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Spotlight

National collaboration mechanism for standardization research institutes established
全国标准化研究机构协作机制成立

Dialogue

Dialogue on standards: standardization facilitates the healthy development of AI
标准对话：标准化助力人工智能健康发展

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CHINA WATER WEEK 2025

March 22-28

Conserving water and sources with standards

Co-building a sustainable future

Branch of Resource and Environment, CNIS
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公益广告

Working together to achieve more

Coming together is a beginning, keeping together is progress, and working together is success. The theory is almost applicable to any area, and the standardization community is no exception.

The State Council issued the *Opinions on Accelerating the Construction of Unified National Market* in March 2022, which has become an important national strategy since then. Standards must and shall play a big role in speeding up the construction of a unified national market and improving market regulation. The *National Standardization Development Outline* also requires to establish the standardization science and technology system led by the national comprehensive standardization research institute and supported by industrial, regional and local standardization research institutes.

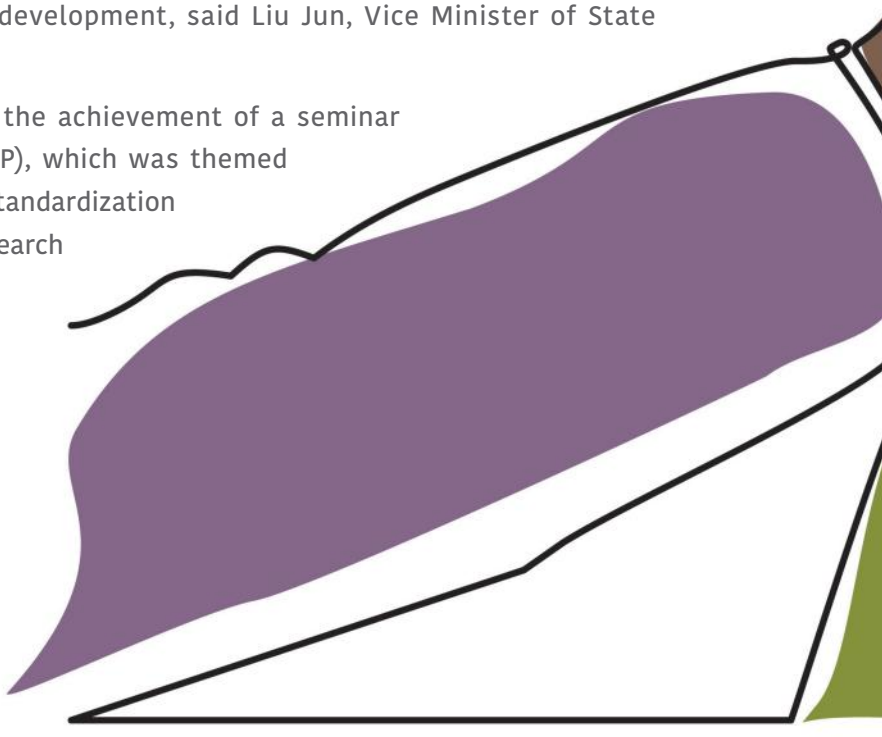
To this end, the national collaboration mechanism for standardization research institutes was established at the end of November 2024, which was led and organized by China National Institute of Standardization (CNIS), and participated by 64 institutes across the nation.

At the inaugural ceremony, CNIS President Luo Fangping said, we will work hand in hand with other standardization research institutes across the country, taking practical actions, collaborating closely, and striving together. Our goal is to build a high-level, distinctive, and smooth operating collaborative innovation platform, and to establish a sound ecosystem for standardization research based on shared development, mutual benefits and win-win cooperation.

The collaboration mechanism is very significant for helping standards play a fundamental and leading role in facilitating high-quality development, said Liu Jun, Vice Minister of State Administration for Market Regulation (SAMR).

In the DIALOGUE column, we present you the achievement of a seminar organized by China Standardization Press (CSP), which was themed on AI standardization. The event invited five standardization and AI experts from leading companies and research institutes to discuss the future development of AI standardization, the standardization mechanism to adapt to AI technologies, the role of standardization in safeguarding users' rights and interests, how to create the healthy and sustainable AI ecosystem with standardization, as well as the in-depth application of AI in various sectors.

To find more details, read the March/ April issue. Enjoy your reading!



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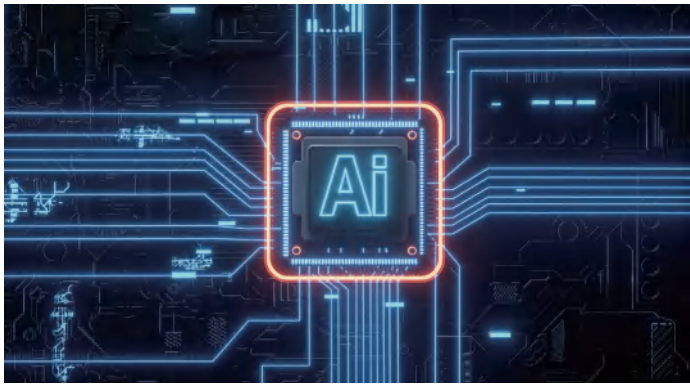
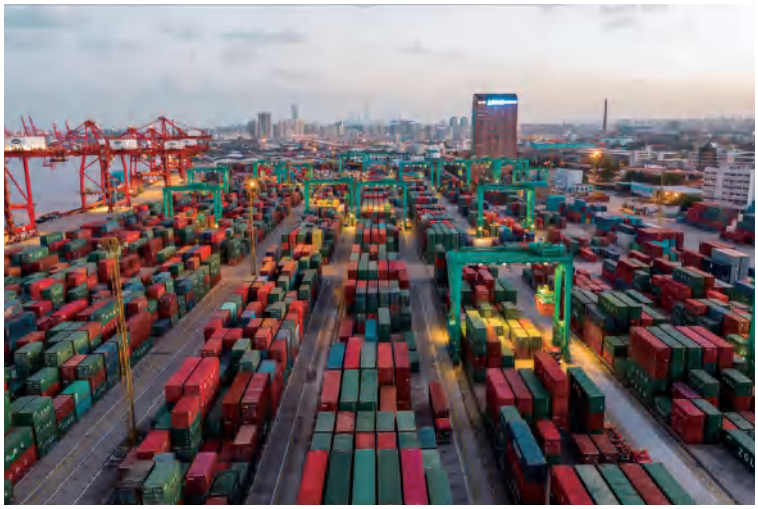
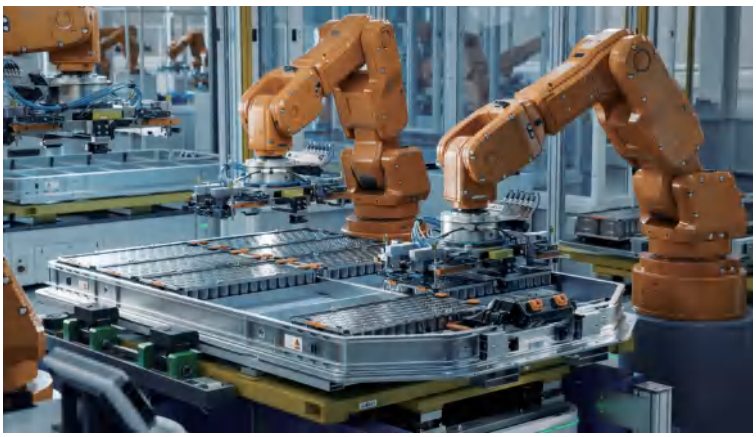
CONTENTS







China supports foreign-owned enterprises to join in standards development and revision

A briefing on policy was held by the State Council Information Office of China on February 20. At the briefing, Zhou Weijun, Director General of the Credit Supervision and Management Department, State Administration for Market Regulation (SAMR), expounded the policy on the participation of foreign-owned enterprises in the development and revision of standards for the large-scale equipment upgrade and consumer goods trade-in programs.

Standards improvement is the key engine to boost the large-scale renewal of equipment and the trade-in of consumer goods, according to Zhou. SAMR plans to develop 294 national standards for the programs in 2024-2025, and has issued 168 national standards, including 81 for equipment renewal, 49 for trade-in of consumer goods, and 38 for recycling waste products.

Relevant authorities always positively support the participation of foreign-owned enterprises in standards development and revision, Zhou stated. The *Guidelines on the Participation of Foreign-owned Enterprises in China's Standardization Work*, jointly released by the National Standardization Administration of China (SAC), National Development and Reform Commission, and Ministry of Commerce, has clarified the entity and scope of participation, patent protection, and rights and obligations of foreign-owned enterprises.

"On the one hand, SAMR strives for the openness and transparency of the development and revision of national standards, and enables the participation of foreign-owned enterprises in every step such as standards proposal, development, public consultation, and review, through the National Public Service Platform for Standards Information. On the other hand, application channels for TC members are available for the society, to enhance the breadth of TC membership." By the end of 2024, foreign-owned enterprises have become members of 837 TCs, which account for 61% of all TCs, said Zhou.

SAMR will expedite the development of vital standards together with relevant departments, formulate policies on steadily expanding the institutional opening-up of standards, and support foreign experts to join the association standards development and related standards organizations. More foreign-owned enterprises and foreign experts are welcomed to participate in the standards development and revision, to make greater achievements in the large-scale equipment upgrade and consumer goods trade-in programs.

SAMR kicks off pilot project of local standards management system reform

SAMR published the *Notice on Deepening the Pilot Project of Local Standards Management System Reform* on January 27.

Adhering to the deployment and requirements of the third plenary session of the 20th CPC Central Committee, the pilot work aims to explore new measures, mechanisms and models of the reform of local standards management system, and reshape the local standards development process, standards system, and institutional system, to propel the building of a unified national market and high-quality development. The pilot project will be launched in 13 provinces and cities including Hebei province, Heilongjiang province, and Shanghai.

The notice lays out key tasks in five aspects: First, introducing the negative list for local standards development on a trial basis to reduce the amount of local standards; Second, establishing the new whole-process management mechanism of local standards, and promoting the reconstruction of local standards development process; Third, implementing rigid management of local standards development at the city level, and improving the management system; Fourth, strengthening the supervision of application, adoption and implementation of local standards; Fifth, exploring new paths to change the function of local standardization work and enhancing their standardization capabilities.

Sixteen sectoral standards for ecology and environment released

The Plan of Protecting Ecological Environment during the 14th Five-Year Plan period (2021-2025) requires to establish the national standards system for environment, develop a batch of national environmental standards, and build the national database for environmental benchmarks.

Basic data underlies the development of environmental standards and the establishment of national environmental standards database. The rationality, accuracy, and reliability of data are directly related to the quality of work.

Based on relevant standards of environment informatization, metadata, and dataset, the Ministry of Ecology and Environment released China's first batch of 16 sectoral standards for environment benchmarks, including HJ 1410.1-2025, *Basic dataset of derivation of water quality criteria for aquatic organisms—Part 1: General principles*. They are also the first group of data standards in the environment field.

The standards include one standard for general principles and 15 ones for the dataset of different kinds of aquatic organisms. These standards can be applied as a set with HJ 837-2022, *Technical guideline for deriving water quality criteria for freshwater organisms*, and HJ 1260-2022, *Technical guideline for deriving water quality criteria for marine organisms (on trial)*.

The basic dataset sets the criterion for specific business, consisting of normative expression of necessary data element, which can guide the standardized collection of data and the standardization work of information system. Through implementing data governance from the source, the basic dataset also lays the foundation for data exchange and sharing, and big data application among information systems.

The standards provide guidelines on derivation criteria for aquatic organisms, and guarantee the high-quality data for relevant environmental research.

Annual meeting of SAC/SWG 29 on standards digitalization held

The annual meeting of SAC/SWG 29, *Digitalization of standards*, and the standard technical review meeting were held in Beijing on February 14, which were presided over by Wang Yiyi, Secretary-General of the working group.

Wei Hong, Deputy Director-General of Standards Technical Management Department of SAMR, Li Zhiping, Vice President of China National Institute of Standardization (CNIS), and approximately 90 participants attended the meeting.

Wu Hequan, Academician of Chinese Academy of Engineering and Consultant of SAC/SWG 29, Zhang Xiaogang, former ISO President, and Bai Dianyi, Researcher of CNIS, put forward expectations and suggestions for the work of SAC/SWG 29 in the aspects of AI-driven standards digitalization, standards digitalization and intellectualization, and standardization principles and methods. Wei Hong praised the achievements of SAC/SWG 29 in 2024, and put forward relevant requirements from the perspectives of the position and direction of the working group, standards development, as well as international exchange and cooperation.

On behalf of CNIS, which holds the secretariat of SAC/SWG 29, Li Zhiping introduced the work of CNIS in 2024, highlighted the issues that the working group needs to pay attention to in the future, and promised to gather resources and support the work of SAC/SWG 29. Wang Yiyi delivered the annual work report, and introduced the work in 2024 and the work plan for 2025, which was approved by the members of the working group.

The attendees also approved the technical review of two national standard drafts for standards digitalization and standard-oriented knowledge graphs respectively.

Chinese experts attend the 62nd session of the IPCC

The Intergovernmental Panel on Climate Change (IPCC) convened the 62nd session on February 24-28 in Hangzhou, Zhejiang province, which was the first time for IPCC to hold the session in China.

The session attracted approximately 600 attendees, who were government representatives of more than 130 countries, and representatives of relevant observer organizations and international organizations, including Chen Zhenlin, Administrator of China Meteorological Administration and Chief Representative of China in IPCC, Jim Skea, IPCC Chair, and Liu Zhenmin, China's Special Envoy for Climate Change.

Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the IPCC is an organization of member countries of the UN or WMO. ISO became an IPCC Observer Organization in 2024, and sent representatives to attend the meeting for the first time. Commissioned by the ISO Central Secretariat, Sun Liang and Zhang Xiaoxin, Associate Researchers from the Branch of Resource and Environment, China National Institute of Standardization (CNIS), attended the session as observers.

In recent years, CNIS experts have actively participated in the ISO climate change-related governance mechanisms and standards development for climate change. In the next step, CNIS will vigorously participate in ISO's work, enhance the level of cooperation with ISO, IPCC and other international organizations, and better play the important role of standards in addressing climate change.

