7z-Q.

1. Computing power continues to scale up, providing an efficiency foundation for innovation and application of AI large models

First, global AI computing capacity demonstrates robust growth. As of the end of 2023, worldwide computing power reached 910 EFLOPS (FP32), marking 40% year-on-year growth, with AI computing capacity surging 136%. The United States led with 291.2 EFLOPS (32% share), followed by China's 230+ EFLOPS (27.03% share)[1]. **Second, hyperscale data centers experience rapid global expansion.** China, the U.S., and Europe are accelerating hyperscale data center deployment, surpassing 1,000 hyperscale facilities globally by early 2024, with 120-130 new installations annually. By regional IT load distribution, U.S. dominates with 51% of global capacity, Europe holds 17%, and China accounts for 16%[2]. Global hyperscale data center capacity has doubled over the past four years. **Third, AI powers intensify computing infrastructure investments.** In January 2025, the United States announced the launch of the "Stargate Project", planning to invest $500 billion over the next four years to build a new AI infrastructure, with the total investment exceeding the combined funding of the Manhattan and Apollo programs; China Mobile has established two 10,000+ GPU clusters (Harbin, Hohhot) and twelve 1,000-GPU resource pools (Beijing, Shanghai, Guangzhou etc.), achieving 29.2 EFLOPS AI computing capacity[3].

2. Data scale is growing rapidly, fuelling AI technology evolution

IDC data reveals global data generation reached 159.2 ZB in 2024, projected to double to 384.6 ZB by 2028[4]. As AI further converges with cross-domain technologies, applications including intelligent monitoring systems, AI assistants, and AI-powered business tools/industrial automation will drive sustained data expansion. This growth will present new development opportunities for AI innovation and applications. On one hand, massive multimodal data will fuel AI large model training/optimization/refinement, enabling performance breakthroughs, and provide essential support for cutting-edge world models and large concept models development. On the other hand, exponential data growth will supply rich samples for the development of traditional AI technologies such as data analytics and machine learning, and accelerate innovation and progress in AI technology, bringing new opportunities and possibilities to the development of fields such as intelligent transportation, smart cities, and intelligent healthcare. China Mobile's Wutong big data platform, the world's largest telecom data cluster, possesses 5 trillion token high-quality datasets and 2,000+ PB core data assets[5].

(iii) The scope of application continues to expand, unlocking opportunities for digital and intelligent transformation across industries

Global AI technology is accelerating penetration across all real economy sectors. The worldwide AI industry market size reached $638.23 billion in 2024 and is projected to surge to $3,680.47 billion by 2034 at a 19.1% CAGR[6]. Gartner forecasts that over 80% of enterprises will adopt generative AI APIs or deploy generative AI applications by 2026[7].

[1]Source: China Computing Power Development Report (2024). https://www.sohu.com/a/816467490_121757514.
[2]Source: Global Digital Economy Development Research Report (2024). https://mp.weixin.qq.com/s/a35PWUU2_wRm_a1zHYByIw.
[3]Source: China Mobile's AI computing capacity reaches 29 EFLOPS. https://finance.sina.com.cn/stock/relnews/cn/2025-03-04.
[4]Source: Global Digital Economy Development Research Report (2024). https://mp.weixin.qq.com/s/a35PWUU2_wRm_a1zHYByIw.
[5]Source: China Mobile's network-wide high-quality dataset is implemented in Hangzhou. https://tidenews.com.cn/news.html?id=2910020.
[6]Source: Precedence research. https://www.precedenceresearch.com/ai.
[7]Source: Gartner. https://www.gartner.com/en/newsroom/press-releaes/2023-10-11-gartner-says-more-than-80-percent-of-enterprises-will-have-used-generative-ai-apis-or-deployed-generative-ai-enabled-applications-by-2026.

