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Special report

2025 International Standardization (Chilin) Forum held in Nanjing

2025国际标准化（麒麟）大会在南京召开

Exclusive interview

Building on collaboration to create a smart future
Interview with IEC President Mr. Jo Cops

IEC主席乔·科普斯: 以协作为基础 创造智慧未来

China and IEC can cooperate very well for the future
Interview with Mr. Vimal Mahendru,
IEC Vice-President and Chair of SMB

IEC副主席兼SMB主席维马尔·马亨德鲁:
中国与IEC深化合作 共创未来

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The voluntary national standard,

GB/T 11856.1-2025,

Quality requirements for spirits–Part 1:

Whisky,

was released by SAMR and SAC on January 24, 2025,
which will be implemented on February 1, 2026.

The standard will replace GB/T 11857-2008, and it refers to the relevant regulations and documents in countries and regions such as the US, Canada, the EU, Scotland and Ireland during the revision, which is also based on the actual production situation of whisky in China. It aims to standardize the quality requirements in the production, testing and sales of whisky.

Cooperation is crucial for a better future

An annual event in March in China is the Two Sessions, the meetings of the National People's Congress (NPC) and the National Committee of the Chinese People's Political Consultative Conference (CPPCC). The SPOTLIGHT column of the issue displays the speech highlights of Luo Wen, SAMR Minister, and the insights into standards of representatives during the meetings.

The 2025 International Standardization (Chilin) Forum was held in Nanjing city, East China's Jiangsu province, on April 16, which focuses on the theme of "Towards carbon peak and carbon neutrality: international carbon footprint standards driving green and low-carbon development". The SPECIAL REPORT column introduces the main achievements of the meeting and highlights of addresses and keynote speeches of more than 10 domestic and international officials and experts.

At the forum, *China Standardization* interviewed IEC President Mr. Jo Cops and IEC Vice-President and Chair of SMB Mr. Vimal Mahendru. Jo Cops introduced the latest progresses of the IEC Global Impact Fund (GIF), IEC's measures to respond to the ever-changing world and technological innovation, and the achievements during his presidency. "We have achieved a lot during my presidency, thanks to the very solid foundations laid down by my predecessor, Dr. Shu Yinbiao, the 36th IEC President. We have completed important work on the long-term sustainability of the IEC, created the IEC GIF, and developed smart products and services to bring IEC standards and conformity assessment into the digital age," he said.

Vimal Mahendru shared his insights into the issues such as how IEC collaborates with other international standards organizations, the biggest challenges faced by IEC, its priorities and the areas that IEC and China can cooperate. He said, "Energy efficiency is already a big topic in China. But the future is about zero-energy and zero-emission buildings. How can we make sure that a building becomes so self-sufficient in energy that it doesn't take anything from the grid and doesn't emit any smoke or pollution? This is the future. Those are areas where China and IEC can cooperate very well."

Europe also held an important annual meeting in March, the 9th Cybersecurity Standardization Conference, which was organized by the EU Agency for Cybersecurity and the European Standardization Organizations (ESOs)–CEN, CENELEC and ETSI. More details can be found in the FEATURES column.

The RESEARCH & EXPLORATION column presents three academic papers that make a comparative analysis of frame strength standards for intelligent urban rail vehicles, research into China's standards system of fire extinguishing agents, and a standardized process for prognostic biomarker discovery based on genetic big data, respectively.

Enjoy the reading!

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China revises measures for adopting international standards

The State Administration for Market Regulation (SAMR) revised and issued the *Measures for the Adoption of International Standards* recently, to further regulate the adoption of international standards in China, steadily expand the institutional opening up of standards, and accelerate the development of integrated domestic and foreign trade.

The Measures will come into effect on June 1, 2025. Its main revised contents include the following five aspects.

First, it clarifies the adoption scope of the international standards and the scope of entities of standards adoption. The international standards refer to standards of ISO, IEC, and ITU. Identical adoption and modified adoption of international standards are both acceptable.

Second, it establishes a whole-process tracking mechanism for international standards. Domestic units undertaking the mirror committees of international standards organizations should track and study the latest progress and development trends of relevant international standards.

Third, it stipulates the requirements for the development cycle of the national standards adopting international standards. According to the Measures, priority should be given to national standards projects adopting international standards. If the international standards to be adopted are under development, it is encouraged to simultaneously develop and implement the corresponding national standards.

Fourth, it strengthens the requirements of copyright policies. Requirements for copyright protection are put forward at multiple stages of the national standards adopting international standards, including the project evaluation, approval review and standard disclosure. The Measures specifies that the disclosure of the national standards adopting international standards should comply with China's laws and regulations as well as the copyright policies of international standards organizations.

Fifth, it improves the supervision and correction mechanism for adopting international standards. The administrative departments in charge of standardization under the State Council should uniformly organize and carry out the assessment of the implementation effect of the national standards adopting international standards in key fields. Suggestions for modification should be reported to international standards organizations, if problems are found in the assessment.

SAC/TC 260 convenes Standards Week in Suzhou

The Standards Week activity was held on April 15-17 in Suzhou city, East China's Jiangsu province.

The event was attended and addressed by Wang Jingtao, Vice Administrator of Cyberspace Administration of China and Deputy Head of Office of the Central Cyberspace Affairs Commission, and Chair of SAC/TC 260, and Liu Xiaotao, Secretary of Suzhou Municipal Committee of CPC.

To foster China's strength in cyberspace, Wang Jingtao put forward the following suggestions. First, the work of cybersecurity should cover the whole cyberspace to establish a comprehensive working paradigm. Second, the mandatory role of standards should be highlighted, to effectively support the implementation of policies and regulations. Third, the balance of development and security should be kept, fully supporting the high-quality development of emerging industries. Fourth, upholding the concept of openness and innovation, China's experience in cyber governance can be shared with global partners.

The Standards Week was jointly organized by the secretariat of SAC/TC 260 on cybersecurity, China Electronics Standardization Institute, and the Cyberspace Affairs Commission of Suzhou Municipal Committee of CPC. More than 800 participants attended the event, including members of SAC/TC 260, leaders of working groups, and representatives of member units.

During the Standards Week, four technical exchange meetings were held, focusing on artificial intelligence security, protection of critical information infrastructure security, personal information protection, as well as standards and application of commercial cryptography. Meetings of working groups, training sessions on basic knowledge of national standards, and exchange meetings on cybersecurity standards practices were held as well.

China issues national standard on high performance computing

The first national standard on high performance computing (HPC), GB/T 45400-2025, *Information technology—Cloud computing—General requirements of HPC in cloud*, was issued by the State Administration for Market Regulation (National Standardization Administration of China), which will come into effect in October.

The development of the voluntary national standard was led by Alibaba Cloud, China Electronics Standardization Institute and other institutions. It lays the foundation for the large-scale application of HPC in cloud, and promotes the construction of China's computing infrastructure towards a standardized and intelligent phase.

As a new type of HPC, HPC in cloud provides elastic and extendable HPC services externally based on cloud infrastructure. Currently, traditional HPC has been applied in fields such as large model training, autonomous driving, life sciences, industrial manufacturing, and semiconductor chips, and is gradually blending with other industries.

However, traditional HPC often has complex architectures, poor scalability, performance bottlenecks, and high prices, which hinders its adoption in many enterprises and makes HPC in cloud a new choice for enterprises.

GB/T 45400-2025 delineates definitions of the infrastructure of HPC in cloud, collaborative scheduling of resources, full-stack security and trust system, and other key technical indicators. It covers the entire process of cloud HPC services, including design and development, deployment and operation, and performance evaluation, providing a guide for various industries regarding the design, implementation, application, and selection of such products.

The 3rd Annual Meeting of Carbon Label held in Beijing

Jointly hosted by institutions including the China Carbon Label Industry Innovation Alliance (CLIIA), and the committee on low-carbon economy of China Electronics Energy Saving Technology Association (CEESTA), the 3rd Annual Meeting of Carbon Label was held on April 16 in Beijing, which was attended by over 200 representatives from the government, enterprises and academia.

The meeting focused on the evolution process of the carbon label standards system in the past decade, and released the carbon label standards system coordinating infrastructure and industry, which marks China's solution to global low-carbon transformation.

Carbon labels connect low-carbon production and green consumption, and the conference is a platform to reach consensus and deepen cooperation, said Huang Jianzhong, Chairman of CEESTA, in his speech.

From the perspective of scientific and technological innovation, Fei Weiyang, Academician of Chinese Academy of Sciences said, "We must make efforts to promote industrial transformation with standards upgrading, and establish low-carbon ecology covering the whole industrial chain." Green and low-carbon technologies should be applied to achieve major breakthroughs, and work on all aspects of carbon labels and green and low-carbon development should be promoted to ensure the achievement of the dual carbon goals.

At the opening ceremony, the 2.0 version of *Guidelines on Carbon Footprint and Carbon Labels* in China was released. It specifies the accounting methods of product carbon footprints, providing more operational guidance for enterprises and consumers. The youth-oriented low-carbon science popularization book, *Hello, Carbon*, was released at the event, which is a crucial step in the popularization of low-carbon education among the public.

ISO releases two standards for tourism

ISO 9468:2025, *Tourism and related services—Online travel agency (OTA)—Guidelines for online accommodation booking platform services*, and ISO 25639-1:2025, *Exhibitions and events—Part 1: Vocabulary*, were released recently, the development of which were led by China.

Adopted by many countries, ISO 9468:2025 and ISO 25639-1:2025 are important achievements in tourism standards with China's contribution since the release of ISO 14785:2024 on tourist information services.

ISO 9468:2025 provides technical support for relevant services of online accommodation booking platforms, which will enhance the quality and transparency of tourism services and facilitate inbound trips. Through defining clear responsibilities, transparent information, standardized processes, strengthened security guarantees, and dispute resolution mechanisms, the standard systematically establishes a three-party trust mechanism among users, platforms and service providers. It further puts forward requirements on information security, financial security and privacy protection, to effectively safeguard consumers' right to know and choose. In addition, it emphasizes the accessibility service function of OTAs, ensuring the smooth booking of people with special needs.

Catering to the prosperous development of digital economy and demands of fully implementing SDGs, ISO 25639-1:2025 focuses on the industrial development trends of innovation, coordination, and sustainability. The revised standard consists of 5 major categories and 94 terminologies, providing a unified and universal conceptual system for the global exhibition and event industry. It eliminates ambiguities and misunderstandings and facilitates international exchanges and cooperation.