IEC standard for AAL robots assists lives of the elderly

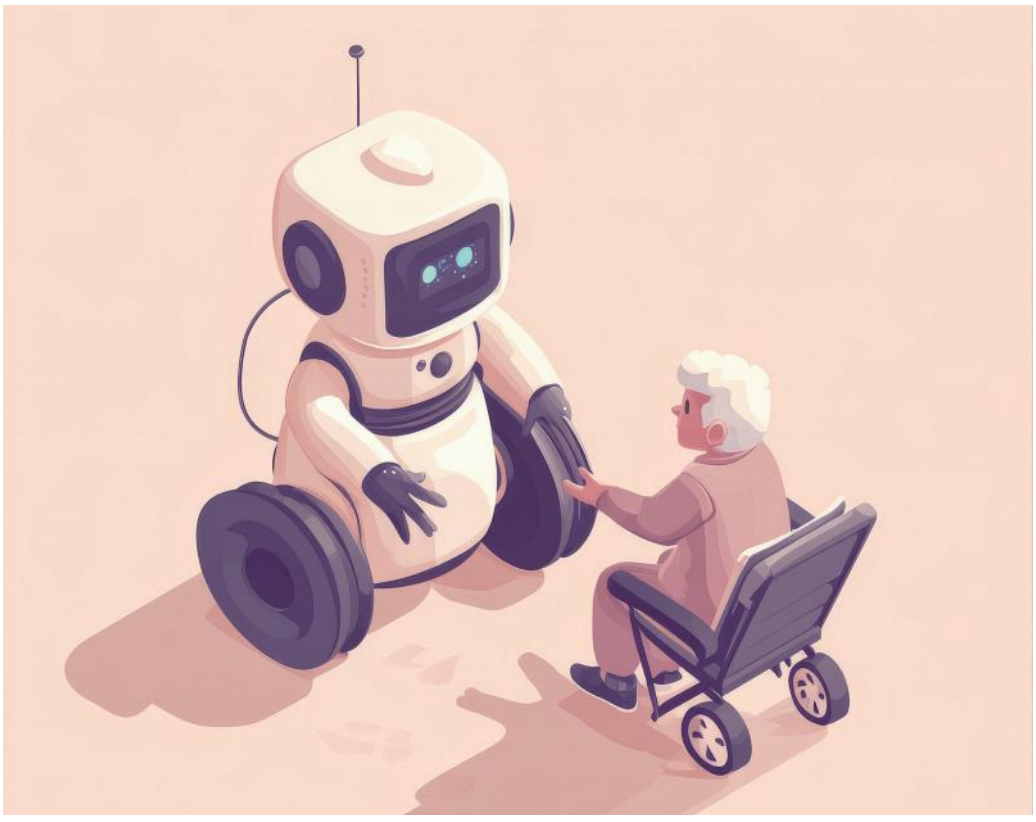
Recently, the international standard IEC 63310:2025, *Functional performance criteria for AAL robots used in connected home environment*, was officially issued, the development of which was led by China.

The standard provides the functional performance criteria and guidelines for robots used in the active assisted living connected home environment (AAL CHE), and sets the benchmarks for product design, manufacturing, testing and certification of various kinds of elderly-care robots, which will lead the healthy development of the global industry.

According to the WTO, the global population aged 60 and above is predicted to rise to 2.1 billion by 2050, with 426 million elderly population aged 80 and above. Therefore, the emergence of AAL robots can assist the social and family care for the elderly, and enable the elderly to have dignified and independent high-quality life.

IEC 63310:2025 focuses on the needs and characteristics of the elderly in daily life and health care under the circumstances of connected home environment. Based on the assistance levels needed by elderly users, it specifies the functions and performance classification of AAL robots.

The standard is expected to guide the manufacturers to target at physiological and psychological characteristics and actual needs of the elderly, better design and develop AAL robots and improve product quality, and enhance the integration of the elderly into the society, so as to benefit the global aging population. It will prosper the AAL robotics industry and boost global economic growth.



CNIS expert wins ISO Excellence Award

Liu Meng, Associate Researcher form the Branch of Resource and Environment of CNIS, was awarded the ISO Excellence Award by the ISO Central Secretariat on February 19, for his contributions to ISO/TC 180/SC 4, *Systems—Thermal performance, reliability and durability*. As the project leader, Liu has made efforts to develop international standards such as ISO 24194:2022, *Solar energy—Collector fields—Check of performance*.

The ISO Excellence Award recognizes the contribution of individuals for recent achievements related to ISO's technical work that can further the interests of standardization and related activities. It is the first time for a Chinese expert to win the award in this field, which shows ISO's recognition for China's contribution to international standardization of solar energy.

As the domestic technical counterpart, CNIS has actively organized relevant parties to participate in the work of the ISO/TC 180 and its sub-committees, and has promoted Chinese experts to lead the revision of 7 relevant ISO international standards, with another 9 ones under development. CNIS will facilitate relevant work to provide high-level support for the effective development and utilization of solar energy.

ISO/TC 347/AHG 4 convenes 5th meeting

Presided over by Convenor Zhuang Yuanyuan, ISO/TC 347/AHG 4, *Integrated Pest Management (IPM),* held the 5th meeting on February 7, which was attended by 15 pest management experts from 10 countries including the U.S., France, Japan, China, Jamaica, and the Netherlands.

The meeting focused on the updated work plan of the working group and carried out in-depth discussions. Experts from Singapore shared the experience in crop pest management, providing useful reference for the development of international standards. Chinese experts made a report on the IPM data.

With joint efforts, more progress was expected to be made in the field of IPM.

ISO releases standard for traditional Chinese medicine

The international standard ISO 19851:2025, *Traditional Chinese medicine—Cinnamomum cassia branch*, was published recently, the development of which was led by the team of Zhang Tong, Professor at Shanghai University of Traditional Chinese Medicine.

Zhang Zhongjing, a Chinese doctor during the Eastern Han Dynasty (25-220), was famous for his book *Shanghan Lun*, a medical text that sets out the basic principles of traditional Chinese medicine, which was taken as the Bible of many physicians. The *Cinnamomum cassia* branch was one of the most commonly used Chinese medicines in Zhang Zhongjing's prescriptions.

Moreover, the use of *Cinnamomum cassia* branch extends to the globe, especially in East Asia and Southeast Asia. It plays a significant role in the health care, economy and other aspects. Catering to the rapid development of traditional Chinese medicine industry, Zhang Tong submitted the standard proposal to ISO/TC 249 on traditional Chinese medicine, and the standard was later jointly developed by experts from China, Canada, Italy, Japan, Republic of Korea, and Australia.

ISO 19851:2025 specifies the quality and safety requirements for *Cinnamomum cassia* branch. It is applicable to *Cinnamomum cassia* branch sold as natural medicines in international trade, which is expected to enhance international transactions, promote cooperation between universities and enterprises in the field of traditional Chinese medicine, and facilitate industrial development.

National collaboration mechanism for standardization research institutes established

全国标准化研究机构协作机制成立

By Jin Jili
文/靳吉丽

Hosted by China National Institute of Standardization (CNIS), the Inaugural Ceremony of the National Collaboration Mechanism for Standardization Research Institutes and the 4th Roundtable on Standardization Reform and Development were held in Beijing on November 29, 2024, to implement the *National Standardization Development Outline* and establish a standardization science and technology system with the comprehensive standardization research institute at the national level as the leader, and standardization research institutes at the industrial, regional and local levels as the mainstay.

The collaboration mechanism is of great significance for further giving play to the fundamental and leading role of standardization in promoting high-quality development. It is expected that the collaboration mechanism will facilitate in-depth cooperation among nationwide standardization research institutes, further improve the overall level of standardization in China, and boost scientific and technological self-reliance, said Liu Jun, Vice Administrator of SAMR.

He stressed that we should enhance the level of collaboration, and serve the construction of a unified national market and the central tasks of local governments in the development of standards data resources, transformation of scientific and technological achievements, cultivation of professional talent, and other aspects. We should strive to achieve breakthroughs in standardization science and technology, and lead the development of strategic emerging industries and future-oriented industries with innovation in technologies and standards, so as to promote new quality productive forces.

Xiao Han, Director General of Standards Innovative Management Department of SAMR announced the list of the council members of the collaboration mechanism, and witnessed the signing of the statute by the council members and the official launch of the collaboration mechanism together with Wu Hequan, former Vice President, Academician of the Chinese Academy of Engineering (CAE), and Chair of China Standardization Expert Committee, Gong Ke, former President of Nankai University, Liu Hongsheng, Director General of Standards Technical Management Department of SAMR.

CNIS, assuming the chairmanship of the council, unveiled the *Initiative of the National Collaboration Mechanism of Standardization Research institutes*. Chongqing Institute of Quality & Standardization, Shenzhen Institute of Standards and Technology, and Shandong Institute of Standardization, made statements respectively as the vice-chair or member of the collaboration mechanism.

Luo Fangping, President of CNIS, addressed the event. Wu Hequan and Gong Ke gave speeches, elaborating on the development path of the digital and intelligent transformation of standards, and the opportunities and challenges that coordinated digital and green transformation has brought to the development of standardization.

After the inaugural ceremony, the Roundtable on the Reform and Development of Standardization was held, where experts from the industry, universities, and research institutes delivered speeches on the topic of frontier theory and practice of standardization development, and had a roundtable discussion on the new measures for standardization reforms during the 15th Five-Year Plan period (2026-2030).

Establishing a sound standardization research ecosystem with win-win cooperation

Luo Fangping
President of CNIS

In July 2024, important tasks for further comprehensively deepening reforms and promoting the Chinese modernization were deployed at the third plenary session of the 20th CPC Central Committee. A number of new requirements were put forward for the reform and development of standardization.

CNIS and other standardization research institutes across the country, as the pivotal force in driving standardization reforms, have undertaken the mission of standardization reforms to meet development needs, and ushered in unprecedented development opportunities.

In China, standardization research work is highly valued by the government. The *National Standardization Development Outline* clearly states that it is necessary to "strengthen the theoretical and applied research on standardization, and build a standardization science and technology system with the comprehensive standardization research institute at the national level as the leader and standardization research institutes at the industrial, regional and local levels as the mainstay", which shows the directions and clarifies the tasks for us to establish the national collaboration mechanism of standardization research institutes.

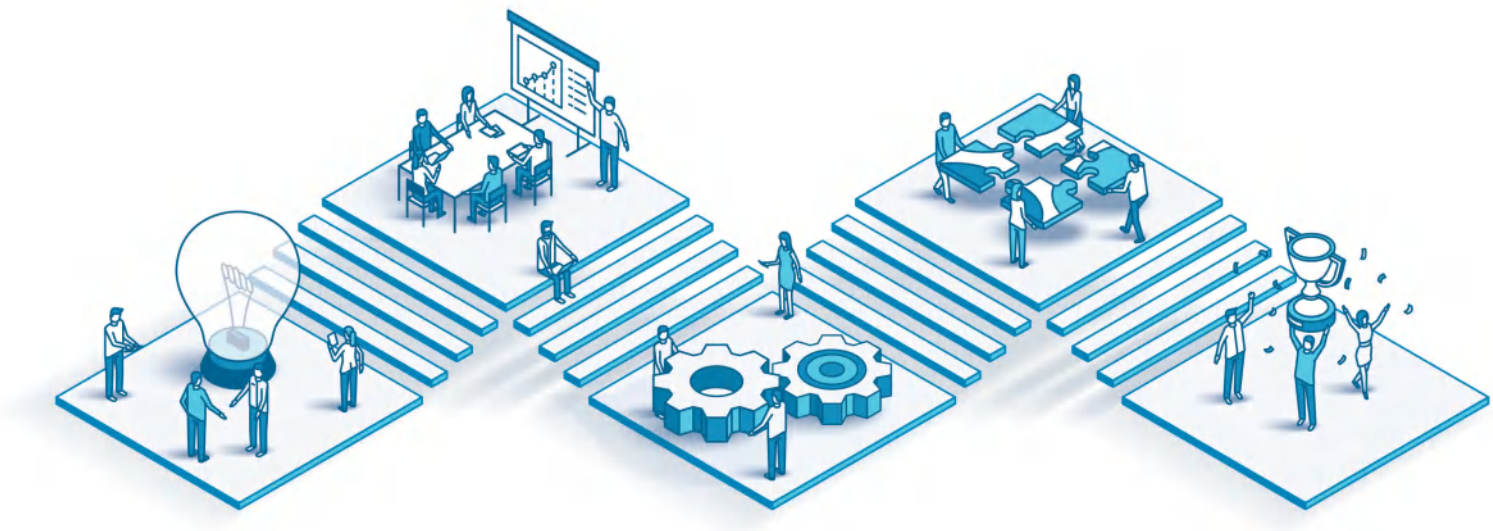
Since the second half of 2024, CNIS has initiated the preparatory work for establishing the collaboration mechanism. It has held symposiums with local standardization research institutes in five regions, including Hunan, Xinjiang, Chongqing, Inner Mongolia and Fujian. At the symposiums, participants discussed the organizational structure, operational mode, priorities and other aspects of the collaboration mechanism, and put forward opinions and suggestions. They talked about standardization visions, shared practical experience, and jointly planned for the reform and development, presenting the courage of taking responsibilities and the sincere unity of standardization research personnel across the country.

After the preparation for nearly half a year, smooth progress has been made. The first batch of 65 research institutes participating in the collaboration

mechanism held a preparatory meeting for the establishment of the collaboration mechanism on November 28, 2024. They reviewed and approved institutional documents such as the statute of the collaboration mechanism, announced the list of the first council members, examined and approved the work plan of the collaboration mechanism in 2024 and 2025, and approved the plan for establishing two working groups on talent cultivation and standards data resources. Today, the collaboration mechanism is ready to embark on a new journey towards the reform and development of standardization undertaking.

On behalf of CNIS, I solemnly pledge that as the leader of the collaboration mechanism, we will boldly undertake the responsibilities and missions of the national comprehensive standardization research institute. With great ambition to advance the significant cause of standardization, we strive to play a leading role in driving the internationalization of standards.