1. The coordinated development of large and small models accelerates the implementation of AI applications

First, specialized small models deepen integration with specialized scenarios. Leveraging advantages like low-resource requirements and stable performance, these small models excel at single-task processing (e.g., image/speech recognition) within specific contexts, now widely deployed in critical production processes. A 2022 CAICT analysis of 507 small model implementations revealed 57% were applied in manufacturing. For instance, in equipment health management, small models can predict maintenance schedules by monitoring CNC machine parameters like cutting tool power consumption and spindle voltage/current fluctuations. **Second, large models dominate universal, creative, and reasoning-intensive scenarios.** The superior generalization, generative, and inferential capabilities of large models drive transformative impacts across product design, ad creative generation, market forecasting, and risk assessment. For instance, Coca-Cola and Carrefour utilized large models for product R&D and marketing content creation; Ping An Insurance's intelligent risk control system enhanced the accuracy of credit fraud detection by correlating user behavior data and geographic information through large models. Concurrently, large models are evolving toward compact architectures for broader deployment. Since 2024, leading developers (OpenAI, DeepSeek, Microsoft, Meta) have released slimmed models via pruning, knowledge distillation, and quantization, achieving parameter reduction while greatly reducing the demand for computing resources and memory, and enabling flexible model deployment.

2. AI-native applications are emerging in large numbers, experiencing explosive growth across multiple fields

In 2024, global AI application traffic surged from 3.6 billion visits in January to 7.6 billion in December, marking a 111% annual increase, highlighting rapid growth in user acceptance and engagement worldwide. **First, AI assistant products.** These tools emerged as the most popular daily applications, with global chatbot traffic skyrocketing from 18 billion visits in 2023 to 44 billion in 2024, a 144.41% YoY growth. **Second, AI video products.** Global traffic for AI video products jumped from 1 billion visits in 2023 to 2.5 billion in 2024, achieving 141.28% annual growth. **Third, AI imaging products.** Usage of AI imaging products climbed from 3 billion visits in 2023 to nearly 5 billion in 2024, representing 44.94% annual growth[1].

3. Application scenarios of technology are expanding, achieving widespread use across the three major industries

AI technology has achieved widespread application across various industries and processes, delivering significant economic and social benefits. This report outlines the current application scenarios and value outcomes of AI in the primary, secondary, and tertiary industries, as detailed below:

[1] Source: CNG. "2024 Global AI Application Trends Report." January 2025. Relevant data is sourced from Similarweb web platform. https://www.douban.com/note/869818415/?_i=2799661Pec_cXq.

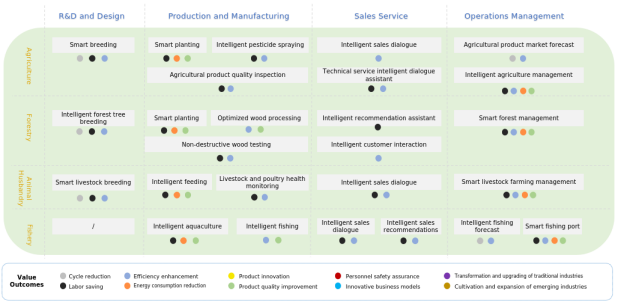

Fig. 3 Key Application Scenarios and Value of AI in the Primary Industry

Fig.4 Key Application Scenarios and Value of AI in the Secondary Industry

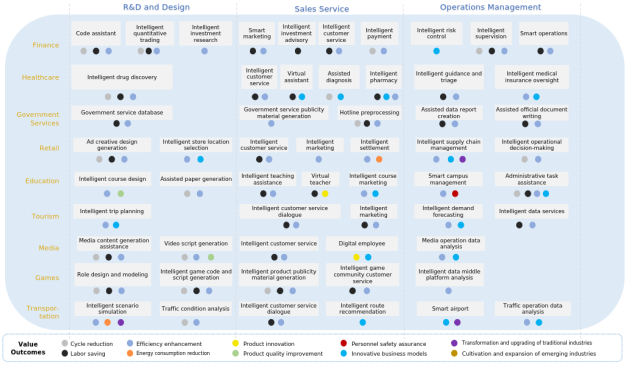

Fig. 5 Key Application Scenarios and Value of AI in the Tertiary Industry

(iv) High-value new scenarios continue to emerge, driving the deep integration of real and digital economies toward tangible outcomes

With technological iteration and deepening integration with the real economy, AI technology is penetrating core industrial processes including R&D and design, manufacturing operations, warehouse and logistics, and safety assurance. Based on the value creation mechanisms of AI-empowered integration of real and digital economies, this section systematically identifies high-value application scenarios across three major industries through the lens of four "new growth drivers". These high-value scenarios represent the substantive deepening direction for the integration of real and digital economies.