The two international standards mark China's contribution to the standardized, high-quality and sustainable development of the tourism industry. The Ministry of Culture and Tourism and SAMR will continuously promote the international standardization work in this field. While sharing China's practices and cases, they will conduct analytical research on the feasibility of adopting international tourism standards to learn from international advanced experience.

Further efforts will be made to boost the coordinated development and improvement of tourism service management around the world, and propel the normative development and quality enhancement in the field of exhibitions and events.

BRICS Economic and Trade Forum convened in Beijing

The BRICS Economic and Trade Forum was convened on April 18 in Beijing, which was themed "Standards cooperation facilitates trade development, BRICS cooperation empowers the Global South".

The forum was hosted by China Council for the Promotion of International Trade (CCPIT) and co-organized by the CCPIT Commercial Sub-Council and the specialized working group on trade and investment of the BRICS Business Council. It was attended by more than 200 representatives from related international organizations, business associations, research institutes, and enterprises, as well as ambassadors to China. The *BRICS Action Plan for Trade Development and Standards Cooperation Initiative (2025-2026)* was released during the forum.

The cooperation on economic and trade cooperation is an important pillar of BRICS cooperation. The business communities of BRICS countries should join hands and uphold the multilateral trading system based on the framework of the World Trade Organization, to jointly address global challenges. We should work together with governmental departments, professional organizations and academia to strengthen standards development for trade, leveraging standardization means to facilitate the trade development of BRICS countries, said Li Qingshuang, Vice Chair of CCPIT.

The BRICS cooperation has great potential and far-reaching influence. The big BRICS family brings more economic and trade rules and sectoral standards to global partners, indicating the vigorous development of BRICS cooperation and demonstrating the BRICS spirit of openness, inclusiveness and win-win cooperation, according to Liao Lin, Chair of the Board of the Industrial and Commercial Bank of China.

In face of a challenging world, we can stimulate innovation, expand business opportunities, and create more jobs by strengthening common standards to facilitate trade, said Tatiana Lacerda Prazeres, Brazil's Secretary of Foreign Trade of the Ministry of Development, Industry and Foreign Trade, who delivered a speech via video.

Chinese expert re-elected Chair of APEC EGEEC

The 64th Meeting of the APEC EGEEC was held on April 8-11 in Hong Kong, China. Liu Meng, Associate Researcher of the Branch of Resource and Environment Research, China National Institute of Standardization (CNIS), was re-elected as the Chair of the APEC Expert Group on Energy Efficiency and Conservation (EGEEC). His new term will last from July 2025 to June 2027.

The APEC EGEEC was established by APEC Energy Working Group (EWG) in 1993 to assist in achieving energy security, advance the economic and social well-being, and realize environmental benefits in the Asia-Pacific region through energy conservation and the application of energy-efficiency practices and technologies. The chair and vice chair lead the research work and technical exchanges, and report to the EWG regularly.

As the domestic counterpart of EGEEC, CNIS participates in its activities on behalf of China, and takes the lead in implementation of APEC cooperative projects in the field of energy conservation and low carbon. CNIS experts have served as the chair or vice chair of EGEEC since 2015. They have played a significant role in the standardization and sustainable development of EGEEC, winning the recognition of experts from relevant economies.

CNIS will continue to enhance its participation in technical activities related to energy efficiency and conservation within the APEC framework, support regional collaboration on energy-saving and low-carbon technologies, standards and policies, share China's experience in energy conservation and decarbonization. It will strive for APEC's aspirational goal of reducing energy intensity by at least 45% in 2035 compared to that in 2005.

AdHoc meeting held for an ISO standard project on digital product passport

The ISO/UNECE joint working group for information exchange of supply chain aligned to UN/CEFACT semantics (ISO/TC 154/JWG 9) held the AdHoc Meeting of ISO/PWl 25534-1, *Digital product passport—Part 1: Overview and fundamental principles*, on March 25.

The meeting was attended by over 400 representatives from participating and observing members of ISO/TC 154 such as China, the U.S., Germany, France, Japan, the Republic of Korea, and other countries, as well as international organizations, governments, and enterprises. CNIS supported the meeting as the secretariat of ISO/TC 154 and joint organizer of the ISO/PWI 25534-1 project.

Hosted by Jim Wilson, Co-convenor of ISO/TC 154/JWG 9, the meeting aims to understand the opinions of global digital product passport (DPP) stakeholders and promote their cooperation, so as to ensure global interoperability and wide adoption of DPP standards. The attendees further discussed how to improve the scope and direction of ISO/PWI 25534-1.

The ISO DPP standards are of great significance for promoting global sustainable development, facilitating enterprise transformation, enhancing product data transparency and traceability, and providing solid support for global value chains. As the first of a series of standards for DPP, ISO/PWI 25534-1 is under development, which will underlie the international consensus on DPP and subsequent development of other relevant standards.

CNIS will accelerate the pre-research work, fully leverage the coordinating role of the joint leading party, and conduct industrial and technological research in key fields such as textiles and batteries to promote the coordination of stakeholders. It will establish a regular working mechanism for DPP standardization in China, and contribute to establishing China's DPP standards system, promoting industrial application, and realizing global sustainable development.

Building on collaboration to create a smart future

Interview with IEC President **Mr. Jo Cops**

以协作为基础 创造智慧未来
——专访IEC主席 乔·科普斯

Last year, China Standardization Press interviewed Mr. Jo Cops, IEC President, during the IEC Global Impact Fund Forum in Nanjing city, East China's Jiangsu province. He talked about IEC's contribution to an all-electric, connected, and sustainable world, and further expounded on the vision and practice of the newly established IEC Global Impact Fund.

This year, we are glad to meet Mr. Jo Cops again in Nanjing. He has brought the latest progress of IEC GIF, and shared his opinions on standardization work.

***China Standardization*: During the IEC Global Impact Fund Forum last year, you talked about the newly launched IEC GIF. Is there any new progress?**

Mr. Jo Cops: The IEC Global Impact Fund has successfully launched two projects aimed at bringing the benefits of IEC standards to society through enabling clean, sustainable and safe energy access to communities in need.

We could provide electricity locally for communities that are too far away from the grid. It is economically not viable to connect them to the grid and cost too much money. So we came up with an alternative fully based on IEC standards and conformity assessment.

The IEC GIF formed several partnerships with organizations that support its mission and can help propel progress through attracting funding, awareness and joint activities. This includes the Korean Agency for Technology and Standards (KATS) as the first financing partner for the Fund. Under the agreement, KATS, which hosts the IEC National Committee for Korea, is contributing CHF 200,000 (about USD 241,580) per year.

The first project is to empower Kenyan communities to create a better cleaner future. Under the project, the Differ Community Power (DCP), an international provider of solar energy services to communities, is determining the feasibility of using second-life lithium batteries to rehabilitate solar photovoltaic (PV) installations at critical locations such as schools and healthcare facilities in Kenya, with the help of international standards. If the approach is proven viable, it is expected to extend to other existing solar PV installations across sub-Saharan Africa, thus improving potentially thousands of lives through enabling reliable, clean sources of electricity.

I was there last year and I could see firsthand how these things were going. I had heard the stories that when women came to the hospital in the middle of the night where there were no lights, they had to give birth while holding the torch. That had gone straight to my heart. So we tried to help those communities by providing electricity.

A total of 9 sites (7 schools and 2 health facilities) were chosen to benefit from the project and inform IEC's work. Installations have been started, and are expected to be completed in June this year. The significant impact of the project lies in the communities. It enables families to receive necessary vaccines, medications and more appropriate healthcare, nurses to charge their phones locally without having to drive for miles, teachers to be able to use learning equipment such as tablets and projectors, and the wider community will be able to benefit from the lighting and power to charge their phones too.

That is a very successful project that we want to scale up in the coming months.

The second project was launched last year and an implementing partner has just been selected. It is aimed at supporting an SME-led project to bring clean cooking solutions to communities, given that around 2.1 billion people—roughly a third of the global population—still rely heavily on solid fuels like wood, charcoal and animal dung for cooking. These methods are not only inefficient but also dangerous. The need for cleaner, more sustainable cooking solutions is clear and urgent.

In that case, we are trying together with other organizations like the Sustainable Energy for All, which is an organization hosted by the United Nations Office for Project Services (UNOPS), with a global mandate to accelerate progress on the energy transition in developing countries. We try to bring eCooking (electric cooking) to the communities.

Can you further explain eCooking?

It is about making the supply of electricity for clean cooking available to rural or economically disadvantaged residents. They tend to rely on fuels such as wood and animal dung for cooking, and the gathering of fuels is mostly undertaken by women and even children.

The fuel-based cooking is very polluting and also not very efficient. The emergence of solar home systems sized for cooking, mini-grids designed to support cooking loads, and household energy storage to buffer unreliable grid supply, has enabled eCooking to become a much more equitable solution to the clean cooking challenge. It can facilitate energy production, and make more time available for the kids to study, which is a project beneficial to those communities.

Emerging technologies such as AI, big data, and cloud computing are prospering and blending with traditional industries. How is IEC responding to this ever-changing world and technological innovation?

IEC is already involved in those new technologies. We are tracking new technologies all the time. We try to see what is going on in the market and we try to base our work on what is happening there. For example, we are involved in the ISO/IEC JTC 1/SC 42 on AI, and we have other subcommittees focusing on cybersecurity as well. We also have the IEC Market Strategy Board, which is having its annual meeting here in Nanjing, to keep a close eye on the technological trends.

Jo Cops visits Kenya to investigate the first project of the IEC Global Impact Fund.

While the IEC already develops standards and conformity assessment solutions for the digital economy, including for emerging technologies such as artificial intelligence and quantum, a paradigm shift is underway. One big development we are seeing and expecting very soon is the smart future. The smart future consisting of smart standardization and smart conformity assessment is the next big step.

The IEC is currently developing smart products and services that will make it possible for users to choose not only entire IEC standards but also paragraphs or even smaller information units from different publications, and to combine them in a way that addresses specific needs. We are currently piloting a white label app on this purpose. By inserting code based on PDF documents, the work flow will become much more automated. That is how we visualize for ourselves the smart future. Furthermore, the IEC Board is committed to investing a lot in the smart future.

What has IEC done to realize global prosperity?

Our work supports global prosperity by helping to remove barriers to trade. Under the World Trade Organization's Technical Barriers to Trade (TBT) Agreement, WTO members commit to using international standards as the basis for their national standards, mandatory technical regulations and testing and certification practices. Global value chains can only function efficiently when all participating economies follow the same harmonized, globally agreed rules, which are embedded in international standards.