We will work hand in hand with other standardization research institutes within the market regulation system across the country, taking practical actions, collaborating closely, and striving together. Our goal is to build a high-level, distinctive, and smooth operating collaborative innovation platform, and to establish a sound ecosystem for standardization research based on shared development, mutual benefits and win-win cooperation, advancing China's standardization undertaking to new heights.



AI promotes digital and intelligent transformation of standardization

Wu Hequan
Academician of CAE

AI has promoted the transformation of the research and development paradigm of standardization.

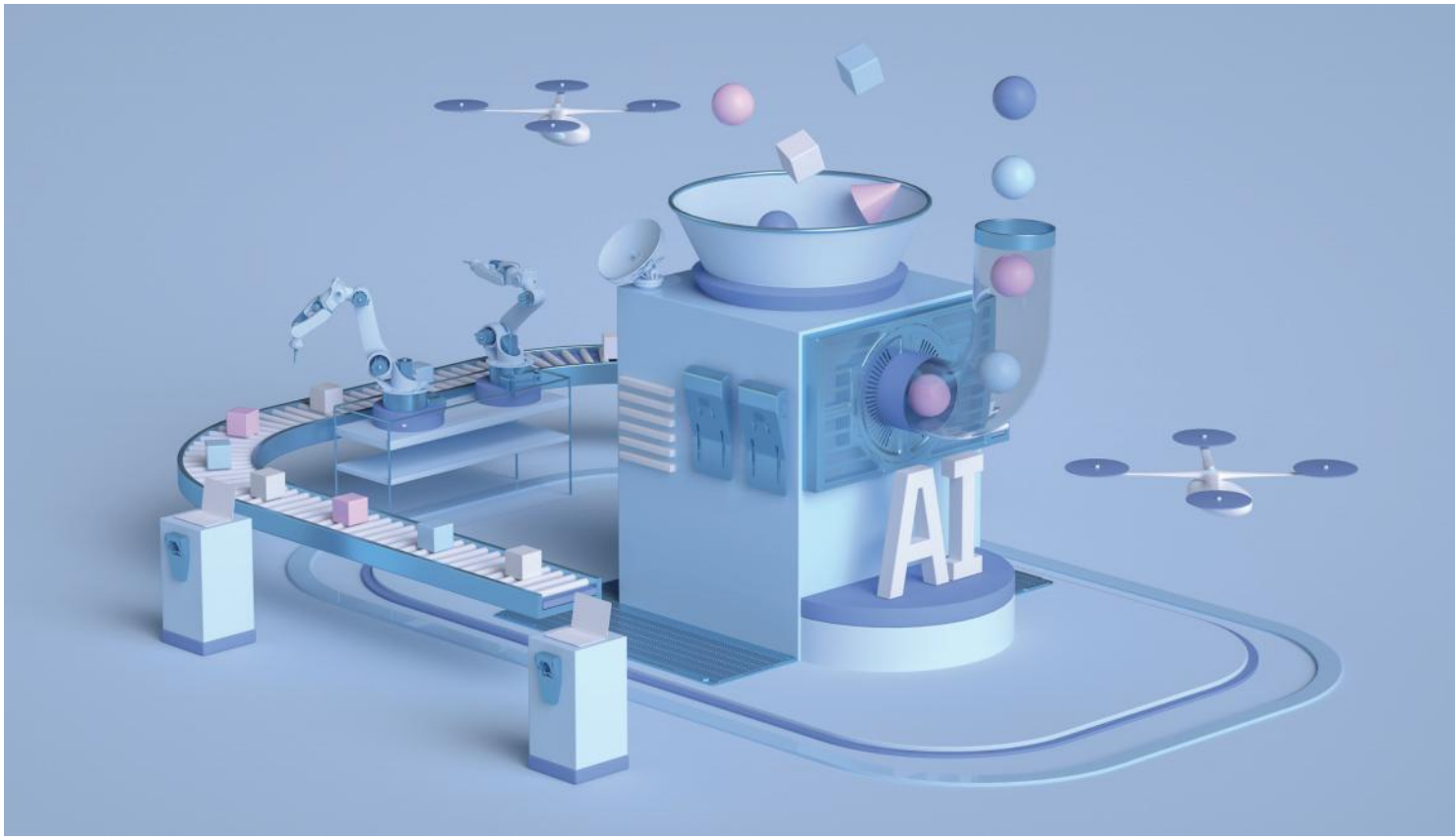
The application of AI technologies in standardization are showed in five aspects: firstly, the standardization of AI technologies has become a very urgent topic; secondly, AI provides new methods for standardization research; thirdly, AI has initiated the standardization of some emerging industries; fourthly, AI has prompted many new growth drivers in the standardization of intelligent application in vertical industries; fifthly, AI has promoted the implementation of standards digitalization.

What are the standards for AI? Based on the documents of relevant ministries and commissions, and by referring to ISO standards, we roughly divide such standards into three categories.

The first category is standards for data quality, including methods for measuring if the data meets the quality requirements, how to identify the data generated by AI, if the multi-modal semantics of data can be equivalent, as well as the management of data lifespan quality. The second category is standards for performance evaluation of machine learning, natural language processing and recognition, neural networks, and other aspects. The third category is standards for safety supervision, which cover functional safety and interpretability safety.

The digitalization of standards is a direction for standardization development, which is actually an important form of the integration of digital and physical worlds. One typical example is the digitalization of the presentation form of standards. In the past, many standards were in text form. Since standards contain formulas, charts, tables, and even photos, their digitalization is not only about texts, but also about the conversion of formats and rules during the digitalization process.

We hope that digitalization is convenient for readers, and also machine-readable. It is not just about changing the format into a digital one, but



also about making it understandable and executable by machines, and even enabling intelligent application.

Now, it is appropriate to use AI methods to identify the text format of standards and even understand their semantics, and translate them in standardization work. Many domestic research institutes are studying different formats and the semantic understanding of parametric graphic curves. In the future, the digitalization of standards will include not only texts, but also open-source software and computer programs, all of which may become standards.

Although the digitalization of standards was proposed earlier than AI, now it is the great time to integrate the digital application of standards with AI. Digitalization includes not only converting texts into digital forms, but also establishing a working database and developing it into a standard-oriented knowledge graph.

There are some new models for China's standardization work in the new era, which are reflected in four aspects: firstly, the focus has shifted from national standards to association standards; secondly, the development and revision of standards have evolved from uncertainty to iterative stage goals; thirdly, standardization work has transitioned from numerous experiments to simulation-based optimization by computer means; fourthly, the standardization management of government has shifted from micro-level guidance to macro-level guidance, which requires the government to provide a sound ecosystem for its development in the whole society. The coordination mechanism established today can serve as a good way to create such an ecosystem.

Standardization reform and development in the context of digital and green transformation

Gong Ke
Executive President of Chinese Institute of New Generation Artificial Intelligence Development Strategies

The standardization reform and development are faced with two transformations. One is the revolutionary digital transformation driven by emerging digital technologies such as AI, big data, and the Internet of Things; the other is green transformation driven by human values. How to position standardization work to serve the two transformations and Chinese modernization has become a prominent strategic task of the times.

A standardization system that can adapt to and accelerate the digital and green transformation must be established, so as to play a fundamental and leading role.

In terms of the system, the coordinated digital and green transformation will surely break through the industrial segmentation and penetrate into all industries and professions. This means that standardization work requires an effective overall planning and cooperation mechanism with cross industries, disciplines, and TCs, in order to adapt to new changes in the system.

In terms of the content of standardization, the transformations have put forward many urgent standardization tasks, which feature rapid responsiveness and global relevance. Also, a comprehensive green review and update of existing standards are needed. Many existing standards may not meet current green requirements, especially those related to low carbon.

In terms of methods, to respond to digital and green transformation, a comprehensive reform on the system, fields, content, and methods of standardization should be carried out. Efforts should be made to integrate digital, networked and intelligent development by establishing an open-source public platform, building a model of standards information, and incorporating green development into the strategic goals and guidelines for standardization development.

编译/靳吉丽
(Edited and translated by Jin Jili)

High association standards facilitate high-quality industrial development

You Fang
Director of Standardization Department, Huawei Technologies Co., Ltd.

The *Standardization Law of China* and *National Standardization Development Outline* have established a dual structure of government-led standards and market-driven standards. The former plays a very important cornerstone role in serving domestic supervision and stable market operation. While the latter, association standards in particular, can quickly respond to the needs of the market and technological innovation.

How can an association standard be widely adopted in the world? In the first condition, the standard itself is widely accepted across the world. Or when it develops to a certain stage, it can be absorbed by the three international standards organizations to become an international standard, so that it has better prospects for global adoption.

With increasing investment year by year, Huawei has participated in the activities of ISO, IEC and ITU and hundreds of international organizations for association standards. We deeply feel that in the industries of global key and emerging technologies, association standards of these organizations tend to play a better role than those of the three international standards organizations. This may be related to the development of technologies and the positioning of international standards organizations. In particular, association standards play a big role in interconnected protocol technology.

How to develop high-quality association standards? First, these organizations should have convenient registration and flexible governance rules. Second, international positioning, openness and transparency are very important factors in attracting global members. Third, it is easier for the organizations to succeed with the help of industry pionneers. Fourth, there is a channel to introduce association standards to ISO. Fifth, association standards, together with conformity assessment, can promote technological brands and international implementation.

Standardization of intelligent social governance

Ru Peng
Professor at School of Public Management, Tsinghua University, Secretary-General of SAC/SWG 35

In recent years, a clear trend of international standardization is the shift from technical standards to governance standards.

The Chinese government has attached great importance to the profound impact that intelligent technologies have brought, and the important role of standardization in addressing the challenges of intelligent social governance.

Relevant departments are formulating the *Guidelines for Standardization of Intelligent Social Governance*. This policy will provide guidance on the overall and governance principles of intelligent social governance standardization, and application scenarios and social impact observation and evaluation of intelligent technologies, and initially build a standards system framework for intelligent social governance.

At present, the main topics of international and domestic intelligent social governance standardization have gradually expanded from algorithms, data, and security to privacy, ethics, risk management, management systems and social impact. The National Working Group on Intelligent Technology Social Application and Evaluation Basic Standardization (SAC/SWG 35), whose secretariat is held by Tsinghua University and CNIS, has conducted some practical explorations.

Since its establishment, the working group has focused on the performance requirements of social applications, principles and methods of social applications, optimized governance solutions, social impact observation, application effects and impact evaluation of intelligent technologies. So far, it has promoted the approval of five national standards projects, such as the *Social impact of generative artificial intelligence technology application—Assessment guidelines*, and established three standards drafting working groups for intelligent technology energy, government affairs, and social applications of embodied intelligence. In the future, it will also promote the development of key standards in relevant fields.

Standard innovation supports the construction of new power systems

Zhao Haixiang

Director of Technical Standards Division of Science and Technology Department, State Grid Corporation of China

State Grid Corporation of China (SGCC) has fulfilled its responsibilities as a central enterprise, implemented the national decisions and arrangements on standardization work, and vigorously put the *National Standardization Development Outline* in place, to support the high-quality development with standardization.

At present, one of the core tasks of SGCC is to accelerate the construction of new power systems. It will accelerate standards innovation to meet the needs of new power systems in the following areas.

First, the mode of scientific research management must be changed. We will accelerate the deep integration of standardization and scientific research project management, and truly realize the role of standards in the transformation of innovative achievements.

Second, the scientific and technological innovation demonstration projects shall be optimized and adjusted. We will change the organizational model of the experimental research system, support the construction of the standards system for entire new power system, and accelerate the development of relevant standards based on major scientific and technological innovation demonstration projects.

Third, the construction mode of the standards system shall be changed. We will use system-level standards to improve the quality of the entire equipment-level standards, and achieve the integration of equipment level and system level.

Fourth, the working method of association standards shall be changed. We will develop good association standards under the guidance of the government and relevant organizations, and improve the quality of association standards through application.

Fifth, the digital transformation of standards shall be accelerated. The production process can be controlled by digital technologies and realized by digital standards.

Development trend of SEP disputes

Ding Wenyan
Director of the Civil and Commercial Trial Research Department, China Institute of Applied Jurisprudence

Standard essential patent (SEP) is the product of the integrative development of patents and standards, and is also the representative of new quality productive forces. Since SEP contains huge commercial interests and value, in recent years, there have been incessant cases brought to court by companies, especially multinational companies, due to disputes arising from SEP licensing negotiations.

SEP disputes are a general term for a series of disputes between right holders and implementers due to SEP licensing negotiations.

SEP disputes around the world have the development trends below: first, many countries are issuing relevant policies to influence the resolutions of SEP disputes; second, parallel litigation of SEP disputes has become normal; third, the jurisdiction of litigation disputes has become decentralized; fourth, the dispute issues are more complicated; fifth, the dispute resolution mechanism tends to be diversified.

SEP disputes in China show the following development trends: first, the number of cases has increased rapidly and the scope has gradually expanded; second, the number of courts for SEP cases has gradually increased; third, the ways of dispute resolutions have become more diversified; fourth, the status of the subject of litigation disputes has changed; fifth, the dispute resolution mechanism is becoming more diversified.

To deal with disputes over SEPs, it is necessary to promote innovation in SEP practices. My suggestions are as follows: first, improve the overall legislative, judicial and law enforcement rules and systems from a strategic perspective; second, relevant departments should build a comprehensive collaborative working mechanism; third, establish a distinctive trial system; fourth, strengthen international exchanges and cooperation and align with international rules.

Accelerating the digital transformation of standards

Wang Yiyi

Director of Standards Information Institute of CNIS
(Technical Trade Measures Research Center of SAMR) and
Director of National Library of Standards

The urgency of the digital transformation of standards can be showed from three perspectives. First, the digitalization of standards becomes a national strategy in many countries to support digital development. Second, the standardization activities are undergoing profound changes. Third, the knowledge architecture of standards should be changed to meet demands.

During the 14th Five-Year Plan period (2021-2025), the Ministry of Science and Technology launched the project entitled Research on Key Technologies and Standards for Digital Evolution of Standards (Phase I), led by CNIS, focusing on solving the top-level design and key technologies of digitalization of standards as well as basic national standards with some phased progress.