1. R&D and Design

AI applications can extend and amplify human knowledge and creativity, driving paradigm shifts in scientific research while enhancing R&D efficiency. In AI4S (AI for Science) scenarios, AI constructs complex predictive models to assist scientists in hypothesis generation, experimental design, and simulation-based inference, and enables insights unattainable through conventional methods, accelerating experimental design and drug discovery. **In simulation design scenarios,** AI can be applied in engineering design, product design, and industrial control, integrating with traditional industrial software to optimize design parameters, generate development code and sketches, and enhance software efficiency.

Case study of AI4S scenarios:

Google DeepMind's latest AI model in protein structure prediction—AlphaFold3—can precisely predict the structures and interaction mechanisms of all biomolecules including proteins, DNA, RNA, and ligands, providing critical insights into disease pathways, genomics, therapeutic targets, protein engineering, and synthetic biology[1].

[1] Source: AlphaFold 3 appears in Nature: The structure and interactions of all life molecules have been predicted by AI. May 9, 2024. https://www.thepaper.cn/newsDetail_forward_27308470.

Case study of simulation design scenarios:

CRRC has developed the "Aizor" large model for high-end equipment manufacturing, achieving end-to-end integration across industrial chains, supply networks, and innovation ecosystems through five-dimensional optimization: full-process operations, comprehensive management, full-cycle customer engagement, pan-industrial domains, and ecosystem-wide industries. Building upon this, the model focuses on R&D and design in advanced manufacturing. Its inaugural implementation—intelligent aerodynamic simulation systems for high-speed EMUs—has realized a quantum leap in simulation efficiency[1].

2. Manufacturing Operations

AI technology, deeply integrated with IoT and big data, has become fully embedded in traditional manufacturing processes, driving intelligent transformation. In intelligent production scheduling scenarios, AI enables real-time collection and analysis of multi-source data parameters, and empowers dynamic resource allocation and production scheduling optimization. **In predictive equipment maintenance scenarios,** AI can intelligently monitor equipment operating status, and predict equipment failures and maintenance needs, ensuring production continuity and stability. **In automated control scenarios,** AI integrates with smart robots and automated production lines to regulate operational precision in real-time, enhancing product quality and production efficiency.

Case study of intelligent production scheduling scenarios:

AVIC has implemented AI algorithms to optimize production scheduling in aircraft manufacturing, achieving 20% efficiency gains and 15% reduction in product defect rates, thus establishing an industry benchmark for intelligent transformation in high-end manufacturing[2].

Case study of predictive equipment maintenance scenarios:

CSG has developed the "XuRui 1000D" AI platform for pumped storage power stations. Leveraging over 5,000 AI algorithm inputs and outputs, it can provide precise diagnostics of unit conditions and perform "millisecond-level" analysis of operational data for the power stations, units, systems, and components, identifying the causes of equipment anomalies. Since its commissioning, the platform has accurately and proactively identified over 140 potential defects, generating an annual economic benefit of approximately 35 million yuan by reducing maintenance costs and avoiding unnecessary unit shutdowns[3].

Case study of automated control scenarios:

Siemens has integrated cutting-edge technologies including AI, augmented reality, and industrial IoT with automation systems in JYT's intelligent control scenarios for photovoltaic monocrystalline silicon production, which addresses critical challenges in wafer manufacturing such as non-linear control, MIMO coordination, and high-latency response. Each furnace station requires only 12.5% of the original number of operators, significantly decreasing various faults such as prolonged monocrystalline silicon temperature adjustment and crystal seeding failures[4].