Starting from working in the industry, you have expanded your career at national, regional, and international level, which is especially valuable to standardization. Please share your opinions on how standardization work at national and international level interact with each other.

The first thing to remember is that standards usually start at the country level. Most countries have their own national standards-making bodies and many of these host IEC National Committees. Under the WTO rules, governments are required to base their national regulations on standards produced by organizations like IEC and ISO. Driven in part by these rules, and further accelerated by the broader forces of globalization, national and regional standards bodies are increasingly adopting or aligning with international standards wherever feasible.

What achievements have been made during your IEC presidency? What advice do you have for Mr. James Matthews, the President-Elect?

We have achieved a lot during my presidency, also thanks to the very solid foundations laid down by my predecessor, Dr. Shu Yinbiao, the 36th IEC President. Three years is not very long, but during this time we have completed important work on the long-term sustainability of the IEC, created the IEC GIF, and developed smart products and services to bring IEC standards and conformity assessment into the digital age.

I believe I have left James a platform that he can build on. As mentioned previously, three years is not very long. Our role is really to ensure the passing of the baton is as smooth as possible and it helps that James' vision and mine are very much aligned. I have a tremendous respect for Jim and his abilities. The IEC will be in very capable hands.

采访/方洛凡
(Interviewed by Fang Luofan)

About Mr. Jo Cops

Mr. Jo Cops became IEC President on January 1, 2023, for a three-year term. Prior to that, he served as Treasurer of IEC from 2018 to 2022. He led the Belgian Electrotechnical Committee (CEB-BEC) as the Secretary-General from 2012 to August 2021.

Mr. Cops has a master's degree in engineering and has had a distinguished career in industry. He was the Director of Industry Relations at Niko, a European leader in smart home solutions. He began his career with Sony Belgium and subsequently held various management positions within Sony Europe, followed by senior positions at Telenet (Liberty Global) and Alpha Technologies Europe.

China and IEC
can cooperate very well for the future

Interview with **Mr. Vimal Mahendru**,
IEC Vice-President and Chair of SMB

中国与IEC深化合作 共创未来
——专访IEC副主席兼标准化管理局主席
维马尔·马亨德鲁

***China Standardization*: You have served many leading roles in IEC. Can you share with us your main professional experience, in particular how did you get involved in the IEC standardization work?**

Mr. Vimal Mahendru: I was born in a small town in north India. My father was very hard-working, and in 1958 he set up a company for making electrical switches. He made switches with his hands, and then sold them in the market. It was a very small business. I grew up seeing him working hard with the electrical equipment, which gave me some ideas about electricity. Growing up in a small town, I was very clear that I had to work hard to become an engineer and study hard to develop myself.

So I became an engineer. Then I went to the U.S. to study my master courses. Later, I came back to India and joined my father in the business of making low-voltage electrical equipment. We did well to make the business grow to a good size in India. Then I became a member of the vibrant Indian Electric and Electronic Manufacturers Association (IEEMA). I became its president in 2010. Around that time, the business had grown so much that my family decided to sell it to a French company. We sold the business, and I began to lead the French business in India.

At that time, the Indian government was looking for people who could lead the work of electrification for the country. I got involved in working with the government to make a policy for electricity access. But we needed standards, so we went to the IEC headquarters in Geneva for the standards for rural electrification. In IEC, they said, "Well, good idea. But if you need standards, you must be part of the committee to chair it and lead this work".

It was in 2014 that for the first time I got involved in IEC to enable writing the standards for electricity access. I was lucky that in the same year I got elected to the Standardization Management Board (SMB) as a member representing India. Since then, I had been a member of the board for 8 years. In 2022, the IEC community almost unanimously voted me as the Chair of the board. That is my journey in becoming the IEC SMB Chair and Vice President.

How does IEC collaborate with other international standards organizations including ISO and ITU in developing harmonized international standards, especially those for digitalization?

The collaboration works at many levels. The first level is the World Standards Cooperation (WSC). This is a cooperation forum where the leaderships of IEC, ISO and ITU, the presidents, secretary-generals and vice presidents, meet once a year to discuss the global agenda. We coordinate with each other, and pull our resources to write standards.

The second level is the standardization level. IEC, ISO and ITU come together in the Standardization Programme Coordination Group (SPCG). The SPCG has regular meetings every year, to look at the complete standardization programmes of IEC, ISO and ITU, and make sure that we are not doing the same thing and we don't leave a vacuum that nobody is doing. That becomes a very important part of our coordination.

The third level is actually where we write standards. In the technical committees in IEC, ISO

Vimal Mahendru gives a speech at the 2025 International Standardization (Chilin) Forum held in Nanjing city, Jiangsu province, China.

and ITU, there are a lot of members who sit in each other's technical committees. We have a formal structure called liaisons. These liaisons work both ways. For example, ambassadors of a technical committee in IEC go to the other committee in another organization like ITU or ISO to share what we have done and listen to what their need is, and then bring it to IEC. This is how at three levels the cooperation and coordination on standardization works.

In the area of digitalization, there is a lot of coordination going on. Especially IEC and ISO have a joint delivery program where we are totally synchronized on our digitalization efforts. IEC and ISO have coordinated to make the standards development process in a digital way on the Online Standards Development (OSD) platform. The OSD is a common platform of IEC and ISO where all future standards are going to be written. It has been already implemented since January this year. All experts worldwide in IEC and ISO are expected to be using this platform to write standards. Also, we are writing digital apps and the digitalization of standards is going on. There is a lot of work to be done. IEC and ISO have formed a joint operational team, which will implement the complete digital transformation of standards in IEC and ISO. From users' perspective, they see only one app and a clear transparent view of the digitalized version of standards.

The cooperation of IEC, ISO and ITU is very cordial. For example, as Chair of IEC SMB, I sit on the Technical Management Board (TMB) of ISO and the Chair of ISO TMB sits on the IEC SMB. So, the chairs are sitting on each other's boards, and they bring information from their respective organizations to the other. This is good cooperation. We make sure that these are two separate organizations, so they make their own decisions. But to understand what is going on, we sit with each other to coordinate.

In your opinion, what are the biggest challenges faced by the current IEC standardization work system?

With evolving technologies in the fast-growing world, there are multiple challenges. I will list the top three challenges that we face.

The first challenge is that we don't have everyone sharing their problems or issues with us. There are some countries that are leading the standardization work, sitting at the table, writing the standards, and defining the problems that the standards solve. But there are many countries that are not even telling the IEC the challenges they may be facing. They are not even articulating what they need from the standards. That is a challenge to really develop globally relevant standards. We need every country to come in and share what issues they have, so that the solutions that the standards bring can serve the whole global community.

The second challenge is that technology is changing very rapidly. For instance, digital transformation, sustainability, circular economy, hazardous materials, resilience, and AI. These are changing very fast in the last 10 years. Even before standards are written, policy makers worldwide and regulators are stepping in and they are making policies around AI, circularity and other major shifts in society. This tells me that IEC must do a better job of engaging with policy makers and understanding what governments and policy makers want, in order to address them speedily through our standards. This means we need to listen to governments and policy makers more in the future. This is important.

The third challenge is with so many disruptive technologies, I find that IEC is going at a certain speed, which is okay when a technology is not changing. But today when the technology is evolving very rapidly, we need to be faster and understand new technologies and start the standardization. You will see in the coming months and years, IEC will be a lot more engaged and responsive in addressing the changes in society and bringing those changes in a standardized way much faster.

With the ever-changing global landscape and rapid development of emerging technologies, what are the priorities of IEC standardization work this year or in the next few years? How is China doing in these areas?

In my opinion, the first priority is smart and sustainable cities and communities. This is very important. The majority of the world today lives in cities and communities. Are we living better than 20 or 30 years ago, or is the quality of life going down? It has to continue to improve. To this end, IEC and ISO have recently formed a joint technical committee on smart and sustainable cities and communities. This is pivotal work. I welcome China to partner in this, bringing Chinese experts to contribute their knowledge and experience to the smart and sustainable cities.

The second priority is sustainable electric transport. China has done an amazing job in this area. If you see the fleet of electric vehicles, not only personal vehicles but also commercial vehicles and public transport, you will know that China has done very well. I congratulate the Chinese industry

and its leadership. This is required by the world. So sustainable electric transport is another work that IEC is doing. This is very relevant today. This year we are going to do a lot of work in this. I sincerely welcome Chinese experts to be involved in this.

The third priority, which was also the theme of this year's International Standardization (Chilin) Forum, is carbon-free energy and clean energy technologies. This is at the heart of development. Today there is almost nothing you can do without electricity, electronics, or software. These technology domains are at the heart of IEC. This is the reason why IEC standards are written. We are working toward an all-electric and connected society. It becomes very important to write standards which bring clean energy and carbon-free electricity to all. China has a lot of experience in this area, which I believe is very significant to the world. Thus, bringing relevant Chinese knowledge to IEC would be very helpful.

China has played an increasingly important role in developing and promoting IEC standards. What areas can China and IEC carry out in-depth cooperation for mutual benefits and global well-being?

There are a lot of them, for example quantum technologies, biodigital convergence, and space technologies. Energy efficiency is already a big topic in China. But the future is about zero-energy and zero-emission buildings. How can we make sure that a building becomes so self-sufficient in energy that it doesn't take anything from the grid and doesn't emit any smoke or pollution? This is the future. Those are areas where China and IEC can cooperate very well.

I want to conclude by quoting a beautiful sentence that I saw in the exhibition center of the IEC Promotion Center (Nanjing) this morning: "China is becoming more and more important to IEC, and IEC is becoming more and more important to China". I totally believe in that.