In the future, to better accelerate the digital transformation of standards, the following work needs to be done well. First, the new directions for scientific research shall be jointly sought. To meet the major needs of the 15th Five-Year Plan, important projects can take shape for the research on large models of standards, intelligent development of standards, and big data analysis of standards.

Second, a new ecosystem for resource cooperation shall be jointly established. As standards are constantly updated and iterated, in addition to the huge stock of standards resources, the annual increment is also huge. We need to use collaborative mechanisms to establish new models for acquisition, construction, and efficient utilization of resources.

Third, new digital standards platforms shall be jointly promoted. The best platform for the implementation of digital standards is the National Digital Standards Library of CNIS. The library is expected to build “one center, one platform” in a few years, that is, a world-leading standards data resource center, as well as a digital, networked, and intelligent standardization research and service platform, to support other industries in further carrying out related work on the digital transformation of standards.

编译/曹欣欣

(Edited and translated by Cao Xinxin)

Topic

New measures for standardization reform in the 15th Five-Year Plan period (2026-2030)

Keeping the nature of standards

Yu Xinli
President of China Association for Standardization

Standards play a vital role in the transformation of technological achievements. However, it is important to make sure that standards are the means or tools rather than the goals of the transformation.

The purpose of standards and standardization can be delineated in the following three aspects. Firstly, standards should be suitable for the economic and social development level. Secondly, standards should be well applied. Thirdly, standards should bring excellent products and performance. Only through effective implementation can standards bring benefits.

Deepening standardization reform with coordinated efforts

Zhang Feng
a member of the 14th CPPCC National Committee
and former Vice President of Institutes of Science
and Development, Chinese Academy of Sciences

From an international perspective, the United States, Japan, and other countries and the European Union have taken the standardization strategic plan as an important means to improve standardization level, promote technological innovation, and propel industrial development. China has adopted over 10,000 international standards as national standards, and positively submitted proposals in international standards organizations such as ISO and IEC.

During the 15th Five-Year Plan period (2026-2030), I suggest strengthening China's cooperation with international and regional standards organizations. China should actively participate in global standardization governance, and transform the standardization efforts from "domestically driven" to "mutually promotion of domestic and international work". Capable organizations and individuals should be encouraged to participate in international standardization activities in multiple ways. Enterprises, social organizations, and research institutions should be supported to join various international standards organizations. International standards organizations should be supported to establish offices in China, and a number of social standards organizations with the participation of both domestic and foreign stakeholders should be fostered.

From a domestic perspective, attention should be paid to the demands of emerging industries in the process of fostering new quality productive forces, which require coordinated promotion in multiple aspects including standards. The pre-research and pre-planning of standards should be strengthened, industrial transformation and upgrading should be driven by improving standards in key areas, and the perspectiveness and adaptability of standardization work should be enhanced.

Standardization work should keep pace with the times, accurately grasp the characteristics of productivity in the new round of technological revolution and industrial transformation, clarify the fundamental rule of high-quality development, and define ideas for further optimizing productive relations. When prospering the future industries including general artificial intelligence, quantum information, genetic technology, and future networks, we should deepen international standards cooperation, learn from the advanced experience of international standards organizations, and lay out a standards system and implementation mechanism that accords with China's national conditions.

Making breakthroughs in standardization theories

Hou Junjun
Vice President of Hunan University of Technology and Business

Firstly, strengthening the theoretical research on standardization. With the technological and social development, the understanding of standards becomes more diverse, and the meaning of standards can be further extended. The new ideas and theoretical framework of standards can be discussed with foreign experts on international academic platforms.

Secondly, reinforcing the use of standards. It is found that many assessment systems for standardization work focus on how many standards are transformed into international standards, but pay less attention to how many standards are applied, as well as the application scope and effect.

Thirdly, enhancing and promoting standards services. The promotion of standards services can learn from legal and patent services, to achieve the goal of being widely accepted and used.

Playing the leading role of standards for better technological transformation

Cao Lili
Director of Sub-institute of Standardization Theory and Strategy, CNIS

From the perspective of industrial development, the role of standards has gradually shifted from being a supporter to a leader, which is increasingly prominent to meet the rapid development demands of new products, new business formats, and new business models. The development model of emerging industries is driven by the simultaneous technology R&D and standards development.

The new generation of information technology and an increasing trend of multi-discipline development have brought many issues of security, ethics and compatibility involving integration, systematization, and dynamics. All of these issues need the simultaneous advancement of technologies and standards. Technical rules should be developed in the first place, to reduce innovation costs and clarify innovation directions.

From the perspective of global standardization, major countries and regions around the world have strengthened the leading role of standardization in strategic policies on science and technology, industry, and trade: emphasizing the standardization research, determining the standardization roadmap, identifying the priorities of standardization work, establishing a testing platform for system integration, strengthening the cooperation mechanism of government and enterprises, and focusing on the coordination of standards and patents, to achieve better standards layout in fields of key and emerging technologies.

Therefore, we should achieve the better combination of efficient markets and competent government, continue to promote standardization reform and innovation, and capitalize the leading role of standards.

A batch of new standards in key and emerging industries should be developed, to deeply integrate the national development plan with the strategic deployment of standardization. The resources of technology R&D, standards development, and testing and certification in the whole process should be integrated, and the key links of the full industrial and supply chains should be connected, which will spur leading enterprises, national key laboratories, universities and other institutions to participate in standardization activities. With more intensive communication between researchers and standardizers, a solid network of technologies and standards can be built in key areas.

On the one hand, enterprises should transform advanced and applicable technological innovation into standards. On the other hand, standardization research institutions should also take the initiative to work with social associations to provide high-quality standardization services. In this case, a biennial ecosystem of technological innovation, industrial development, and standardization can be established.

Thoughts on transformation of local standardization institutes

Yang Jieming
President of Shanghai Institute of Quality and Standardization

From a global perspective, it is necessary for a local standardization research institute to set strategic goals, layout, and coordination, which is determined by its social responsibilities and the local demands. As a member of the national collaboration mechanism for standardization research institutes, only with a global horizon can we discuss and solve problems in the same context, to reach more consensus on the blueprint for national standardization reform and development. In addition, SAC has set up foreign regional standards research centers in some local standardization research institutes, which share research achievements under the collaboration mechanism, and facilitate the implementation of standardization reform and development tasks.

In face of the national development strategy, we should focus on new driving forces of industrial development and more cross-sector collaboration, and plan for the innovative development of local standardization research institutes. The Shanghai Institute of Quality and Standardization considers the status of Shanghai, and promotes the development of standardization clause catering to national deployment.

We should allocate resources to more flexibly participate in association standardization activities in key areas. Both the national development and reform and the *National Standardization Development Outline* have put forward clear requirements for the reform of local standardization research institutes. Local standardization research institutes should utilize the local advantages in combination with the development strategies and make more achievements through a diverse path based on local status.

Establishing a national public service platform for standards in digital era

Sun Yamin

Director of Standardization Department of Qingdao Administration for Market Supervision, and President of Qingdao Institute of Standardization

Necessities for a public platform for standards digitalization

CEN and CENELEC have released the declaration for the new legislative cycle (2024-2029) to "recommit, transform and strengthen" the Single Market. The declaration identifies the three key pillars, two of which are "transform Europe to reach net zero ambitions and the digital age through standardization" and "strengthen European leadership through standardization". Standardization is regarded as a strategic pillar for digital transformation in the EU and advanced countries, and there is no exception in China.

The *National Standardization Development Outline* highlights the supporting role of standards, and improve the level of standards technical support. Digitalization of standards is an inevitable trend, and we should implement relevant policies. However, the resource integration of nationwide standardization research institutes is insufficient, and there are systemic deficiencies in the standards information services and the supply of domestic and foreign standards resources, which calls for a national public service platform for standards digitalization.

What can the platform do?

After the establishment of the collaboration mechanism, building a national public service platform for standards digitalization as soon as possible can implement the mechanism more quickly and effectively.

All standardization institutes should consider the means of transformation to better serve enterprises and the government in the digital era. We must enhance our ability to provide digital standards services, including one-to-one services for big enterprises, a digital standards database for industrial clusters, and an industrial internet platform for more enterprises. Also, the institutes should promote the standards digitalization in facilitating digital government, laying a solid foundation for the implementation of mandatory national standards and basic common national standards.

In terms of standards development, the platform can greatly improve work efficiency through online drafting by multiple users, which can save the time of technical personnel to refer to normative reference documents. In terms of standards implementation, machine-readable standards can be integrated into various systems of design, production, and management in enterprises to enhance the implementation rate of standards. In the supervision of standards, big data technology can be used to evaluate the effect of standards through the reference frequency.

编译/方洛凡

(Edited and translated by Fang Luofan)

Dialogue on standards: standardization facilitates the healthy development of AI

标准对话：标准化助力人工智能健康发展

By Jin Jili
文/靳吉丽

The government work report of 2024 pointed out "striving to modernize the industrial system and developing new quality productive forces at a faster pace". In terms of promoting the innovative development of the digital economy, it put forward stepping up R&D and application of big data and artificial intelligence (AI), launching an AI Plus initiative, and building digital industry clusters with international competitiveness.

This is the first time that AI has been written into a government work report. As a typical representative of new quality productive forces, AI has become a focus of national industrial policies. It is one of the most disruptive technologies of the 21st century, which has made remarkable achievements in various fields, ranging from self-driving cars, smart homes, virtual assistants to medical diagnosis.

To facilitate the development of AI, the *Development Plan for the New Generation of AI* was released by the State Council in July 2017, which put forward the development goals of AI by 2020, 2025 and 2030 respectively. In the same year, a launching ceremony was held by the Ministry of Science and Technology (MOST) for the development plan and major science and technology projects on AI, which announced the establishment of the Office for the Development Plan Promotion of the New Generation of AI and the list of first batch of national open innovation platforms.

In December 2023, the Central Economic Work Conference put forward vigorously pushing forward the new industrialization, developing the digital economy, and accelerating the development of AI.

In February 2024, State-owned Assets Supervision and Administration Commission convened a special meeting to advance the AI development in central enterprises. Later in July, the *Guidelines for Establishing the National Comprehensive Standardization System of AI Industry (2024)* was jointly released

Yu Xinli
President of China Association for Standardization

by the Ministry of Industry and Information Technology (MIIT), Office of the Central Cyberspace Affairs Commission, National Development and Reform Commission, and SAC. In the same month, the *Global AI Governance Initiative* was unveiled at the 2024 World AI Conference and High-level Meeting on Global AI Governance held in Shanghai.

To date, many standards for AI have been released in China, including the following national standards GB/Z 42759-2023, *Smart city—Classification guide for application scenarios of artificial intelligence technology*, GB/T 42382.1-2023, *Information technology—Neural network representation and model compression—Part 1: Convolutional neural network*, and GB/T 43782-2024, *Artificial intelligence—Technical requirements for machine learning system*.

With the rapid development of AI, many problems such as algorithm bias, data security, and privacy protection have become the bottleneck to be resolved so as to foster the healthy development of AI. In this case, standardization becomes particularly important as it can evaluate the maturity and security of AI technologies, and ensure the steady leap forward in technologies.

To dig into the role of standardization in AI development, China Standardization Press (CSP) held a dialogue on standards, which was presided over by Yu Xinli, President of China Association for Standardization (CAS).

The event invited several standardization and AI experts from domestic leading companies and research institutes to provide their insightful views about the future development of AI standardization, the standardization mechanism to adapt to AI technologies, the role of standardization in safeguarding users' rights and interests, the healthy and sustainable AI industrial ecosystem with standardization, as well as the in-depth application of AI in various sectors.

AI standardization and its **future development**

Tian Li
Director of Standards Strategy Department, ZTE Corporation

At present, AI is the core driving force of a new round of scientific and technological revolution and industrial transformation. Since the emergence of large models, AI has brought a profound impact on the global economy, society and governance system.

Standardization is crucial in the frontier areas of AI. By establishing rules and norms, standardization can facilitate the coordinated development of AI innovation and security. It also enables the transformation of technological achievements into industrial application, which helps improve the industrial efficiency and ensure the effective implementation of AI technologies in various industries.

AI standardization in China

At the national level, the Office for the Development Plan Promotion of the New Generation of AI has been established, and the arrangements for AI development have been included in the national economic plan. In particular, the *Guidelines for Establishing the National Comprehensive Standardization System of AI Industry* was released in July 2024, which covers 7 sections with 50 subdivisions, fully reflecting the state's top-level planning and detailed deployment in this regard.

The Cyberspace Administration of China issued the *Interim Measures for the Management of Generative AI Services* in July 2023, and later released a document in September 2024, requiring that the information (such as pictures and videos) generated by AI should be labeled for regulation identification.

In addition, data elements are inseparable from the development of AI. The National Data Administration and SAC/TC 609 on data have been established to promote the mechanisms and systems for data supply, circulation, application,

security and other aspects, support the data infrastructure, and build the data industrial ecosystem.

At the industrial level, MIIT has initiated the preparation of the standardization committee for AI technologies, which has held an inaugural meeting to start relevant sectoral standardization work.