[1] Source: SASAC. Sun Yongcai from CRRC: Striving to Be a Strong "Power Source" for National Technological Progress and Industrial Upgrading. March 10, 2025. https://baijiahao.baidu.com/s?id=1826209528453266110&wfr=spider&for=pc.
[2] Source: China City Hope Holding Group Co., Ltd. Fully Deploying the "AI+" Strategy, the AI Wave Sweeps Across the Globe—How Can State-Owned Enterprises Seize the Opportunity to Achieve High-Quality Development? March 20, 2025. http://www.zgcwjt.com/index.php?c=show&id=1126.
[3] Source: First in the country! CSG's "pumped storage + AI" combo is ultra-cool. May 5, 2023. https://mp.weixin.qq.com/s?__biz=MzU4NjI0MDk0Mw==&mid=2247510653&idx=1&sn=c09e47dacaec016cd877f3b2a2f23e31&chksm=fdfcacbdca8b25abac2dd034ad7ca59668a4ad980a327d7c147851dd9b1aa4299637140de082&scene=27.
[4] Source: Siemens in China. April 2024. https://assets.new.siemens.com/siemens/api/uuid:15cfad64-eb45-43d6-8048-77ff99eba1d0/corporate-ppt-2024-04-cn.pdf.

3. Warehouse and Logistics

AI technology is driving the transformation of transportation systems toward unmanned and collaborative operations through intelligent logistics scheduling algorithms, autonomous driving systems, and automated sorting robots, significantly enhancing operational precision and response speed. In intelligent logistics scenarios, autonomous vehicle fleets enable 24/7 operations, reducing labor costs while improving delivery timeliness and accuracy. **In automated warehousing scenarios,** humanoid robots can perform various operations such as grasping, transporting, and palletizing in complex environments, effectively improving warehouse management efficiency.

Case study of intelligent logistics scenarios:
UBTech has developed the world's first humanoid robot-to-autonomous logistics vehicle collaborative solution. The Walker S1 humanoid robot has commenced field deployment at BYD's manufacturing facilities, achieving seamless collaboration with L4 autonomous logistics vehicles, unmanned forklifts, and mobile industrial robots[1].

Case study of automated warehousing scenarios:
Amazon has deployed over 750,000 mobile industrial robots across its operations. Upon customer purchase completion, its fulfillment centers will automatically dispatch Sequoia robots to retrieve purchased items from shelves and deliver them to warehouse staff. The Sequoia system enhances inventory recognition and storage speed by 75%, while reducing order processing time by 25%[2].

4. Safety Assurance

AI systems possess enhanced situational awareness, intelligent decision-making, and autonomous operation capabilities, driving the evolution of safety protocols toward precision engineering and proactive prevention mechanisms, thereby improving emergency response efficiency and operational reliability. In emergency rescue scenarios, AI can be deployed in mine rescues, wildfire containment, and earthquake response, enabling real-time anomaly detection, timely rescue operations, and improved rescue efficiency. **In monitoring and early warning scenarios,** AI can be applied to production line operation monitoring and product quality inspection, enabling real-time and accurate identification and prediction of potential risks, thereby enhancing the accuracy of early warning systems. **In extreme operational scenarios,** AI-powered intelligent equipment can perform operational tasks in harsh environments, such as ensuring people's safety and improving operational efficiency and security in hazardous conditions like nuclear radiation, high temperature and humidity, oxygen deficiency, and confined spaces.

Case study of emergency rescue scenarios:
China Mobile (Chengdu) Industrial Research Institute, leveraging its Jiutian Medical Large Model, has collaborated with Guangzhou 120 Emergency Center and Sichuan Provincial People's Hospital to establish China's first AI-enhanced emergency rescue system. When emergency calls are received, the system will automatically extract critical information such as location and symptoms, and enter it into the dispatch system with one click, improving emergency response efficiency by approximately 30%. During the patient's wait for rescue, the system will generate first-aid instructions, and provide remote assistance, advancing effective intervention by 15 minutes[3].