采访/靳吉丽
(Interviewed by Jin Jili)

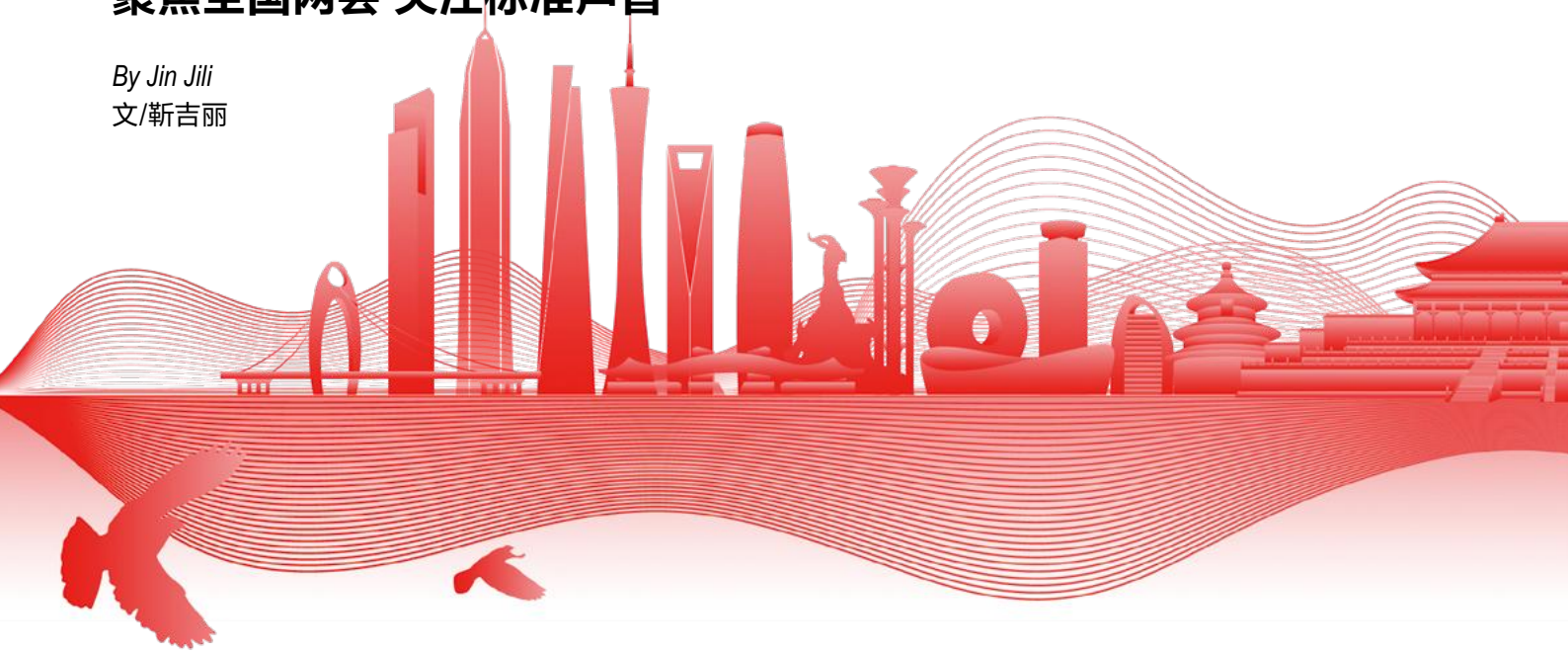
About Mr. Vimal Mahendru

Mr. Vimal Mahendru began his three-year term as IEC Vice-President and Chair of SMB on January 1, 2023. He has been deeply involved in many IEC activities for more than 11 years. Mr. Mahendru is currently the IEC Special Envoy for UN SDGs, member of the IEC Board Task Force on UN SDGs, member of the IEC Business Advisory Committee (BAC), and Chair, and Convenor or Co-Convener for several SMB related boards, strategic groups, and ad hoc groups. He is also Chair of the IEC Systems Committee for Low Voltage Direct Current and Low Voltage Direct Current for Electricity Access (SyC LVDC). Additionally, he is the CEO of Valuon Strategic in India, and a member of the Electrotechnical Divisional Council of the Bureau of Indian Standards.

Voices about standards in the Two Sessions

聚焦全国两会 关注标准声音

By Jin Jili
文/靳吉丽



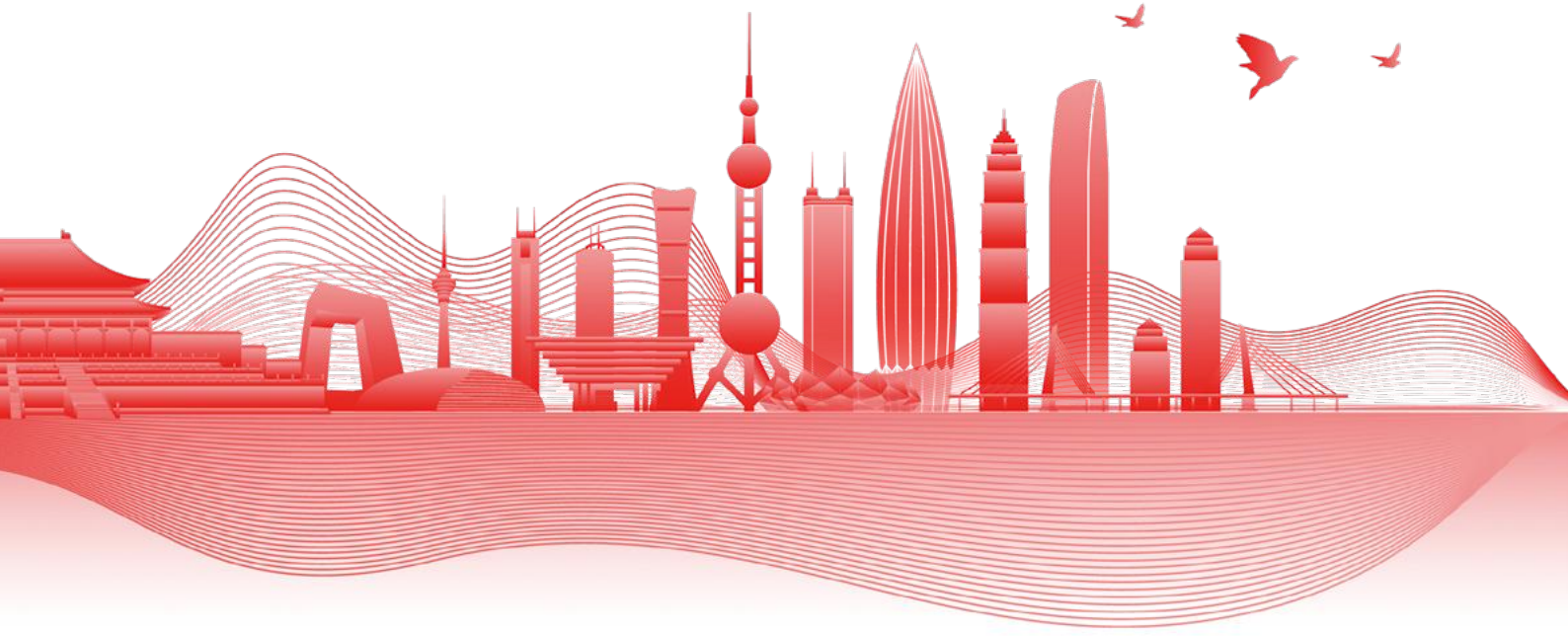
The annual Two Sessions, the meetings of the National People's Congress (NPC) and the National Committee of the Chinese People's Political Consultative Conference (CPPCC), were held in Beijing from March 4 to 11, 2025. This year's meetings raised considerable concern as the year 2025 is the final year for implementing the 14th Five-Year Plan (2021-2025), which is decisive for making the 15th Five-Year Plan (2026-2030), and also very important for further deepening reform comprehensively.

The government work report was delivered by Chinese Premier Li Qiang at the third session of the 14th NPC on March 5. The report starts with a review of the work in 2024, makes overall requirements and policy orientations for economic and social development in 2025, and sets major tasks for 2025.

In the report, the main targets for development this year are projected as follows: the GDP growth of around 5 percent; surveyed urban unemployment rate of around 5.5 percent; over 12 million new urban jobs; CPI increase of around 2 percent; growth in personal income in step with economic growth; a basic equilibrium in the balance of payments; grain output of around 700 million metric tons; a drop of around 3 percent in energy consumption per unit of GDP; continued improvements in the environment.

There are 9 key points directly related to standardization work, covering the fields such as green and low-carbon industries, traditional industries, education, housing, finance, trade, and foreign-funded enterprises. For example, in 2024, "mandatory national standards such as those for environmental protection and safety were formulated or revised".

In 2025, great efforts will be made in several aspects. In terms of education, China will "see compulsory education schools meet educational standards and promote high-quality, well-balanced development of compulsory education". In terms of housing, China will "improve the standards and regulations on building quality homes that are safe, comfortable, eco-friendly, and smart".



When it comes to industrial development, China will "refine the policies and standards supporting green and low-carbon development and foster a sound environment for the development of green and low-carbon industries", and "elevate national standards to guide the upgrading of traditional industries".

In terms of finance, China will "improve the standards and foundational institutions for technology finance, green finance, inclusive finance, pension finance, and digital finance". In terms of trade, China will "support the integrated development of domestic and foreign trade and work faster to address issues concerning standards, certification, and market channels".

With ongoing highlight on foreign-funded enterprises, China will "ensure national treatment for foreign-funded enterprises in fields such as access to production factors, license application, standards setting, and government procurement". CS

Promoting healthy development of platform economy and regulating law enforcement of involving enterprises

罗文局长：促进平台经济健康发展和规范涉企执法

Luo Wen, Minister of SAMR, put forward measures for promoting the healthy development of platform economy and regulating the law enforcement of involving enterprises at the Ministers' Corridor after the completion of third plenary session of the 14th NPC on March 5, 2025.

Standardizing the rules of online trade platforms

In terms of rules, we will adhere to the principle of openness and fairness to facilitate mutual benefits and win-win results of all parties. As for the problems such as rules of refund only, automatic pricing, lowest price, and lagging regulation system building, platforms should define the application scope and specific circumstances of rules, and regulate promotional behaviors. The *Regulatory Measures for the Rules of Online Trade Platforms* will be formulated to ensure the rights and interests of all parties.

In terms of charges, we will take rationality and transparency as the goal to reduce the burden of small and medium-sized merchants. As for the problems such as numerous charging items, complex computing methods, and opaque charging rules, platforms should simplify and publicize the charging items, optimize the pricing mechanism, protect merchants' right to be informed, and help them reduce costs and increase efficiency. The *Compliance Guide for Charging Behavior of Online Trade Platforms* will be formulated to provide clear guidance for platform enterprises to charge fees reasonably.

In terms of live-streaming e-commerce, we will focus on regulating the market order to effectively protect the rights and interests of consumers. As for the problems such as malicious hyping, false marketing, and counterfeit and shoddy products, platforms should strengthen the responsibility of check, special random inspection of product quality, regulation, and law enforcement, and crack down on acts such as false advertising to maintain fair competition and continuously improve the quality of products. Meanwhile, the *Regulatory Measures for Live-streaming E-commerce* will be formulated to establish a long-term regulatory mechanism and effectively standardize live-streaming trading behaviors.