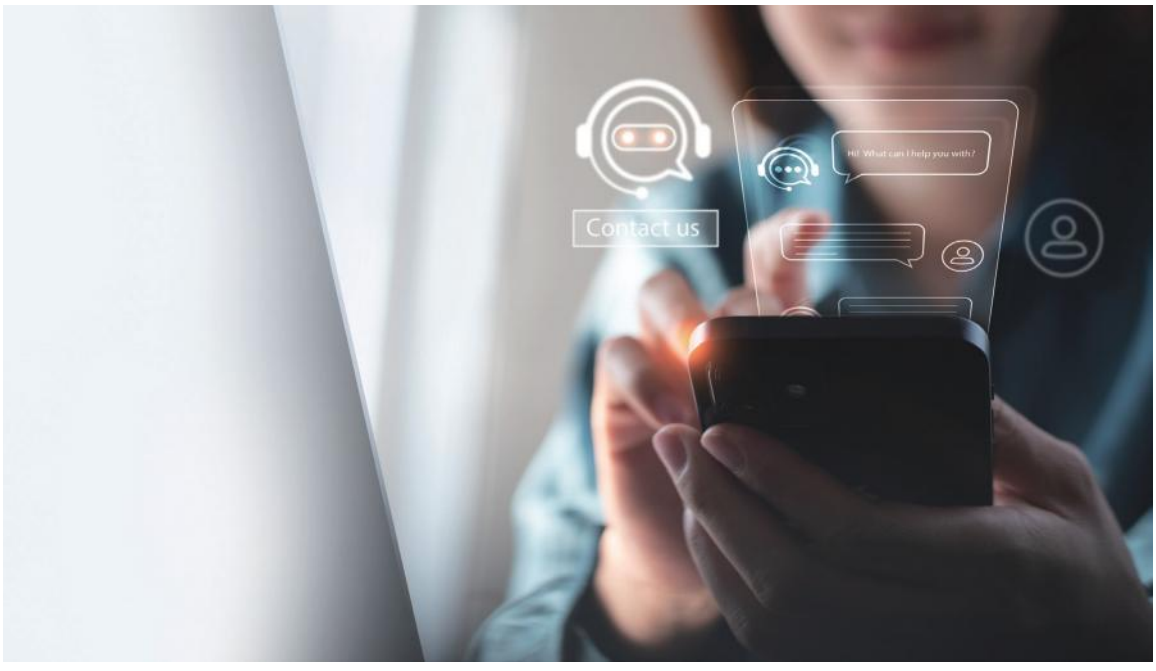
In response to the domestic situation, ZTE Corporation is committed to building itself into an "ultimate AI company", increasing its basic capabilities accumulated in the ICT industry, adhering to the concept of opening up, and working with its partners to drive the standardization and modularization of AI technologies and empower other industries.

International standardization on AI

Europe has taken the lead in formulating AI regulations, as the EU AI Act was issued in August 2024, which is very instructive for the rest of the world, in particular China.

China has made significant contributions to the work of international standards organizations. In the ISO/IEC JTC 1/SC 42 on AI, Chinese experts serve as the convenor and secretary of the JWG 5 on natural language processing. Altogether 55 registered Chinese experts have participated in all working groups, and led the development of eight AI-related standards.

In ITU, although there is no study group dedicated to AI, many study groups are relevant to AI. For example, in the SG13, a study group related to future networks and emerging network technologies, Chinese experts serve as the vice chair of the focus group on AI native for telecommunication networks and the leaders of four subgroups; in the SG21 on technologies for multimedia, content delivery and cable television, a Chinese expert serves as the leader of the group for AI-enabled multimedia application.



In the 2022-2024 study period, Chinese experts have led the development of more than 70 basic technical standards for AI and more than 10 standards related to network intelligence in ITU. At the same time, Chinese experts have contributed to the establishment of an AI expert group in ITU, which is in line with the implementation of AI governance concepts within the United Nations system.

In the 3rd Generation Partnership Project (3GPP), an expert from ZTE serves as the chair of the RAN WG3, playing an important role in the standardization of network intelligence, intelligent operation and maintenance, AI data collection and interaction, and other aspects. In the Institute of Electronic and Electrical Engineers (IEEE), Chinese experts have led the development of more than 40 technical standards.

Future development

As for the future development of AI, one of the most critical aspects is infrastructure. At the bottom level of intelligent computing infrastructure, although the graphics processing unit (GPU) itself focuses on performance, the standards for computing power interconnection are more critical. The construction of large-scale computing center requires the connectivity of a large number of GPU cards and different computing nodes.

In the U.S., NVIDIA builds closed systems, while AMD, Intel and other companies jointly create open ecosystems, such as Ultra Accelerator Link Consortium (UAlink), and Ultra Ethernet Consortium (UEC). In China, most enterprises are open to connectivity, but leading enterprises build their own ecosystems without harmonized standards. In the future, collaboration needs to be strengthened to push forward the industrialization of intelligent computing infrastructure.

At the upper level of large models and artificial intelligence algorithm, the focus is to establish grading and classification standards, support the evaluation of the reasoning ability, multi-modal support, hallucination, security and other aspects of large models to meet various application needs.

At the application level, standards and industrial organizations can gather and promote all kinds of good practice cases, such as the annual AI for Good Global Summit organized by ITU and the collection of pioneer cases released by the Artificial Intelligence Industry Alliance of China. Putting practical experience in place in all walks of life will achieve the effect of empowering new industrialization.

At the level of security and ethical governance, it is necessary to encourage and supervise new technologies. It is expected that the government, enterprises, universities and research institutions in China will work together to foster the sound development of AI, promote the concept and framework of AI governance towards the international arena, and establish the global governance rules for AI.

Establishing **flexible and dynamic** standardization mechanism for AI development

Meng Lingzhong
Associate Researcher of Software Department,
Chinese Academy of Sciences

Our research team has participated in the development of AI standards for a long time, and undertaken some AI-related projects commissioned by ministries such as MIIT and MOST. With rich experience in such work, we have thought about how to establish a flexible and dynamic standardization mechanism tailored to the development of AI technologies.

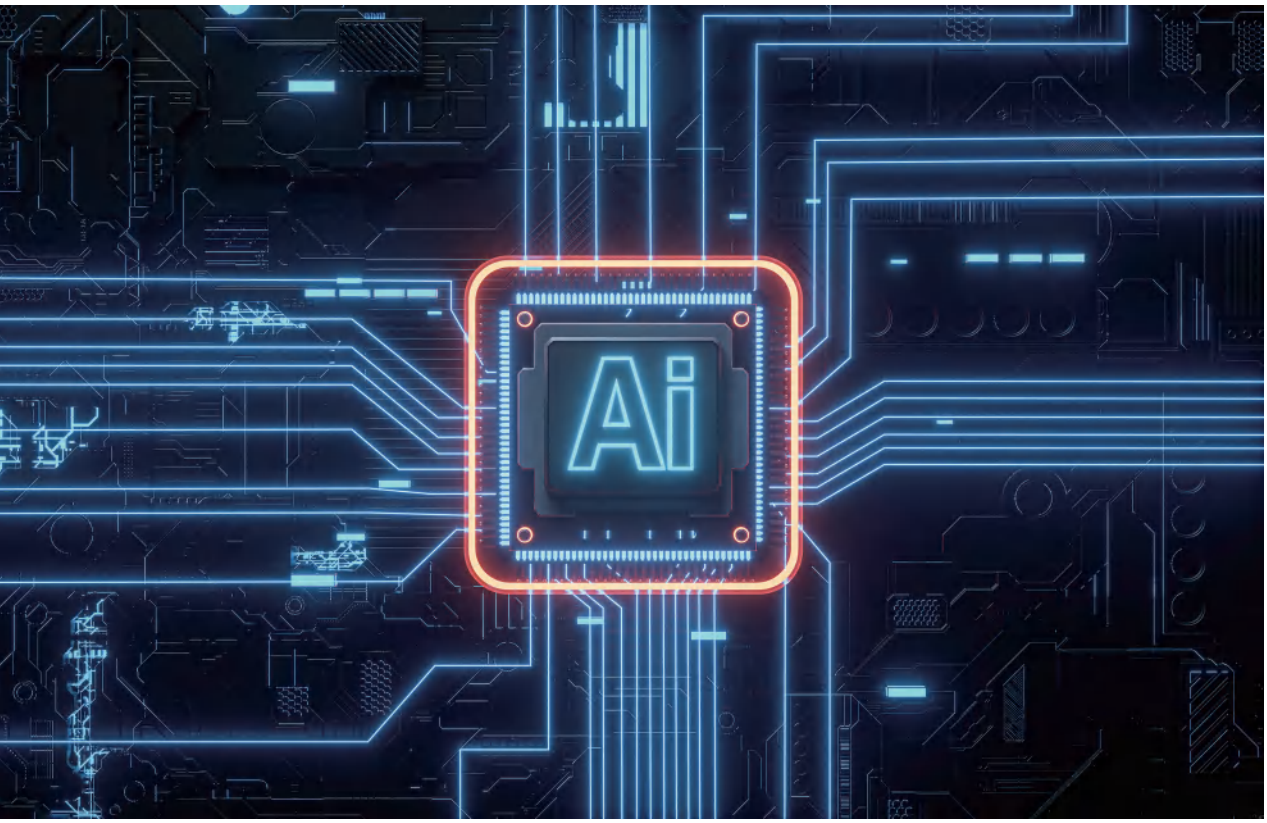
Standardization mechanism for AI development

When it comes to such standardization mechanism, we should ponder over the following two aspects. Firstly, the development pace of AI technologies is astonishing. In the past years, we focused on developing national standards for the evaluation specification of neural network algorithms. While in recent two years, emerging technologies such as generative AI and large models have risen at an incredible speed.

Secondly, the rapid progress of AI technologies has significantly propelled their application in diverse fields. The demands for AI solutions have skyrocketed in the sectors ranging from smart homes and intelligent connected vehicles to steel, power and other sectors.

The impact of AI technologies on standards development is clearly showed in two respects. First, changes in the ISO working groups. ISO/IEC JTC 1/SC 42 on AI has grown from the original five working groups in 2018 to more than ten working groups and joint working groups in 2024. These working groups have expanded their scopes from basic common technologies to technological application, knowledge graphs, large models, generative AI, and computing power.

Second, changes in the number and requirements of national standards. In 2022, national AI standards were mostly related to terminologies. Now, such standards are gradually increasing. Take the national standard for risk management as an example. When it entered the stage of project approval in December 2023, it was required to be completed within 18 months. However, in the



first half of 2024, the time limit was cut down to 12 months, demonstrating the pressing needs for standards development.

Flexible methods

The flexible standardization mechanism features the following four aspects.

(1) Flexible sources. The sources for national standards should not be limited to AI standards developed by ISO/IEC JTC 1/SC 42, which can cover standards on software engineering from SC 7, standards on intelligent connected vehicles from SC 27, standards for intelligent connected vehicles from Society of Automotive Engineers (SAE), as well as related standards from ANSI and standardization bodies in the Europe.

(2) Flexible development. It is recommended to increase the participation of standards application organizations in the development process, and achieve an agile mode of development, application, feedback, implementation and improvement, to help better apply the standards.

(3) Flexible outcomes. The outcomes should not be limited to a single type of standards, which should include association standards, sectoral standards and even national standards, with more emphasis on AI application. In addition to technologies, more attention should be paid to the practical application of AI standards.

(4) Flexible display. Relying on the platform of the China Electronics Standardization Institute, the process and content of standards development can be further displayed, especially the application status of standards, so that various parties can better understand the standards and promote their implementation.

Dynamic procedure

The dynamic standards development procedure is largely manifested in two aspects.

(1) Dynamic project approval. The project approval of association and national standards can flexibly refer to and study the standards of SC 42, SC 7, or SC 27 under the ISO/IEC JTC 1. On the premise of protecting intellectual property rights, relevant working groups should be established for important standards development. A dynamic working group will support experts to participate in international standards development.

(2) Dynamic participation. Dynamic adjustments should be made according to the application differences of AI technologies in different fields. Application organizations and technical bodies in the areas of new technologies should be introduced in a timely manner to meet the timeliness requirements of AI standards. Also, experts participating in international standards development can take advantage of their familiarity with international standards to dynamically take the lead in the implementation of relevant national standards, which can improve the efficiency of standards development.

Sustainable development

The suggestions for sustainable development include the following four aspects:

(1) Sustainable standards planning. More than a dozen working groups under the SC 42 should dynamically adjust their standards development plans every year, and develop standards with concerted efforts. This can not only reflect the development trends of international standards but also highlight the priorities of each working group, with continuous standards outcomes to ensure the sustainability of standards development.

(2) Sustainable support for international standards. With more than 60 domestic experts participating in the development of international standards, a dynamic study working group should be established to provide support. The secretariat should continuously make international standards outcomes, keep up with the development trends of international standards, and do a good job in relevant project approval work.

(3) Continuous evolution of national standards framework. With the rapid development of AI technologies, it is necessary to do a good job in the continuous evolution of association, sectoral and national standards, so as to meet the demands for rapid updates of standards, and establish methods and routes for sustainable development.

(4) Sustainable standards ecosystem. Multiple parties are involved in the development, application and evaluation of standards, which constitute an ecosystem. Each party should have clear responsibilities, and do well in standards sharing. The establishment of the platform can enable more people to use standards, give full play to the role of standards, form a landscape of shared development and sustainability, and adapt to the rapid development of AI technologies.

Standardization for **privacy protection** and **security** of AI

Peng Jin
Director of Technological Strategy Development Department, Ant Group

When it comes to the privacy protection and security of AI, standards are a vital tool, which delineate multi-level requirements of products and services. Data security, cybersecurity, system security, and user rights protection including privacy protection, are essential issues to be considered by digital products and services, which are related to national security and the benign development of industry and enterprises.

Evolving with technological advancement and social development, the standards system and standards at all levels should cater to the changing requirements for security, by providing a consensus-based mechanism and enhancing transparency.

Progress in ensuring AI security in China

From perspectives of different industries, many national standards, sectoral standards, association standards and other standards for information system, data security, cybersecurity, cloud security, application security, and relevant aspects have been developed by standards organizations at all levels, to regulate requirements of governance and technology, and offer implementation guidelines.

For example, GB/T 35273-2020, *Information security technology—Personal information security specification*, provides the general bottom line of personal information protection; GB/T 41817-2022, *Information security technology—Guidelines for personal information security engineering*, puts forward specific guidelines of personal information from the perspective of full life-cycle of products; GB/T 22239-2019, *Information security technology—Baseline for classified protection of cybersecurity*, specifies the basic requirements for the protection of cybersecurity. The standards can be applied in the development, deployment and services of AI, while further standards requirements are put forward in new AI paradigms such as machine learning, deep learning and large models.

The *Regulation on Algorithm Recommendation for Internet Information Services* came into effect in 2022, stipulating rules including pursuit of excellence and goodness, prohibition of enticing users to overspend, enhancement of content management, as well as establishment and improvement of

mechanisms for manual intervention and independent choices of users. The regulation puts forward 7 items for user rights protection, including guaranteeing the right to stay informed of algorithms and choose algorithm services, prohibition of inducing minors to be addicted to the Internet with the services, and facilitating the elderly to use the services safely.