[1]Source: BYD's manufacturing facilities deploy humanoid robots. October 16, 2024. https://baijiahao.baidu.com/s?id=1813072834637753520&wfr=spider&for=pc.
[2]Source: With AI, Amazon handles logistics even more skillfully. November 29, 2023. https://baijiahao.baidu.com/s?id=1783884799602292931&wfr=spider&for=pc.
[3]Source: Smart Health, Smart Future – China Mobile's Jiutian·Medical Large Model Demonstrates Revolutionary Strength. May 27, 2024. https://baijiahao.baidu.com/s?id=1800195963368082443&wfr=spider&for=pc.

Case study of monitoring and early warning scenarios: State Grid Shandong Electric Power Company and the Institute of Automation, Chinese Academy of Sciences have jointly developed FBW-based autonomous UAVs with intelligent inspection capabilities. Through the deployment of DCNN algorithms, these UAVs can execute multi-task operations, including transmission line inspection, spacer damper condition monitoring, and vegetation encroachment detection. This not only increases the defect detection rate to 80% but also enables unmanned inspections, effectively avoiding risks for personnel during inspections[1].

Case study of extreme operational scenarios: Lanzhou Jiaotong University has developed China's first intelligent tunnel inspection robots "Tianyou-3", pioneering new applications in tunnel excavation. Constructed with low-temperature/high-temperature resistant materials, the robots achieve dustproof and waterproof operation, enabling unmanned and fully autonomous execution in western China's extreme alpine environments. Engineering personnel remotely control robots for on-site operations from thousands of kilometers away, creating a novel hazardous-environment operational paradigm that exceeds human physical limits[2].

III.Challenges that Remain to Be Further Addressed

In the context of the in-depth development of AI-empowered integration of real and digital economies, both the technology supply side and the application side face a series of challenges: on the supply side, there are still issues of insufficient usability when deploying models in the real economy, along with risks such as data privacy breaches and AI-generated content forgery during model deployment; on the application side, there are numerous challenges including weak foundational capabilities in the digital and intelligent transformation of enterprises. The path toward the integrated development of real and digital economies remains long and challenging.

(i) Model technology usability needs improvement

The core production and operation processes of enterprises demand high precision, stability and reliability for AI technology, yet the current technical capabilities cannot fully meet these requirements. **First, the limited generalization capability of models results in a significant performance gap between real-world applications andtraining scenarios.** The enterprise model developmentoften relies on proprietary data and specific development environment. While these models may perform exceptionally well in the laboratory environment, their performance varies significantly when exposed to the complexities and diverse application demands of real-world production scenarios. **Second, model hallucination poses safety risks.** In core production processes, enterprises shall strictly adhere to fixed reasoning logic and operation workflows. However, due to inherent limitations in their mechanisms, models cannot fully eliminate hallucination issues, potentially introducing risks to production safety and product compliance. **Third, the costs of model training and optimization remain high.** Training enterprise-scale large models requires massive investments in high-quality data and intelligent computing power, while facing risks such as training interruption, difficult parameter optimization, and model performance degradation. This imposes significant financial pressure and technical trial-and-error costs to enterprises, especially small and medium-sized enterprises (SMEs).

[1] Source: BJNews. UAVs successfully complete FBW-based flight mission across the Yellow River, achieving efficient power transmission line inspection. September 20, 2023. https://baijiahao.baidu.com/s?id=1777555437067215703&wfr=spider&for=pc.
[2] Source: IFENG. First in the country! What can the tunnel robot "supervisor" developed by a Lanzhou university do. July 12, 2024 https://gs.ifeng.com/c/8b8PdWIuV7n.