In terms of algorithms, we will be positive and inclined to goodness to effectively protect the rights and interests of employees in new forms of employment. As for the problems of less transparency in algorithms, big data-enabled price discrimination against regular consumers, and fake orders and credit speculation, we will work with relevant departments to strengthen comprehensive governance, urge platform enterprises to improve the transparency and rules of algorithms, and effectively protect the rights and interests of employees in new forms of employment.

Rectifying the problems of involving enterprises

Regarding the problem of arbitrary charges of involving enterprises, we will adopt a combination of temporary and fundamental solutions.

We will focus on affiliated units of government departments, industry associations, transportation and logistics enterprises, and online platforms, and promote the construction of monitoring sites for charges of involving enterprises, so as to detect and handle the problem of arbitrary charges at an early stage. We will not only actively carry out compliance review of related policies and measures taken by involving enterprises and address the issue at the source, but also formulate measures for dealing with arbitrary charging behaviors, and truly establish a long-term regulatory mechanism.

Regarding the problem of arbitrary fines of involving enterprises, we will implement the principle of proportionality between offenses and penalties.

The principle should reflect that light penalties for minor offenses and heavy penalties for major offenses are imposed to make law enforcement both compassionate and forceful. The principle should also reflect no penalty for first violation and exemption from punishment for minor violations.

Insights into standards in the Two Sessions

全国两会代表、委员话标准

During the Two Sessions, members of the CPPCC National Committee and deputies to the NPC discussed issues of common concern, such as artificial intelligence (AI), new energy vehicles and autonomous driving, low-altitude economy, carbon emissions, circular economy, and e-waste. Let's find out their insights into standards, which play a more important role in the Chinese modernization.

On AI

Improving the standards system for AI terminals

Lei Jun
Deputy to the NPC

Lei Jun, Deputy to the NPC and founder and CEO of Xiaomi Group, focused on the high-quality development of new energy vehicles and AI.

Currently, the improper use of "AI-driven face-swapping and voice-mimicking" technologies has led to illegal infringement acts, which poses great challenges to governance and rectification. In response, Lei Jun proposed to explore and introduce a separate law on AI, strengthen industry self-discipline and co-governance, and enhance the publicity and education of the rule of law on AI.

Lei indicated that AI terminals are in the initial stage of development. Such products vary greatly and have the problems such as bottlenecks in technological innovation and insufficient industrial collaboration, which urgently need to be solved through policy guidance and support.

Therefore, he gave the following suggestions: first, improving the standards system for AI terminals, developing series of standards guided by users' experience, establishing the identification method for AI terminal products, and strengthening the effective coordination of international and domestic standards; second, strengthening the industrial collaboration of AI terminals, building an application and collaborative ecosystem, and accelerating the construction of unified interface specifications and data formats between terminal devices and intelligent applications; third, increasing the government support of the special projects for R&D and application of AI terminals.

Deng Zhonghan

Member of the CPPCC National Committee

Promoting the AI chip industry with standards

To develop China's chip industry rapidly, we must leverage the leading role of standards and form our own industrial ecosystem, according to Deng Zhonghan, Member of the CPPCC National Committee and Academician of the Chinese Academy of Engineering. It is necessary to take advantages of new systems, rapidly develop technical standards for AI chips, combine independent standards with industrial advantages, and improve chip technologies in various application.

How to rapidly develop the semiconductor industry? Deng shared his suggestions: first, promoting the industrial development with standards, accelerating the R&D of Chinese standards, and form the closed loop of "standards-chips-application"; second, tackling key technologies in major fields, increasing investment in core links, and supporting enterprises to enhance their competitiveness; third, building a high-level talent team to cultivate interdisciplinary talents, and attract top talent to devote to the industry.

Chen Xiaohong

Member of the CPPCC National Committee

Accelerating the standards system building for AI Agent

With the rapid development of AI Agent, there are problems such as lagging key technical standards, weak ethical and safety norms, and lack of evaluation and regulatory systems, according to Chen Xiaohong, Member of the CPPCC National Committee and Academician of the Chinese Academy of Engineering.

Chen proposed suggestions as follows: first, improving the AI Agent standards coordination system, establishing a national-level AI Agent standardization coordination body, and developing unified technical standards; second, building an AI Agent risk assessment system, developing technical evaluation standards covering various phases, and establishing regular safety testing and review mechanisms; third, formulating AI Agent ethical guidelines, establishing fair, just, and transparent rules for data use and decision-making, and clarifying the subject of responsibility.

Chen emphasized on strengthening research on international rules, encouraging industry organizations and enterprises to lead the development of technical specifications. She also suggested deepening international communication to provide Chinese solutions for global AI Agent development.

New energy vehicles & autonomous driving

Harmonizing the battery swapping standards for new energy vehicles

Feng Xingya
Deputy to the NPC

In China, battery swapping stations for passenger vehicles are still in the initial development stage. Feng Xingya, Deputy to the NPC and Chair of the Board and General Manager of Guangzhou Automobile Group, recommended to take multiple measures, including strengthening policy support, speeding up overall planning and layout, and harmonizing battery swapping standards.

Aiming at problems such as the low legal status of current regulations, excessive capacity of power battery utilization and recycling, and uneven enterprise quality, Feng hoped to introduce special regulations and standards, accelerate industrial planning to optimize capacity layout, and improve regulatory measures to promote standardized operations.

With the "going global" of Chinese automobiles, he suggested gradually relaxing import restrictions, establishing recycling pilot projects for defective parts in the short term, and revising regulations and standards and optimizing processes in the long term, to solve the problem of "difficulty in returning defective parts to China for detection".

Rapidly improving standards and regulations on autonomous driving

Zhu Huarong
Deputy to the NPC

With the continuous progress of end-to-end intelligent driving and multimodal large model technologies, autonomous driving has a solid technical reserve and commercialization foundation. However, the current *Road Traffic Safety Law* has not yet lifted restrictions on autonomous driving, and there is a lack of technical standards for supporting the access of autonomous driving systems and the rapidly developing unmanned logistics vehicles, said Zhu Huarong, Deputy to the NPC and Chair of the Board of China Changan Automobile Group.

These shortcomings not only restrict the promotion of technologies, but also affect the collaborative innovation and safety guarantee of the upstream and downstream of the industrial chain.

To solve the above problems, Zhu proposed the following suggestions: first, rapidly improving legislation on autonomous driving systems with well-defined responsibilities and diversified regulation landscape; second, rapidly improving the autonomous driving standards system that plays a leading role and relevant general standards; third, unifying technical standards and regulations related to unmanned logistics vehicles with admission mechanism and responsibility tracking system.

On low-altitude economy

Yan Dapeng

Deputy to the NPC

Accelerating the formulation of industry regulations and standards for low-altitude economy

Yan Dapeng, Vice Chair of the Board and Chief Engineer of Wuhan Raycus Fiber Laser Technologies Co., Ltd. put forward the following suggestions to promote the healthy and orderly development of the low-altitude economy.

First, strengthen the top-level design and accelerate the establishment of industry regulations and mandatory standards system. We should accelerate the formulation and revision of national-level policies and regulations on low-altitude airspace management, flight safety, data security, and privacy protection, and accelerate the development of mandatory technical standards, airworthiness standards, and operation standards for low-altitude aircraft. Second, increase efforts in urban innovation planning and infrastructure. Third, keep the bottom line of safety and advance the construction of a low-altitude safety management and control system. We should promote mandatory sectoral management standards such as electronic identity identification and dynamic geofencing, accelerate the development of related equipment and software, realize cross-manufacturer equipment interconnection, to provide support for low-altitude safety supervision and abnormal situation handling.

Zhang Zhiyong

Deputy to the NPC

Enhancing the construction of low-altitude infrastructure with planning, standards, sharing and supervision

At present, the planning and construction of low-altitude infrastructure have not been comprehensively coordinated with the planning of territorial space and urban construction, and a unified national infrastructure planning has not yet been formed. The standards of technology, construction, maintenance, environment, safety and other aspects in different regions and departments are inconsistent, and there is a lack of a systematic technical standard and specification system, according to Zhang Zhiyong, Chair of the Board of China Tower.

Strengthening the construction of low-altitude infrastructure will lay a solid foundation for the booming low-altitude economy. Zhang suggested that efforts should be made in four aspects: First, strengthen planning guidance and optimize facility layout. Second, improve the standards system and standardize construction requirements, including accelerating the development of unified low-altitude infrastructure standards to form a full-process standardized specification system. Third, share intensive construction and quickly form capabilities. Fourth, unify maintenance and supervision and enhance guarantee capabilities.

On carbon emissions

Unifying carbon emission measurement standards

Li Gensheng
Member of the CPPCC National Committee

This year's Report on the Work of the Government proposed to accelerate the construction of a dual-control system for carbon emissions and expand the coverage of industries in the national carbon emission trading market. We should actively and steadily promote the comprehensive transformation from dual control of energy consumption to dual control of carbon emissions, said Li Gensheng, Academician of the Chinese Academy of Engineering.

In terms of improving the carbon emission statistical accounting system, Li suggested that precise carbon emission measurement requires unified standards and a unified national cloud platform for carbon emission management and accounting, a carbon emission factor database, and improved carbon emission-related standard measurement and certification systems. We should also promote the application of technical means such as artificial intelligence and big data, gradually strengthen the statistical accounting capabilities of carbon emissions at the prefecture and city levels, and continuously improve the accuracy and timeliness of carbon emission data statistical accounting.

Speeding up the development of recycled raw materials and product quality standards

Wang Yanxin
Deputy to the NPC

In recent years, China has vigorously developed the circular economy, strengthened the comprehensive utilization of resources, and made positive progress in the recycling of waste. Recycled materials have become important production raw materials, making great contributions to economic development and environmental protection, said Wang Yanxin, Academician of the Chinese Academy of Sciences.

At present, the lack of recycled raw materials and product quality standards has become a key factor restricting the healthy development of the recycling industry. Wang suggested strengthening the development of recycled raw materials and product quality standards, which is an inevitable requirement for coping with resource shortages and environmental pollution. The use of recycled materials that meet the standards can reduce dependence on virgin materials, reduce energy consumption and environmental pollution, and promote the recycling of resources and the sustainable development of the industry.