Also, the national standard GB/T 42888-2023, *Information security technology—Assessment specification for security of machine learning algorithms*, stipulates the safety requirements for full life-cycle of machine learning algorithm. It further puts forward targeted safety requirements of five types of algorithms: the generative, personalized recommendation, sorting and selecting information, searching and filtering, as well as scheduling and decision-making.

Security and ethics is one of the eight parts of China's AI standards system. SAC/TC 260 on cybersecurity is promoting the development of standards for security governance of generative AI, given the advancement of large models. Efforts have been made to develop a set of national standards on basic security requirements for generative AI service, security specification for generative AI pre-training and fine-tuning data, generative AI data annotation security specification, and labeling method for content generated by AI.

With increasing humanoid characteristics and abilities, AI-powered assistants such as Microsoft Copilot can interact with human, and help or replace users to conduct operations, which can be extended from Apps and programs to the physical world with higher-level intelligence. Also, the large model system is complicated, facing attacks at various technical levels. In this case, it is necessary to define the boundary of decision and interaction between AI and users, and to stipulates the safety-related issues.

Global standardization efforts on AI security

The National Institute of Standards and Technology (NIST) in the U.S. has released the Artificial Intelligence Risk Management Framework (AI RMF 1.0) to facilitate the responsible development and use of AI systems, and consider issues of ethics, privacy and security through the life-cycle of AI systems. Other standards such as NIST AI 600-1, *Artificial intelligence risk management framework: generative artificial intelligence profile*, and NIST AI 800-1, *Managing misuse risk for dual-use foundation models*, put forward more specific requirements.

The European Union published the AI Act in 2024, classifying AI systems into four different risk levels: unacceptable, high, limited and minimal risk, with corresponding regulation and requirements of transparency and data protection.

ISO/IEC JTC 1/SC 42 on AI released the world's first AI management system standard ISO/IEC 42001:2023, *Information technology—Artificial intelligence—Management system*, which specifies requirements for establishing, implementing, maintaining, and continually improving an AI management system within organizations. ISO/IEC TR 24028:2020, *Information technology—Artificial intelligence—Overview of trustworthiness in artificial intelligence*, focuses on trustworthiness in AI systems, which, beyond security and privacy, puts forward requirements for availability, resiliency, reliability, and accuracy.

Suggestions on future standards for AI

As for international and domestic policies and technical regulations in this field, documents are being completed at the macro and meso levels, while more standards for specific operation at the micro level are needed. In other words, more technical guidelines shall be developed to better support the construction and service expansion of large models.

In terms of the balance between privacy protection and data use of large models, the technical means of anonymization, which ensures that personal information cannot be identified or recovered to pin down a specific person through technical processing, should be adopted when training large models with massive data. More efforts should be made to develop specific standards for methods.

In terms of security, considering the evolution of attacks against large models, security classification standards should be developed to further improve safety requirements. All security measures will cost money, and cannot achieve absolute safety in every environment, which poses the issue of security classification. The security classification standards can reach the consensus on balancing security, availability and costs, which is more suitable for the B2B ecosystem to evaluate and purchase standards, as well as protect the security of users' information.

In terms of the interpretability and transparency of large models, feasible, operable and measurable standards should be developed. Though the interpretability of deep learning is an academic problem, it is possible to achieve interpretability and operability to some extent. Proper transparency can benefit the protection of user rights and interests, as well as the selection of models products in the B2B ecosystem, and even simple model disclosures are helpful.

In terms of large model application and industrial demands, specific standards for ethics and compliance in different sectors should be developed catering to the professional demands. For instance, the accuracy of large models tends to be less important to generate pictures, while the requirements of large model application in the financial and medical sector turns out to be stricter.

From the perspective of development, the large model application can promote the protection of user rights and interests, such as using AI algorithms to achieve universal benefits of digital application, using AI to make digital applications suitable for the aging people and the disabled, eliminating the digital divide, and promoting the standards development to support business development, in order to achieve the protection of broader user rights and interests.

Standardization leads the high-quality development of **AI industry**

Xu Yang
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China Electronics Standardization Institute (CESI)

The Chinese government has attached great importance to AI, and made key deployments for its industrial development, application, security, governance, and other aspects, so as to facilitate the deep integration of AI and the real economy, thus promoting the new industrialization.

Standardization plays a fundamental and leading role in the development process of the AI industry, which is also very important for advancing technologies, accelerating the manufacturing of new products, and improving the self-supervision of the industry. In recent years, many countries have given careful consideration to how to use standards to facilitate the development of the AI industry, reaching an unprecedented level of standards development.

Policies on AI in the U.S. and the EU

In the last two years, the United States has released four policy documents closely related to AI standards, including the *United States Government's National Standards Strategy for Critical and Emerging Technologies (USG NSSCET)*, the *United States Standards Strategy*, the *Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*, and the *Recommendations for Increasing U.S. Participation & Leadership in Standards Development*. They all emphasize more investment in the pre-research on standards to promote technological innovation, cutting-edge science, and application, and the leadership of the U.S. in AI international standards.

In the U.S., the National Institute of Standards and Technology (NIST) and other agencies are authorized to develop the series standards for AI risk management, set benchmark, create testing environment, and formulate the plan of global participation, so as to establish the research-standards-certification ecosystem, helping the U.S. lead the AI industry in the global market.

In Europe, the European Artificial Intelligence Act entered into force on August 1, 2024. The European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) are authorized to develop about 10 harmonized standards for risk management, data quality, transparency, and other aspects, which are projected to be delivered

before December 2025.

It is clear that, both the U.S. and the EU use standards as tools to try to lead the AI industry by different means.

AI industry in China

With the great support of the government, the AI industry has been developing rapidly in China, reaching remarkable achievements. Breakthroughs have been made in key technologies such as calculation power, algorithm, and data. The AI key industrial scale in China has kept increasing in recent years, reaching nearly 580 billion yuan (about 7.96 billion US dollars) at the end of 2023, with the year-on-year growth rate of 13.9%, and more than 4,400 core companies. Industrial clusters have taken shape in big cities such as Shanghai, Beijing, and Shenzhen. The 421 smart manufacturing demonstration factories at the national level and more than 10,000 digital workshops and smart factories at the provincial level have been constructed, which can promote the new industrialization with AI.

Although progress has been made in China's AI industry, it is still relatively small and scattered. Fortunately, the problem can be solved by standards.

Standards play a big role

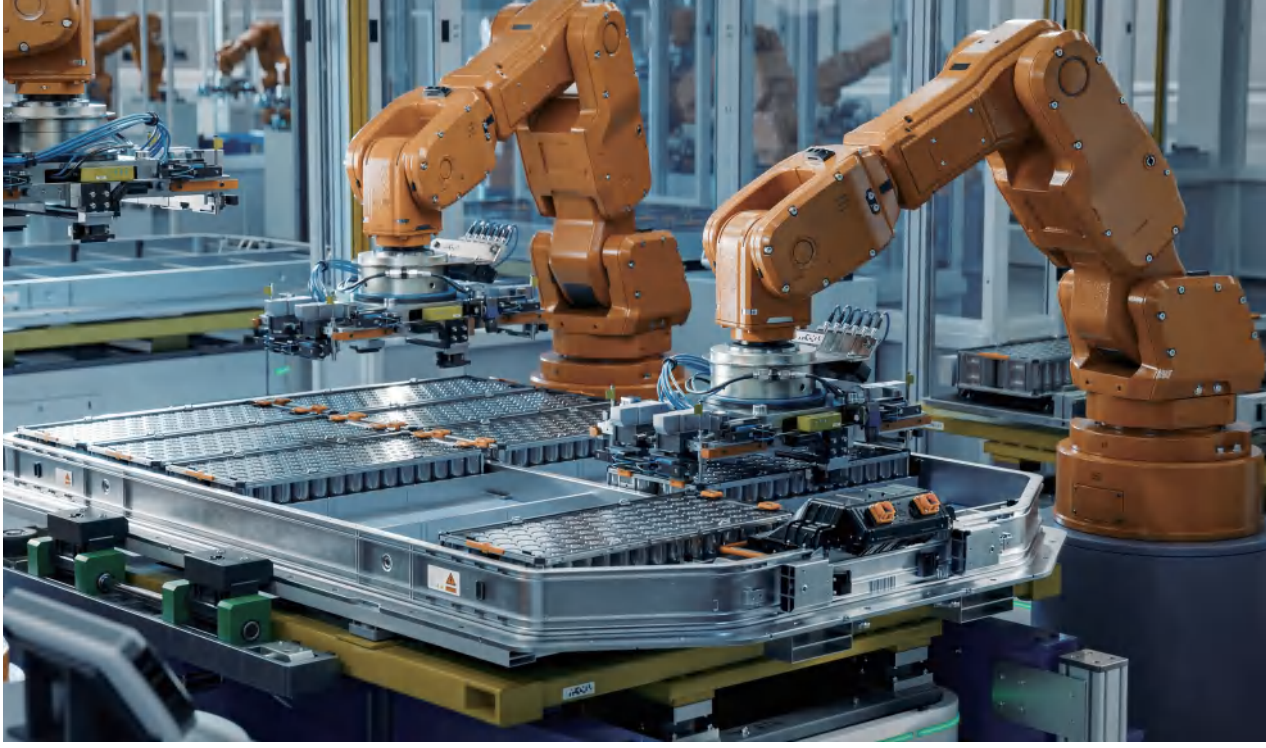
First of all, standards can be used to address the common problems related to AI such as insufficient supply solutions and unclear upgrade way of intelligence in all sectors.

Second, technical standards for the whole-process of large model and relevant standards for different industries shall be developed to build the comprehensive large model standards system. To meet industrial demands, standards for smart products and smart services shall also be developed to facilitate the application of large model products. To actively follow the developmental trend of AI technologies, relevant standards for the new generation AI innovative technologies for intelligent agent, embodied intelligence, and swarm intelligence shall be prepared in advance.

Third, standards can promote the intelligent upgrade of industries. Based on the industrial consensus, standards provide common technical solution and uniform interface specifications, cut down R&D investment, and reduce the costs of intelligent upgrade of industries.

Fourth, standards are also very important for regulating the industrial order, and setting the threshold for market entrance, so as to safeguard the safe bottom line, and address the challenges such as information leak, model vulnerability and algorithm discrimination.

Last but not least, standards can facilitate international communication and cooperation. In the process, the domestic advanced AI technologies and products are shared across the world, making a great contribution to the development of the global AI industry.



Suggestions

My suggestions are as follows:

Standardization collaboration is the key to the integration of different sectors. The national working group of AI standardization should make different kinds of organizations cooperate with each other so as to play a bigger role.

The coordination of standards and innovation should be strengthened. First, an efficient linkage mechanism should be established to promote the connection between scientific and technological innovation and standards development, and promote the rapid transformation of advanced and applicable technical research results into standards. Second, a standards map in the AI field should be compiled, and the comparative analysis of domestic and foreign standards should be conducted to clarify the strengths and weaknesses of standards and development plans. Third, standardization cooperation across the entire industry chain should be strengthened to promote the deployment and promotion of AI technology research and development, standards development and patent layout.

The supply, publicity and application of key standards should be enhanced. First, to meet urgent needs of the industry, standards and specifications focusing on key issues such as data quality, evaluation benchmarks, and interconnection, should be developed as soon as possible. Second, the cooperation of cross-industry and cross-field standardization technical organizations should be enhanced to jointly promote the integration and application of AI in key industries. Third, industry associations and standardization technical organizations can help carry out publicity and implementation of AI standards system and key standards.

International exchanges and interoperability of standards should be strengthened. First, relevant units are encouraged and supported to actively participate in international standardization activities such as ISO, IEC, and ITU, contributing Chinese solutions, and conveying good ideas. Second, the joint efforts of industry, academia, and research institutes should be gathered to build a diversified and high-level team of international AI experts, and continuously improve the number and quality of China's international standards proposals. Third, regional standards connectivity should be promoted through the BRICS cooperation mechanisms, Belt and Road Initiative, and other international cooperation mechanisms, to enhance the influence of Chinese standards.

How standardization promotes the **in-depth application** of AI

Zhang Wei
Director of the Digital Intelligence Center of Baowu Central Research Institute/Data AI Department of Baosteel Group

The application of AI is deepening in a larger scale

AI is a basic and strategic technology that leads a new round of scientific and technological revolution and industrial transformation, which is becoming an important engine for the development of new quality productive forces. AI technologies have gradually penetrated into the fields such as smart cities, smart medical care, and intelligent manufacturing, and made huge economic contributions. In 2017, the *Development Plan for the New Generation of Artificial Intelligence* issued by the State Council predicted that in 2025, the new generation of AI will be widely used in intelligent manufacturing, smart medical care, smart cities, smart agriculture and other fields, and the scale of the core industry of AI will exceed 400 billion yuan (about 55.2 billion dollars). According to the data of the *China's New Generation Artificial Intelligence Technology Industry Development Report 2024*, the scale of China's core AI industry reached 578.4 billion yuan (about 79.9 billion dollars) in 2023 with the development speed far beyond the plan.

The construction of smart cities involves different systems and equipment. How to ensure data sharing, equipment compatibility, and system collaboration is a key issue in the implementation of AI technologies. Standardization plays an important role in this process. Unified data formats, communication protocols, and interface standards can ensure the interconnection of different devices and systems, and promote the efficient operation and intelligent governance of smart cities.

In the field of smart medical care, AI can improve the quality and efficiency of medical services. AI technologies have made significant progress in disease diagnosis, personalized treatment, and telemedicine. As the medical industry involves a large amount of sensitive data and multiple technical platforms, the standardization of AI applications is also crucial. The standardization of medical data can ensure the exchange and sharing of information between medical institutions and avoid data silos; the standardization of diagnosis and treatment algorithms can ensure the effectiveness and accuracy of AI models in different systems and avoid diagnostic errors caused by

technical differences. Unified standards will help build a more efficient and reliable smart medical ecosystem.

In the field of intelligent manufacturing, AI can improve production efficiency and intelligence. China Baowu Steel Group Corporation attaches great importance to AI technologies. In the new round of planning, it clearly focuses on the application of AI and large models in the metallurgical industry, creates a number of typical demonstration projects that deeply integrate big data, AI and steel, and creates new intelligent advantages in the steel industry.