(ii) There are risks in embedding technology into business sytems

During application of AI models, the unpredictability and autonomous decision-making of AI technology pose significant challenges for corporate AI risk governance. **First, compliance risks arise from enterprise data privacy breaches.** When utilizing AI models, enterprises may input critical data such as core production data, trade secrets, customer information and partner details into the models. If the models are hacked by cyber-attacks or suffer system leaks, this may cause damage to corporate commercial interests. **Second, trust risks arise from deepfake of AI-generated content.** Large models may integrate information from multiple sources based on unrealistic data to create deepfake content, including videos, government notices, corporate statements, celebrity remarks, and false financial information. Such AI-generated content could be widely disseminated, mislead the public, and severely damage corporate credibility and reputation.

(iii) Corporate transformation capabilities are constrained

Currently, as most enterprises struggle to overcome barriers in strategic planning, data governance, funding, and talents, AI technology remains fragmented, localized, and experimental in application, facing the "last mile" challenge in implementation.

First, strategic planning capability. Enterprises in traditional industries often have problems such as complex production systems, rigid organizational structure, and a lack of digital-intelligent strategic DNA. These constraints make it challenging for decision-makers to accurately evaluate the potential value and implementation feasibility of AI application, thereby hindering the development of forward-looking AI strategic plans. BCG surveyed AI application across more than 1,000 global enterprises, and found that only 4% have developed cross-functional cutting-edge AI capabilities, which are consistently generating substantial value; 22% possess AI strategies and advanced capabilities, and have begun creating value; 49% remain in the proof-of-concept phase, while 25% lack research and have yet to demonstrate tangible value from using AI.

Second, data governance capability. High-quality, diverse data is a critical factor in supporting the training and optimization of AI models. Currently, enterprises face weak data foundation, including challenges in production equipment data collection, heterogeneous data integration, cross-system data interoperability, and high costs of data cleaning and labeling. These issues result in insufficient data usability, making it difficult to support the creation of high-quality datasets. Tencent Cloud's latest survey reveals that 85% of enterprises encounter data quality issues during AI implementation, with 63% suffering AI project failures due to insufficient data governance.

Third, funding and talents. In terms of funding, intelligent projects require substantial investments in multiple areas, including AI model R&D, production equipment replacement, plant renovation, and software/hardware system upgrade. Enterprises face significant fiscal pressure because of extended ROI cycles. According to the

World Bank, over 41% of SMEs worldwide lack access to financing. In China, this proportion is 25%, below the global average, yet the total financing gap remains up to 3.8 trillion yuan. **In terms of talents,** enterprises require interdisciplinary talents who not only understand business operations but can also translate business needs into digital technology language. Taking Beijing as an example, the city ranks first in the AI industry nationwide, yet there remains a significant talent gap. According to estimates by the ZGC Industry Institute, by 2025, Beijing's demand for AI talent is projected to reach approximately 540,000, with a shortfall of 370,000 (including 160,000 core industry technical professionals and 210,000 interdisciplinary AI-skilled talents).

IV.Development Prospects

(i) Enhancing technological innovation and lowering application barriers

In response to the insufficient usability of AI application in real economy, first, we shall strengthen core technology R&D. Focus should be put on algorithmic mechanism innovation to improve model generalization and cross-scenario applicability. Technical means such as the collaboration of large and small models, multi-model cross-validation, and RAG can be leveraged to mitigate unpredictable risks from model hallucinations in core production processes, thereby improving the reliability of large models. **Second, we shall cultivate interdisciplinary talents.** In this regard, we should foster university-industry collaboration to establish AI oriented talent cultivation programs, strengthen the communication and exchange between research institutions' cutting-edge technical talents and enterprises' business talents, build enterprise-level interdisciplinary AI talent teams, and address bottlenecks in the implementation of AI applications.