On e-waste

An Ting

Member of the CPPCC National Committee

Promoting the use of standardized interfaces of data cables

An Ting focuses on the construction of standardized interfaces and the improvement of the recycling system for electronic products and accessories.

In his view, the reasons for the waste of data cables are reflected in many aspects. First, the technical barriers brought about by differentiated competition in interfaces force consumers to make repeated purchases. With the implementation of a series of sectoral standards, the data cable standards have been basically unified. But manufacturers rarely give consumers the right to choose. Second, the lagging policies and lack of standards are also important reasons for the idleness of data cables. He believed that the materials of most data cables are not easy to degrade, and they will pollute the soil and water sources in the long term. He suggested that the Ministry of Industry and Information Technology and other relevant departments further promote the use of standardized interfaces, encourage enterprises to use unified interface standards, reduce the use of different data cables for devices, and reduce the demand for consumers to buy multiple data cables.

On the construction industry

Yin Cuiping

Deputy to the NPC

Standardizing the housing construction

Yin Cuiping, Director of the Hoisting Division of Hunan Dongfanghong New Building Materials Co., Ltd., said, "the construction industry is in urgent need of transformation and upgrading, and prefabricated buildings are one of the important ways to transform and upgrade."

Achieving standardization can bring about comprehensive upgrades, according to Yin. Just like the standardized production and integrated assembly of parts in automobile manufacturing, the "productized construction and delivery" of buildings can achieve precise production and quality control of building components through unified design modules, prefabricated components and assembly processes. Yin suggested initiating the revision of laws and regulations for the productized construction and delivery model of prefabricated buildings, reforming the traditional construction approval procedures, and introducing relevant incentive policies. The housing and construction departments should organize industry associations, research institutions, and large construction companies to develop sectoral standards and technical specifications.

编译/靳吉丽 曹欣欣

(Edited and translated by Jin Jili and Cao Xinxin based on the news in Chinese)

2025 International Standardization (Chilin) Forum held in Nanjing

2025国际标准化（麒麟）大会在南京召开

By Jin Jili
文/靳吉丽

The 2025 International Standardization (Chilin) Forum was held in Nanjing city, East China's Jiangsu province, on April 16 with the theme of "Towards carbon peak and carbon neutrality: international carbon footprint standards driving green and low-carbon development".

Over 400 experts and representatives from domestic and foreign standards organizations, research institutions and enterprises came together to discuss the topics such as standards system building of product carbon footprints, low-carbon transition, green supply chain building, green technology innovation, and green energy technologies, contributing wisdom and strength to the global carbon neutrality goal.

As one of the most important platforms for standardization communication, the Forum has been successfully held for four consecutive years. This year's event is guided by International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), International Telecommunication Union (ITU), German Commission for Electrical, Electronic & Information Technologies (DKE), British Standards Institution (BSI), and World Green Design Organization (WGDO), and organized by the Nanjing Municipal Government, State Grid Corporation of China (SGCC), China Huaneng Group, and Chinese Society for Electrical Engineering.

The event was addressed by officials of State Administration for Market Regulation (SAMR) and Nanjing Municipal Government, leaders of IEC, ITU, DKE and BSI, and representatives of major energy and electric power companies in China, which briefed on standardization efforts at different levels.

Keynote speeches were delivered by renowned experts on topics including the research on the framework of product carbon footprint standard accounting and certification system, the development and current status of product carbon footprint, the role of carbon emission reduction in achieving sustainable development, the quality infrastructure of the dual carbon management system, and the collaborative innovation of electricity and carbon in new power systems.

Relevant achievements were unveiled at the event, including two IEC white papers: *Emerging photovoltaic materials and technologies* and *Smart hydropower*. As official IEC publications, IEC white papers are compiled by experts from the IEC Market Strategy Board (MSB). They are strategic technical documents that define the future development directions of IEC, which serve as fundamental and guiding documents of IEC international standards.

The launching ceremony for the VDE DKE Regional Office in IEC Promotion Center (Nanjing) was held at the event. Both sides will carry out in-depth cooperation in the research and development of international standards, certification system building, and international mutual recognition mechanisms, and jointly establish an open, mutually trusted, and win-win standardization ecosystem, creating a favorable cooperation environment for international standards mutual recognition.

The key achievements of Jiangsu Product Carbon Footprint Public Service Platform, the first of its kind in China, were also displayed. The platform has integrated cutting-edge technologies such as digital twin and blockchain, which is equipped with an independently developed, intelligent, and controllable carbon chain operating system. It has enabled the intelligent analysis and certification of carbon emissions across the entire industrial chain of key industries.

Additionally, two thematic sessions were held during the period, where experts and enterprise representatives shared industrial progresses and application practices on carbon footprint accounting and low-carbon transition practices in key industries, as well as green technology innovation and digital empowerment.

Addresses by guests

Jiang Min
Deputy Mayor of Nanjing Municipal Government

Over the past three years, enterprises and research institutions in Nanjing have led and participated in the development of 38 ISO and IEC international standards and over 1,200 national standards, and completed 30 national and provincial standardization pilot projects to promote the application of standards. In particular, a number of standards innovation achievements have been reached, and leading enterprises with nationwide influence have been cultivated in key industries such as smart grids, software and information services, new materials, aerospace, and high-end equipment. All major standardization indicators in Nanjing rank among the top of similar cities across the country.

Relying on the IEC Promotion Center (Nanjing), Nanjing is attracting more high-end academic exchange platforms and leading enterprises, giving greater play to the fundamental, guiding, and representative role of standards, and continuously enhancing the city's leading role in innovative development and international cooperation, in order to make standards an important support for the high-quality development of Nanjing.

Jo Cops
IEC President

The IEC is essential for the green transition through electrotechnical standardization. Our standards enable carbon footprint measurement, energy efficiency and low-carbon technologies. We collaborate with ISO, ITU and national standardization bodies, to harmonize global carbon footprint methodologies. In alignment with our commitment to sustainability, the IEC has articulated a comprehensive strategic plan that emphasizes three primary focus areas: enabling a digital and all-electric society, fostering a sustainable world, and leading trust, inclusion and collaboration.

IEC standards provide the technical foundation needed to ensure that clean energy solutions can be scaled up efficiently and integrate seamlessly into existing systems. Accurate carbon footprint measurement is vital. The IEC develops verification schemes for reliable emission calculation crucial for investment, policy and consumer trust in sustainable products. In addition to setting global standards, the IEC is also committed to making a tangible impact to the IEC Global Impact Fund.

However, we must recognize that no single organization or country can achieve carbon neutrality alone. International cooperation is essential to achieve carbon neutrality. Governments, industries and standardization bodies must collaborate.

Bilel Jamoussi
Deputy Director of ITU-T

ITU plays a key role in supporting the digital sector's commitment to forge a path towards a sustainable future. At our recent World Telecommunications Standardization Assembly, we all mandated an increased focus on minimizing the environmental impact of information and communication technologies (ICTs). It drives the work of the study groups, for example, Study Group 5 and Study Group 20.

We joined IEC and ISO in pledging to uphold the principles that allow sustainability to be built into standards by design and deliver standards that make both business and environmental sense. Through our strong cooperation under the World Standards Cooperation, we ensure transparency, avoid duplication, and support the global adoption of international standards.

In recent years, ITU has focused on standards development to advance the vision of sustainable AI as a powerful tool for climate action while mitigating its environmental impact. We have been advancing ongoing standards work, looking at how to calculate the greenhouse gas emission and energy efficiency of AI.

China and Germany are closely together to advance, for example, green and low-carbon economy and digital transformation of the industry. We also work together on many more important topics. I am sure in the future there will be even more. Together we are successful because we share a vision of an all-electric and connected society. With this vision in mind, we look forward to collaborating with China even more.

One example is the digital product passport. At the moment, this is an initiative in Europe. But we know that this project can only be successful when it is employed on an international level. In Germany, the international level is always more important for us than the national or regional level. We have a saying like this: "Do what you want, do it right and do it internationally". That is why we will establish a new IEC and ISO join technical committee for digital product passport.

Florian Spiteller
Head of External Relations & Support Department, DKE

It is only through collaboration and the development of internationally recognized consensus-based standards, we can create trusted frameworks to underpin the transition to net zero and beyond. I see three priorities for standards looking into the future. Firstly, moving from compliance to confidence. Standards must move beyond being merely seen as a tool. Secondly, the systems thinking and interoperability. As the world moves towards digitalization, electrification, and decarbonization, no central region can act in isolation. Thirdly, global collaboration and local relevance. Standards are the most powerful when they are globally agreed but locally relevant.

BSI is committed to continue to work alongside Chinese colleagues to shape the future of international standardization. A few weeks ago, BSI jointly delivered a successful technical dialogue on carbon capture and storage (CCS) with National Standardization Administration of China (SAC) and China National Institute of Standardization (CNIS) to discuss the critical role of standardization in securing CCS technology safely and effectively to enable decarbonization and transition to net zero.

Scott Steedman
Director-General, Standards of BSI

Chen Guoping
Executive Vice President of SGCC

SGCC has highly valued international standardization work with a series of outcomes: submitting 305 international standard proposals that have been approved, leading and participating in the development of 134 international standards of IEC, ISO and ITU. In particular in the green and low-carbon field, it has submitted 81 international standard proposals that have been approved, and led and participated in the development of 42 international standards.

In the future, SGCC will continue to take an open and cooperative attitude, focus on key areas such as new energy and green and low-carbon development, and strengthen standards innovation capabilities. It will work with all parties to reinforce the international carbon market standards system and actively participate in global governance to address climate change. Suggestions on cooperation are proposed as follows: first, strengthening the research and mutual recognition of green and low-carbon international standards; second, enhancing the cultivation of international standardization talent; third, promoting the construction of a green energy ecosystem.

Hao Jinyu
Vice President of China Huaneng Group

China Huaneng Group has always adhered to the guidance of the new energy security strategy, taken the dual carbon goals as the lead, focused on building new energy systems and new power systems, and led green and low-carbon transition with international standardization work. By the end of last year, the proportion of clean energy installed capacity of China Huaneng exceeded 52%.

International standards serve as a common language for global cooperation, and play a fundamental and supporting role in global green and low-carbon development. China Huaneng attaches great importance to international standardization work, and has vigorously cultivated and developed international standards projects focusing on energy and electric power. Up to now, China Huaneng has led and participated in the development of 28 international standards with 30 ones under development.