Standardization promotes the in-depth application of AI

The International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and other standardization organizations have successively established intelligent manufacturing working groups or formed global advanced industrial system groups to promote the unification and coordination of the global intelligent manufacturing technology system. SAC has implemented the plan on manufacturing standardization improvement specified in the "Made in China 2025" plan to promote the development of intelligent manufacturing technical standards.

In June 2024, MIIT and other four departments issued the *Guidelines for Establishing the National Comprehensive Standardization System of Artificial Intelligence Industry (2024)*. The guidelines elaborated on the overall requirements and construction ideas of the AI industry standards system in five aspects, and especially released the structure diagram and framework diagram of AI standards system.

The business side is also developing rapidly in the application of AI technologies. Taking China Baowu as an example, a large amount of AI technology research and development has been carried out in the manufacturing management, supply chain decision-making, key manufacturing processes, and other work, and a wide range of AI technology applications have been carried out.

In the next three years, the AI model capabilities will be fully deployed to form decision-making, control-oriented, and perceptual-oriented AI for the steel industry. This has put forward an urgent

demand for standards development and also provided a large number of application scenarios for standards development. To this end, the AI Subcommittee of the National Information Technology Standardization Technical Committee has innovated its working model and established application working groups in the steel, power, petrochemical and other industries, promoting standardization in both the application end and the technology supply end.

As the leader of the steel application working group, Baosteel Co., Ltd. has promoted the development of a number of sectoral standards, such as *Artificial intelligence—Technical requirements for steel large model*, *Artificial intelligence—Technical Requirements for knowledge graph construction in the steel production process*, and *Artificial intelligence—Technical requirements for intelligent decision-making data processing and model construction in steel production and smelting process*, which are under development. It is also developing standards such as *Artificial intelligence steel large model dataset*, to promote the unified language of "AI + steel" and form an architecture. At the same time, it is carrying out the development of standards, such as *Artificial intelligence empowers the steel industry typical scenario map, Technical requirements for artificial intelligence steel large model dataset*, and *Artificial Intelligence—Technical requirements for steelmaking production planning scheduling and dispatch optimization system*.

According to statistics, since the 13th Five-Year Plan period (2016-2020), a total of 394 national standards have been released in the field of intelligent manufacturing, including 109 basic common standards, 280 key technical standards, and 5 sectoral application standards. Forty-eight international standards have been developed. These standards have played an important role in promoting intelligent manufacturing and enhancing international influence.

Thoughts and suggestions

(1) Breaking boundries of sectors, reflecting the systematic and integrated nature of standards. It is necessary to focus on standardization around cross-domain, cross-level, and cross-interface system integration to form a standards system that integrates data, computing power, algorithms, and applications. First, data standardization is the basis for the successful application of AI technologies. Unified data formats and exchange standards can ensure the flow and sharing of data between different platforms. Second, algorithm standardization is also crucial, especially the transparency and explainability of AI algorithms, to ensure the credibility and fairness of AI decisions. In addition, security standards are a key part in standardization work.

(2) Strengthening layout, reflecting the timeliness and leadership of standards. AI, big data, and information technology are rapidly iterating and developing. We must keep up with technological progress, avoid hype and hot spots that affect the authority and accuracy of standards, and avoid missing the chance of standardizing new technologies and new applications.

(3) Emphasizing effectiveness, reflecting the practicality and value of standards. Adhering to scenario and demand-driven rules, standards can be vital. In 2024, the Science and Technology Department of MIIT launched the case collection and selection of *Typical Applications of Artificial Intelligence Empowering New Industrialization*, with 151 cases selected. China Electronics Standardization Institute proposed to give priority to incubating these key scenarios into national standards and sectoral standards, which fully reflects the principle of demand-driven standardization.

编译/靳吉丽、方洛凡、曹欣欣

(Edited and translated by Jin Jili, Fang Luofan and Cao Xinxin)

Discover the CEN and CENELEC Work Programme 2025!

CEN and CENELEC are excited to announce that the 2025 Work Programme has been published. The Work Programme is one of the flagship publications of CEN and CENELEC, setting out the priorities and most important actions in European standardization for the year ahead.

2025 will be a defining year for European standardization. As we navigate a dynamic global landscape, CEN and CENELEC are committed to supporting the Single Market's digital and green transitions to boost resilience and competitiveness.

Many of our key projects will translate the European Commission's Competitiveness Compass into actionable steps, with a focus on strengthening Europe's industrial base and technological leadership. By developing standards for strategic sectors like, among others, artificial intelligence (AI), cyber resilience, clean tech, and electricity grids, European standards will enhance Europe's competitiveness, foster trust in new technologies, and ensure a fair and sustainable Single Market.

We are also committed to embedding standardization into the European research ecosystem, ensuring that innovative ideas reach the market faster and more effectively. In 2025, we will focus on collaborating with academia and research institutions, identifying emerging standardization areas, and shaping FP10.

The CEN and CENELEC Work Programme 2025 presents the main standardization developments and strategic priority areas for CEN and CENELEC in 2025, across 14 business sectors. The Work Programme also highlights three horizontal business topics, key to meeting present and future challenges: Accessibility, Sustainability, and Conformity Assessment.

Finally, the last section gives a horizontal overview of the most important strategic highlights that will shape CEN and CENELEC's development over the course of 2025 and beyond. This section includes the continuing implementation and midpoint review of the Strategy 2030 and the reinforcing of the representativeness of societal stakeholders in standardization.

For more information about the Work Programme: **https://wp2025.cencenelec.eu**

(Source: CEN)

Responsible cinema: best practices spread

Nine months after the publication of AFNOR Spec 2308, during the 2024 Cannes Film Festival, film, audiovisual and advertising professionals are adopting best practices for more responsible filming. This was the objective of our sponsors, the French Ministry of Culture and the Centre national du cinéma et de l'image animée.

Supported by the French Ministry of Culture and the Centre national du cinéma et de l'image animée (CNC), it is the fruit of a collective effort involving 130 professionals, including film, audiovisual and advertising production organizations representing employers and employees, and two historical experts on these issues, Ecoprod and Flying Secoya.

The AFNOR Spec standard offers production companies concrete actions for deploying a film, audiovisual or advertising project that takes into account the three major aspects of CSR: environmental, social and economic issues. All this, from the filming preparation phase through to post-production. The document is divided into seven chapters: governance, energy and mobility, responsible purchasing, food and waste management, digital sobriety, biodiversity and animal welfare, inclusion, parity and quality of life at work, training and awareness-raising. A shoot featuring animals, for example, will be particularly interested in chapter 6; another for a gastronomic program will be interested in chapter 4. The guidelines propose three progressive levels of commitment:

· Level 1: Production commits to a responsible approach to its project;

· Level 2: Reinforces responsibility for the project;

· Level 3: the production company implements a responsible approach to all its projects.

The use of AFNOR Spec is notably in line with the transformation of practices promoted by the CNC's "Plan Action!", a framework program for ecological and energy transition in the cinema, audiovisual and moving image sectors. Published in May 2024, this first national standardization document is available to production professionals, who can take it up voluntarily.

(Source: AFNOR)

MPLS & SRv6 AI Net World Congress

March 25-27, Paris, France

The 2025 conference programme will mainly address AI & ML impact on current infrastructures and services. Experts will discuss intelligent computing networks, digital twins, software engineering and automation aspects.

A large part will be dedicated to IPv6 networks and SRv6 deployments: inter-cluster connectivity, deterministic path placement, IPM hardware connectivity and other crucial evolutions.

Other sessions will cover IP/optical networks, routing issues, 5G/6G & the edge, latency and security. For more information on the event website: **https://www.uppersideconferences.com/mpls-sdn-nfv**

Girls in ICTs: Bridging ALL Divides for an Inclusive Digital Transformation

April 24, Bishkek, Kyrgyzstan

In 2025, Girls in ICT Day global celebration will be part of the Regional Preparatory Meeting RPM in the CIS region for WTDC 2025.

The event will provide a platform for interactive intergenerational dialogue, focused on identifying concrete actions that promote gender equality and equity and will serve as a key turning point for young girls, inspiring them through the examples of women role models and the encouragement of men, to embrace ICT and pursue careers in STEM and tech field.

This celebration will also be an opportunity for government officials, leaders in ICT sector, and representatives from the ITU-D Network of Women in the CIS region and beyond to come together and demonstrate a united commitment to empowering ALL girls and young women to ensure an inclusive digital transformation process and build a barrier free digital future.

For more information on the event website: **https://www.itu.int/women-and-girls/girls-in-ict**

FutureNet World 2025

May 7-8, London, the U.K.

ETSI is pleased to actively support this year again FutureNet World 2025. FutureNet World 2025 is the premier event bringing the global telecoms industry together to explore and address the strategic and commercial priorities shaping today's digital landscape. This event is the ultimate platform for decision-makers, thought leaders, and innovators to discuss the future of network transformation.

The agenda is designed to tackle the industry's most pressing questions, including:

How can AI enable intelligent, self-optimising networks?

What role does automation play in building resilience and competitiveness in a hyper-connected world?

How can telcos evolve to meet the growing demands of data-intensive applications

For more information on the event website: **https://www.etsi.org/events/2491-futurenet-world-2025**

Bharat 6G 2025

May 14, New Delhi, India

While 5G has ushered in a new era of connectivity, the impending arrival of 6G promises to redefine the boundaries of what's possible. The potential impact of 6G is significant, as it has the power to reshape human interactions, machine communications, and data interactions.

Next Gen 6G networks will facilitate a future proof compute infrastructure for communication service providers, allowing them to host multi channel networks, with sustainability and security, thereby radically transforming the digital landscape. The transformative potential of next gen networks, extends beyond tech advancements, and surpass the potential to bridge the digital divide, bringing connectivity and opportunities to underserved populations.

Keeping in mind Indian Government initiative on 6G, Bharat Exhibitions is pleased to present the 3rd edition of Bharat 6G 2025 International Conference & Exhibition scheduled on May 14, 2025 in New Delhi. For more information on the event website: **https://www.bharatexhibitions.com/en/6GI2025**

Construction of a standardized analysis method for identifying meat quality-related genes in Ordos fine-wool sheep based on transcriptome sequencing data

基于转录组测序数据的鄂尔多斯细毛羊肉品质相关基因标准化分析方法构建研究

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Abstract: In this paper, a standardized analysis method is established for identifying meat quality-related genes in Ordos fine-wool sheep using transcriptome sequencing data. A meticulously standardized approach is utilized to investigate the genetic determinants of meat quality in Ordos fine-wool sheep through transcriptome sequencing analysis. Muscle samples from the *longissimus dorsi* of one-year-old sheep are collected under controlled conditions, and key texture properties—hardness, elasticity, and chewiness—are measured to categorize samples into high- and low-textural-value groups. Genes significantly associated with meat quality traits are identified through standardized RNA extraction, high-throughput sequencing, and differential gene expression analysis. Functional enrichment analysis reveals their involvement in biological processes such as extracellular matrix organization and metabolic pathways. The findings underscore the pivotal role of standardization in meat quality research, laying a solid scientific foundation for future research on meat quality improvement and molecular breeding.
Keywords: Ordos fine-wool sheep, meat quality characteristics, transcriptome sequencing, genes, functional enrichment analysis

1. Introduction

Lamb meat is a globally important agricultural product, and its quality is a critical factor in meat scientific research and livestock production. Meat quality assessment encompasses various dimensions, including tenderness, flavor, juiciness, color, and texture, with hardness, chewiness, and elasticity being pivotal indicators of meat palatability[1].

The Ordos fine-wool sheep, an indigenous breed in China, is distinguished by its premium wool and meat quality. Its lamb meat, celebrated for unique flavor and texture, shows molecular mechanisms that determine meat quality, which are yet to be fully understood. Figuring out the gene expression patterns associated with meat quality of this breed presents substantial scientific value and potential applications for elucidating the molecular underpinnings of muscle formation.

Advancements in transcriptome sequencing technology have armed meat quality research with novel tools and methodologies. By examining gene expression variances across lamb meat samples with diverse quality traits, it is possible to pinpoint key genes and regulatory networks that influence meat quality. Such insights are vital for comprehending the molecular mechanisms of muscle formation, guiding breed improvement efforts, and optimizing feeding practices. The high-throughput sequencing has rendered transcriptome data acquisition more accessible and cost-effective, facilitating large-scale gene expression analyses and significantly advancing meat quality research.

A standardized analysis method is established in this paper to identify meat quality-related genes in Ordos fine-wool sheep, using transcriptome sequencing data. Through comparative analysis of samples with divergent meat quality attributes, candidate genes have been identified, which are correlated with hardness, chewiness, and elasticity of meat, and their roles in muscle formation have been elucidated. Furthermore, functional enrichment analysis of these candidate genes are undertaken to comprehend their involvement in biological processes and metabolic

pathways. Standardized protocols in sample handling, RNA extraction, and bioinformatics analysis ensure consistent and reproducible data. The outcomes of this research are expected to lay a foundation for enhancing the meat quality of Ordos fine-wool sheep, thereby contributing to the betterment of lamb meat quality and consumer satisfaction.

2. Materials and methods

2.1 Standardization of sample collection and preparation

To ensure the consistency and comparability of meat quality traits, a rigorous standardization protocol was established for the collection and preparation of samples. Muscle tissue samples were obtained from the *longissimus dorsi* of one-year-old Ordos fine-wool sheep. All sheep were castrated and raised under identical environmental conditions, with a standardized diet to minimize any dietary or environmental variability that might influence meat characteristics. Immediately following collection, the muscle samples were rapidly frozen in liquid nitrogen to preserve RNA integrity, which is critical for accurate gene expression analysis. Ethical approval for the animal study was granted by the Animal Ethics Committee of the Inner Mongolia Institute of Quality and Standardization (approval number: NZBY-02209002). The meat samples were handled following NY/T 1180-2006 on determination of meat tenderness, and the key texture parameters, including hardness, elasticity, and chewiness, were measured using a texture analyzer. Based on these textural characteristics, the samples were grouped into two categories: those with higher and those with lower textural values.