(ii) Strengthening the data foundation and accelerating digital transformation

In response to the weak foundation for digital-intelligent transformation of enterprises, first, we shall advance digital networked construction to achieve data interoperability. Through equipment updating, system software upgrades, and OT-IT integration, enterprises can build a digital foundation across all processes and workflows to achieve interconnection of internal cross-system data and upstream-downstream supply chain data, ultimately breaking down information silos. **Second, we shall promote the development of high-quality industry datasets to support the construction of industry-specific large models.** Industrial leading enterprises should comprehensively consolidate internal data resources while actively collaborating to acquire external data resources, including upstream and downstream supply chains, industry associations, and administrative departments, to explore data ecosystem collaboration and synthetic data development and utilization. This approach can improve the diversity and richness of industrial datasets, ultimately breaking through data bottlenecks of large models.

(iii) Strengthening governance capabilities and building application security defenses

First, we shall enhance AI security risk identification and explore effective response strategies. In this regard, we should establish a systematic AI security risk identification methodology, explore an agile, accurate and efficient security risk identification mechanism, and strengthen risk assessment across all processes including model development, deployment, application, and iteration, ultimately creating dynamically evolving risk identification and response strategies. **Second, we shall strengthen the integration of technological innovation and governance tools to build a trusted technical support system.** In this regard, we should strengthen the security safeguards of blockchain and privacy computing in application scenarios to reduce risks such as algorithmic bias and privacy breaches. We should also strengthen algorithmic interpretability and develop fairness quantification tools to mitigate discrimination and forgery risks at the source. Meanwhile, we should promote federated learning and privacy computing to ensure security for the privacy protection of data sharing between enterprises.

(iv) Jointly building application ecosystems and improving inclusive services

First, we shall establish a dual-driven AI product capability shared ecosystem integrating market-oriented services and public services. Leading enterprises on the AI supply side (algorithm models, hardware equipment, and software applications) should aggregate resource capabilities to provide SMEs with light weight and standardized AI products and solutions, thus reducing barriers for SMEs in AI technology application. Industry associations and leading companies should support SMEs within their sectors in technological integration and application innovation through methods such as clarifying innovation needs, sharing innovation resources, opening application scenarios, and offering technical consulting. This multi-faceted support, encompassing technology, capital, talent, and data, will fully unleash the vital role of SMEs in the integrated development of real and digital economies. **Second, we shall promote the co-construction and sharing of intelligent computing infrastructure.** In this regard, we should carry out large-scale construction and intensive development of high-performance computing resources to support large-scale AI model training and meet diverse, customized inference needs of enterprises.

Introduction to China Mobile Think Tank(CMTT)

China Mobile Think Tank(CMTT), the core R&D institution within China Mobile's technological innovation system, positions itself as "a world-class innovation engine in information service technologies" while fulfilling its dual role as a national strategic technology powerhouse and corporate innovation leader.

CMTT has actively undertaken over 200 state-funded national key S&T projects, including major national innovation platforms such as the "Next Generation Mobile ICT National Engineering Research Center" and the "National New Generation AI Open Innovation Platform for Intelligent Networks". CMTT has played a pivotal role in China's mobile communication evolution through "1G initiation, 2G catch-up, 3G breakthroughs, 4G parallel development, and 5G leadership". Its pioneering computing-power network concept has gained national strategic recognition, while leading advancements in optical communication technologies. It has established the Jiutian AI Innovation Zone, launching foundational and industry-specific large AI models, positioning itself as the national AI leader among central SOEs. Its digital-intelligent capabilities have been widely deployed across network operations, marketing systems, and management architectures. CMTT has received 7 Special Prizes for National Scientific and Technological Progress Award and 213 provincial/ministerial awards.

In March 2023, China Mobile established the CMTT with its Research Institute as the core entity, aiming to provide policy decision-making support in digital economy for national and governmental entities, facilitate industrial digital transformation, and support corporate high-quality development. Rooted in the information industry, CMTT leverages China Mobile's technological, market, industrial, and data advantages to consolidate cross-sector research capabilities in the digital economy. Committed to professional research methodologies, specialized analytical perspectives, and evidence-based policy recommendations, it systematically enhances the academic rigor and authoritative stature of policy-oriented studies. Furthermore, it amplifies research impact through strengthened credibility, public trust, and dissemination efficacy, providing intellectual empowerment for high-quality development of the digital economy.


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