China Three Gorges Corporation (CTG) has actively participated in the development and application of IEC standards and the compilation of white papers, attended IEC General Meeting and MSB meetings, and organized dozens of young experts to participate in the activities of IEC. CTG has taken the lead in applying IEC standards in areas such as wind power, photovoltaic power, energy storage, and data communication, contributing Chinese strength to the promotion of IEC standards. With massive data, rich application scenarios, and demonstration projects, CTG has provided a solid foundation for the development, application, and promotion of standards.

I put forward the following suggestions: first, deepening standards cooperation to promote the coordination of IEC standards and regional policies, especially in regions with the fastest-growing electricity demand such as the Asia-Pacific region; second, establishing harmonized technical rules by collaboration to jointly develop and promote standards and facilitate the global application of energy technologies; third, strengthening communication with different stakeholders to strengthen cooperation, build trust and share best practices with standards as a strong bond.

Lyu Tingyan
Executive Vice President of CTG

SAMR attaches great importance to the carbon peak and neutrality work. It has established the dual carbon work leading group, and successively issued important documents on establishing and improving the standard and metrology system, guidelines for the standards system, and comprehensively utilizing quality certification to support the dual carbon work. Last year, SAMR officially launched the pilot work of carbon footprint certification.

In terms of dual carbon related standards, 46 national standards for greenhouse gas accounting and 7 national standards for product carbon footprint have been released. A total of 339 local standards have been developed and released, and the development of more than 10 international standards have been led and participated in by Chinese experts. In terms of certification and accreditation, pilot projects on carbon footprint certification have been launched for 11 types of products such as lithium batteries and photovoltaic products, and the regulation of greenhouse gas validation and verification institutions has been strengthened.

Zhu Meina
Deputy Director-General of Metrology Department, SAMR

Keynote speeches

Shu Yinbiao
Academician of the Chinese Academy of Engineering, former IEC President and President of Chinese Society for Electrical Engineering

Constructing standardized accounting and certification system of product carbon footprints

Carrying out carbon emission statistical accounting, and establishing a product carbon footprint management system and a carbon labeling certification system can help actively respond to green trade barriers. Strengthening carbon footprint standardized accounting and certification has become an important institutional guarantee for the world to address climate change and achieve sustainable development.

It is an urgent task for China to build a product carbon footprint management system. Since the carbon peak and neutrality goals were proposed in 2020, China has unswervingly fulfilled its commitments, accelerated the adjustment of its energy structure, and achieved leapfrog development in new energy. As a major producer and exporter of industrial products in the world, China needs to make greater contribution to international standards, promote global technological innovation and industrial development, improve international trade rules, and maintain the stability of global green supply chain. So far, China has published 7 national standards for product carbon footprint and more than 400 relevant association standards. The standardization of product carbon footprint has become a key force in green transformation.

Wang Jinnan
Academician of the Chinese Academy of Engineering, Deputy Head of Population Resources and Environment Committee of CPPCC, WGDO President

Development and current situation of product carbon footprints

Why does China need to establish a carbon footprint management system? Because we must respond to international carbon footprint disclosure requirements, or we will become passive and may be hampered in the international trade system.

In May 2024, the Ministry of Ecology and Environment, together with 14 departments, issued the *Implementation Plan for Establishing a Carbon Footprint Management System*. The plan requires the establishment of a carbon footprint management system, the formation of a green and low-carbon supply chain and production and lifestyle, the promotion of the development of new quality productive forces, and the achievement of carbon peak and neutrality goals. It puts forward four main tasks: first, establish and improve the carbon footprint management system; second, build a multi-party carbon footprint work pattern; third, promote international mutual trust and mutual recognition of carbon footprint rules; fourth, continue to strengthen the capacity building of product carbon footprint.

Vimal Mahendru
IEC Vice-President and Chair of the Standardization Management Board (SMB)

Reducing carbon emission to achieve sustainable development

We are clearly heading towards an all-electric and connected society. That's where the role of IEC is embedded. But when we talk about an all-electric and connected society, it means technologies are essential, and we have to have a clear strategy. The strategy has three pillars: a digital and electrified world, sustainability, and partnership. I think partnership is the most critical aspect of our strategy, because it is only through partnership and dialogue that you can continue to build the world and all-electric society.

I suggest that China may actively participate in the work of IEC in the following aspects: IEC SMB/SG 11 on hot topics radar, IEC SEG 16 on standardization of sustainability technologies, IEC SyC SM on smart manufacturing, IEC Conformity Assessment systems (e.g. IECQ for quality assessment system), and IEC Young professionals Programme.

Zhang Gang
Former Counsellor of the State Council, Deputy Director of China Standardization Expert Committee

Thoughts on the quality infrastructure of dual carbon management system

In responding to global climate change and achieving sustainable development goals, the role of quality infrastructure (QI) has become increasingly prominent. It is an important support for global carbon footprint management.

The QI of carbon footprint management in China is accelerating. The *Implementation Plan for Establishing a Carbon Footprint Management System*, issued in May 2024, clarifies the need to develop general standards for product carbon footprint accounting and key product carbon footprint accounting rules and standards.

The National Carbon Peak and Neutrality Measurement Technical Committee has been established, and a full-chain technical platform for measurement benchmarks, industrial testing, and policy evaluation has been built to ensure that the quality of carbon emission data is reliable, comparable, and credible.

In December 2024, the Ministry of Ecology and Environment, together with multiple departments, issued the *Guidelines for Drafting Product Carbon Footprint Accounting Standards*. At present, there are 7 standards in the field of carbon footprint, with 66 ones under development.

Shan Shewu
President of State Grid Electric Power Research Institute and General Manager of NARI Group Corporation

Thoughts and practices of electricity-carbon collaborative innovation in new power systems

International standards are of great significance in enhancing the coordination and efficiency of global low-carbon economic development. NARI Group attaches great importance to international standardization work. It has led the establishment of a working group on carbon emission management in the IEC SC 8 for network management in interconnected electric power systems, and has submitted an international standard proposal for monitoring and evaluating carbon emissions. In addition, NARI actively undertakes the secretariat work of the IEC SyC SET for sustainable electrified transportation, and promotes the establishment of ahG 5 on sustainable electric air transportation to accurately measure carbon emissions in the entire electric transportation chain.

In the future, NARI will continue to rely on domestic counterparts of relevant IEC technical bodies, strengthen the top-level planning, technical roadmaps, and core technical standards in key areas such as sustainable electrified transportation, system stability control, low-carbon electricity, and smart hydropower, and give full play to the basic support and leading role of international standards. CS

编译/靳吉丽 曹欣欣
(Edited and translated by Jin Jili and Cao Xinxin based on the speeches in Chinese)

Striding towards a safer cyberspace: **Cybersecurity Standardization Conference 2025** held in Belgium

2025年欧洲网络安全标准化大会在比利时召开

By Fang Luofan
文/方洛凡

The European Standardization Organizations (ESOs), CEN, CENELEC and ETSI, joined forces with ENISA, the EU Agency for Cybersecurity, to host the 9th Cybersecurity Standardization Conference on March 20 in Brussels, Belgium.

The conference attracted over 1,700 on-site and online participants, bringing together policymakers, industry leaders, academics, and cybersecurity professionals, to discuss topics with the theme of "European standardization supporting new legislative cybersecurity landscape".

The conference provided a platform to explore the future of cybersecurity standards, emphasizing the importance of cooperation in a rapidly evolving world. It consisted of four panels on state of play of the European standardization, interplay of cybersecurity legislation, overarching cybersecurity by standards, and visions of the future, respectively. The speakers shared the latest trends and progress of cybersecurity standardization, seeking for solutions to common challenges and calling for global collaboration.

Panel 1: State of play of the European standardization

With the rapid development of ICT, intelligence has become an inevitable trend in all industries, which upgrades products and services, enhances overall efficiency, and promotes the optimization of industrial structure. Therefore, cybersecurity draws increasing attention globally, influencing national security and prosperity, as well as personal safety.

The EU is building up the legislation for cybersecurity. In 2016, the *General Data Protection Regulation* was released to build trust in personal data access. In 2019, the *EU Cybersecurity Act* was released, which enabled the establishment of ENISA and a framework for cybersecurity certification. In 2024, the *Cyber Resilience Act* was released to improve security, transparency and resilience of products with digital elements.

Raluca Stefanuc, Deputy Head of Cybersecurity and Digital Privacy Policy of the EU, Jos Remy, Vice President of CENELEC, Jan Ellsberger, Director-General of ETSI, and Florian Pennings, Associate Chief Cybersecurity and Operational Officer of ENISA, discussed the current challenges and the role of ESOs in the global ecosystem. They highlighted the necessity of standardization in supporting the EU's strategic priorities and enhancing cybersecurity.

Panel 2: Interplay of cybersecurity legislation

The panel invited speakers including Camille Dornier, Legal Officer in the Cybersecurity and Digital Privacy Policy Unit in DG Connect, European Commission, Kia Slæbæk Jensen, Danish Representation to the EU, François Zamora, Chief Security Officer for the Europe division of Orange, Paloma LLaneza from Certicar and ETSI TC ESI, and Sid Hollman, Policy Manager for Cybersecurity, Digital Infrastructure & Mobility of Digital Europe.

The EU has issued a lot of rules in this field. With that much legislation in the last few years, maybe there are some inconsistencies between them, and we need to establish a coherent framework, said Sid Hollman.

According to Camille Dornier, it is true that the EU has adopted a lot of digital legislation and is implementing many acts in the cybersecurity field, because there is a need to have such legislation to ensure an adequate level of cybersecurity in the EU. We have to remember that in the first place, the cybersecurity legislation is meant to protect businesses and citizens. Technology is changing fast, and global circumstances are changing super fast. She believes that we will be busy in the coming years and standardization organizations have to frequently update standards.