2.2 Standardization of RNA extraction and quality control

A standardized RNA extraction protocol was followed in accordance with the national standard GB/T 33681.1-2017, *Methods to prepare samples for high-throughput gene sequencing—Part 1: Preparing samples of animal tissues*, to ensure high-quality RNA suitable for high-throughput sequencing. The integrity and quality of the RNA were assessed using a NanoDrop spectrophotometer and an Agilent 2100 Bioanalyzer, which are widely accepted in the industry for quantifying and assessing RNA. The RNA Integrity Number (RIN) was used as a standardized metric for RNA quality, facilitating the comparison of RNA integrity across all samples and ensuring that only high-quality RNA was used for downstream analysis. This standardized RNA extraction and quality control procedure is critical for obtaining reproducible and reliable gene expression data, which is essential for identifying genes associated with meat quality traits.

2.3 Standardization of sequencing and data analysis

To ensure high-quality sequencing data, quality control of the raw reads was performed using Trimmomatic[2] and FastQC, both widely recognized tools for preprocessing sequencing data. After cleaning the raw reads, they were aligned to the reference genome using HISAT2[3], an accurate and reliable alignment tool. Gene expression levels were quantified using StringTie[4] and Salmon[5], which are well-established methods for accurate gene expression quantification from RNA-Seq data. Differential expression analysis was conducted using DESeq2, a widely used tool for identifying genes that are significantly differentially expressed between the two texture groups (higher and lower textural values). To gain insights into the biological significance of these differentially expressed genes, functional enrichment analysis was performed using clusterProfiler[6], which helps identify the key biological pathways and processes associated with these genes. For data visualization, including heatmaps and scatter plots, the ggplot2 package was used, providing high-quality graphical representations of the results. This comprehensive and standardized approach to data generation and analysis, from sample collection to bioinformatics processing, ensures the production of high-quality, reproducible data that can be used to uncover the genetic factors contributing to meat quality traits in Ordos fine-wool sheep.

This standardized methodology forms the foundation for the investigation of genes related to meat quality in Ordos fine-wool sheep using RNA-Seq data, enabling reliable and robust conclusions about the genetic underpinnings of meat quality traits in this breed.

3. Results

3.1 High-fidelity sequencing data

The standardized sample collection and preparation protocol ensured that the sequencing data from Ordos fine-wool sheep samples was of high quality, as shown in Table 1. All six samples (S1, S4, S7, S10, S11, S12) demonstrated consistent metrics, with an average read length of 150 bp and a Q30 base ratio above 93.61%, indicating a low error rate. The Q20 base ratio was also high, with sample S10 leading at 98.43%. The low N base ratio and balanced GC content across samples confirmed the sequencing data's suitability for accurate transcriptome analysis.

3.2 Transcriptome diversity revealed by NMDS

Non-metric Multidimensional Scaling (NMDS) analysis, a standardized method, effectively separated two groups of samples (HGC_H and HGC_L) in the transcriptome distance space, reflecting transcriptomic diversity and differences in gene expression patterns related to textural properties, as shown in Figure 1.

3.3 Differential gene expression insights

A total of 52,402 genes were analyzed, with 993 significantly upregulated and 475 downregulated in the high-textural-value group (HGC_H), as shown in Figure 2. This standardized differential gene expression analysis highlighted molecular distinctions, such as the upregulation

Sample name	S1	S4	S7	S10	S11	S12
Total Reads Count (#)	61619980	53155968	38397226	60131796	36215694	53142758
Total Bases Count (bp)	9.24E+09	7.97E+09	5.76E+09	9.02E+09	5.43E+09	7.97E+09
Average Read Length (bp)	150	150	150	150	150	150
Q10 Bases Count (bp)	9.19E+09	7.91E+09	5.7E+09	8.97E+09	5.38E+09	7.91E+09
Q10 Bases Ratio (%)	99.47%	99.16%	99.00%	99.46%	99.03%	99.21%
Q20 Bases Count (bp)	9.1E+09	7.79E+09	5.6E+09	8.88E+09	5.29E+09	7.79E+09
Q20 Bases Ratio (%)	98.42%	97.65%	97.27%	98.43%	97.33%	97.78%
Q30 Bases Count (bp)	8.85E+09	7.52E+09	5.39E+09	8.65E+09	5.09E+09	7.54E+09
Q30 Bases Ratio (%)	95.80%	94.30%	93.61%	95.95%	93.76%	94.59%
N Bases Count (bp)	2114502	1265972	347764	1762393	307598	1317310
N Bases Ratio (%)	0.02%	0.02%	0.01%	0.02%	0.01%	0.02%
GC Bases Count (bp)	4.82E+09	4.02E+09	2.95E+09	4.73E+09	2.84E+09	4.24E+09
GC Bases Ratio (%)	52.15%	50.40%	51.24%	52.46%	52.37%	53.20%

Notes:
Total Reads Count: The total number of reads for each sample.
Total Bases Count: The total number of bases, representing the amount of data.
Average Read Length: The average length of the sequence.
Q{N0} Base Count: The number of bases with quality above {N0}.
Q{N0} Base Ratio: The proportion of bases with quality above {N0}.
N Base Count: The number of N bases.
N Base Ratio: The proportion of N bases.
GC Base Count: The number of GC bases.
GC Base Ratio: The percentage of GC content.
e.g., Q30: The probability of incorrect identification is 0.1%, which means an error rate of 0.1%, or a correctness rate of 99.9%.

Table 1: Statistics of sample raw data information

of ITGA5 and COL14A1 in high-textural-value samples, and the downregulation of DHRS12 and LRRC23 in low-textural-value samples, providing insights into the molecular mechanisms affecting meat quality.

3.4 GO enrichment analysis of significant genes

The standardized Gene Ontology (GO) enrichment analysis revealed significant molecular functions, cellular components, and biological processes associated with textural values, as shown in Figure 3. Key molecular functions included cell adhesion molecule binding and cytoskeletal protein binding, while cellular components highlighted the extracellular matrix and actin cytoskeleton. Biological processes such as cardiovascular system development and multicellular organism development were also significant, offering a comprehensive understanding of the genetic factors influencing meat quality traits in Ordos fine-wool sheep.

4. Discussion

This study successfully delved into the molecular mechanisms underlying the textural variations in meat quality of Ordos fine-wool sheep, employing a rigorous and standardized approach to ensure the precision and reliability of the findings. By adhering to uniform protocols throughout the research workflow—from sample collection and RNA extraction to data analysis—it significantly enhanced the accuracy of gene expression profiling. This methodological rigor not only facilitated the identification of key genetic factors associated with meat quality traits but also established a benchmark for future genetic research in this field.

Key findings and their implications

A systematic and standardized approach that includes sequencing quality assessment, Non-metric Multidimensional Scaling (NMDS) analysis, differential gene expression analysis,

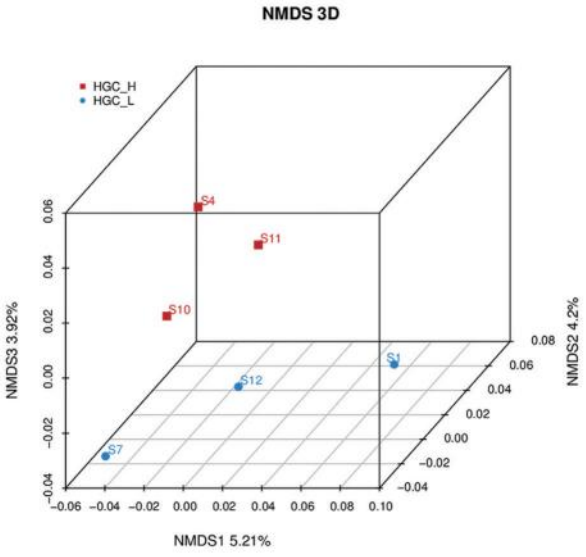

Figure 1: 3D plot of NMDS analysis

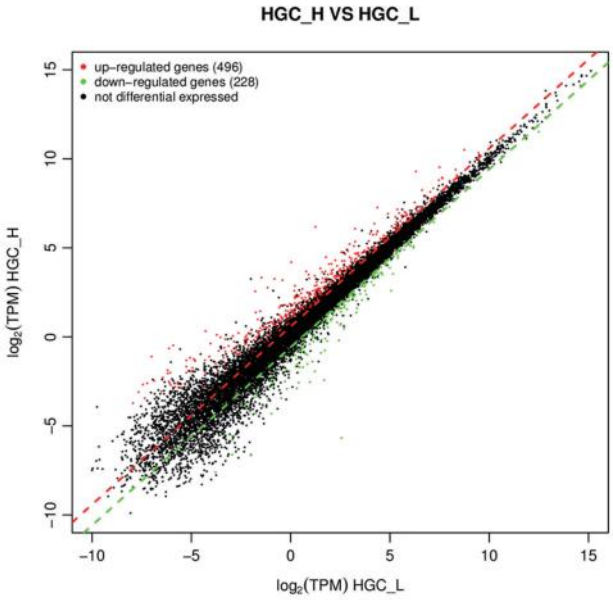

Figure 2: Scatter plot of gene expression

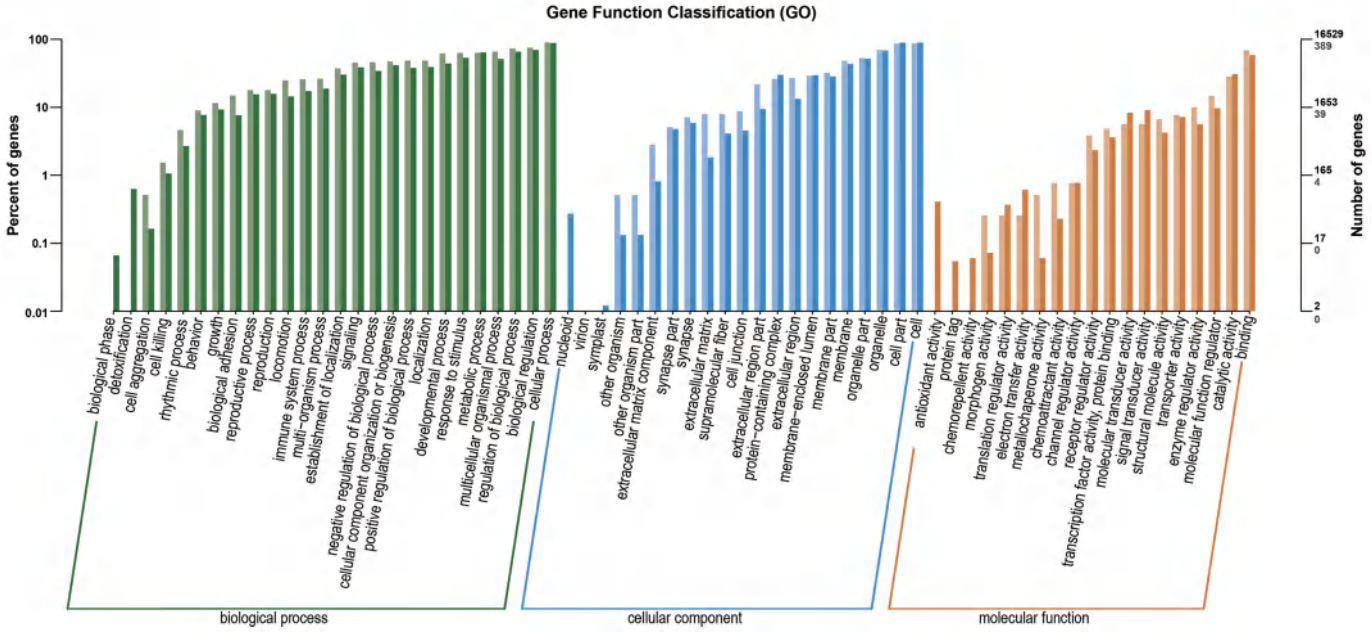

Figure 3: Bar plot of GO enrichment

and GO enrichment analysis have successfully uncovered key genetic factors associated with the hardness, gumminess, and chewiness of meat samples. This comprehensive analysis has provided valuable insights into the genetic determinants of meat texture, reinforcing the significance of standardization in revealing the intricate genetic architecture of meat quality traits.

The influence of standardization protocols

The standardized methods implemented in the study significantly influenced the outcomes. By adopting uniform standard operating procedures in sample collection, RNA extraction, and data analysis, the consistency and comparability of the data was ensured. The application of standardized procedures not only strengthened the discovery of gene expression differences but also provided a solid foundation for the precise identification of genetic markers associated with meat quality.

Implications for future studies

The study emphasizes the importance of standardization in genetic research and provides a reliable framework for future meat quality studies. By adhering to these standardized protocols, future research can more accurately identify the genetic factors influencing meat quality, providing a scientific basis for precision breeding and optimization of feeding practices. Additionally, the application of standardized methods can facilitate the comparison of research results across laboratories and regions, enhancing the universality and applicability of research findings.

Reflection on standardization practice

While standardized methods provided a solid foundation for the research findings, it was recognized that any methodology has its limitations. For instance, standardized procedures may need to be adjusted based on specific breeds or research objectives. Future studies need to consider how to maintain standardization while adapting to the diversity of different environments and genetic backgrounds. Moreover, as sequencing technologies and bioinformatics tools continue to advance, the standardized processes will also need to be updated to capitalize these new technologies.

5. Conclusion

In summary, the integrative approach has delineated the complex genetic architecture underpinning meat texture quality in Ordos fine-wool sheep. The distinct transcriptomic profiles and GO enrichment patterns between the HGC_H and HGC_L groups offer a robust basis for future research endeavors aimed at enhancing meat quality through precision breeding and management strategies. The findings in this paper not only advance the understanding of the genetic basis of meat texture but also pave the way for targeted interventions to improve the attributes of meat products.

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GB 12955-2024, *Fire-resistant doorsets*

a new mandatory national standard of China, was released by SAMR and SAC on October 28, 2024, which will be implemented on May 1, 2026.

The standard will replace the 2008 version. It specifies the classification, code, size, model, technical requirements, testing methods, inspection rules, sign, packaging, transportation, storage and other aspects, which is applicable to the design, manufacturing and quality test of fire-resistant doors for industrial and civil construction.

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