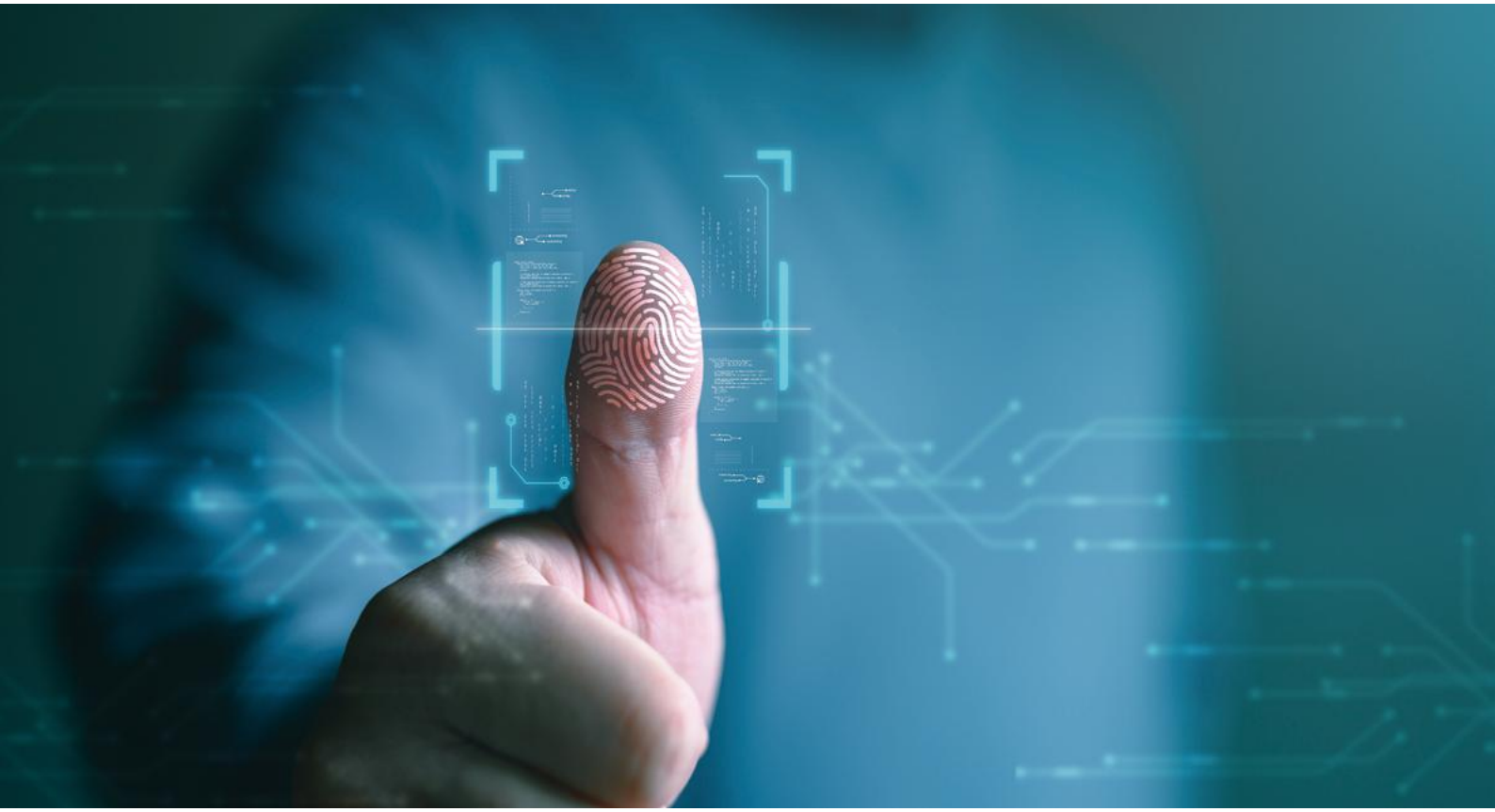
Standards consist of terms and paradigms, and are basically in their own language. Faced by a lot of new legislation and standards, entities, companies, businesses, organizations may have no experience in dealing with them. The relevant expert group is studying how to promote this work, how to implement relevant standards, and how to raise awareness at the member state level, said Kia Slæbæk Jensen.

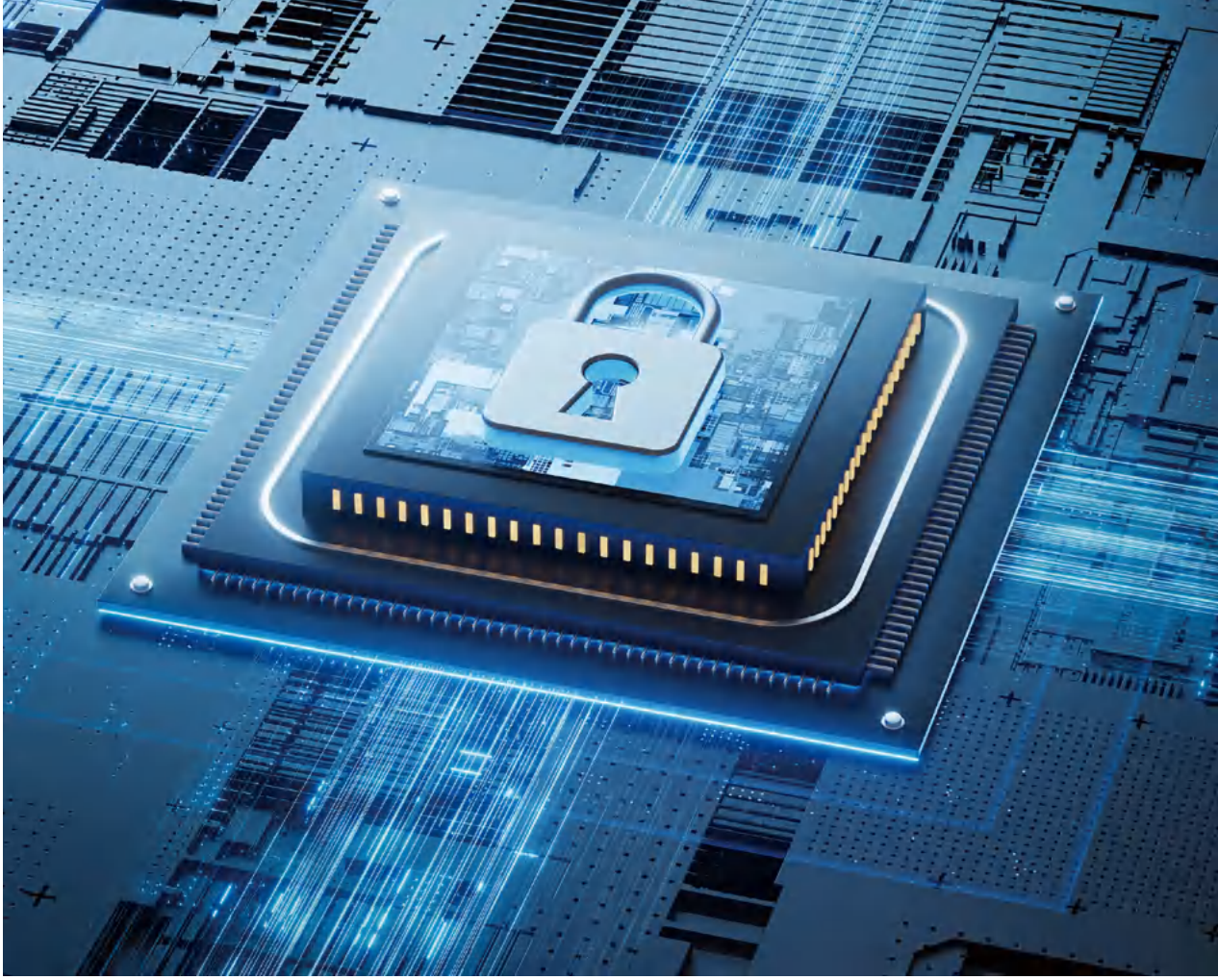
Panel 3: Overarching cybersecurity by standards

During this panel, Michaela Klopstra from Accenture and ETSI TC CYBER, Ben Kokx from Philips and CEN-CENELEC JTC 13, Jean-Daniel Aussel from Thales and GlobalPlatform, Stefane Mouille from Cabinet Louis Reynaud and AFNOR, and Tobie Langel from UnlockOpenWhat, introduced the different approaches and processes towards standardization, to coordinate with new legislation.

Ben Kokx introduced that, within the CEN and CENELEC, the overall approach is to consider harmonized standards in an early stage. Based on discussions with the Commission and understanding of legislation trends, we can find out what to do on the standardization side. CEN and CENELEC get involved by starting discussions before the final law text is developed and the standardization request is determined, to speed up things that we have done for both the *Radio Equipment Directive* (RED) and the *Cyber Resilience Act* (CRA).

Taking the CRA as an example, a sub group has been created because we need more people that can focus on topics related to the CRA. After getting the standardization request and the draft in the beginning, we talk about definitions. If it is aligned and we accept the standardization request, we create work items for all standards that need to be written. Then we need to define the scope, work on the content and bring out the draft, discuss it, reach the consensus, and finally vote to approve it, said Michaela Klopstra.





Panel 4: Visions of the future

If you look far in the future, where are we heading, and where should we head? What challenges await us in the near future and how can we prepare for them? Four experts were invited to look into the future of standardization and hold discussions on hot topics, including Andrea Röck from French Cybersecurity Agency, Joanna Swiatkowska from European Cyber Security Organization, Paolo Campegiani from Namirial, and Cinzia Missiroli from CEN and CENELEC.

Heated discussions focused on the topics such as if standards development will be more relevant, future standardization challenges, if standards development should prioritize Europe or the globe, and how to lower the threshold of standards development, especially with the application of AI.

Andrea Röck believed that in 2035 we will have all regulations in place with a lot of reference on the European standards, which means that only those member states can keep the influence on the cybersecurity world when they really invest in standards. They have to participate, organize themselves together with industry to really influence the standards. This also means that the standardization engineer really becomes a strategic position.

Ten years from now, standards will be a stronger field of competition, said Paolo Campegiani. This means that we have to approach standards as a matter of sovereignty and many instruments and approaches because they are applied with geopolitics.

Cinzia Missiroli indicated that cyber threats are evolving extremely fast, and we must adopt an approach that is anticipatory, collaborative and deeply integrated into every facet of digital innovation. To achieve this vision, we must rethink the way that standards are developed. First, security standards must be dynamic and proactive. Second, we must strengthen global collaboration with Europe leading the way. Third, we must embed security into innovation.

World Telecommunication Information Society Day

May 17, Geneva, Switzerland & online

On May 17, the World Telecommunication and Information Society Day (WTISD), ITU marks 160 years of technology for humanity with a light show at the Place des Nations in Geneva—also streamed live on ITU's social media platforms.

WTISD 2025 highlights the pressing need to advance digital gender equality, so that women and girls everywhere can also benefit from and contribute to digital transformation.

In 2025, ITU commemorates its 160th anniversary, highlighting its long-standing role in advancing global connectivity and fostering international cooperation. For more information on the event website: **https://www.itu.int/160/**

Pacific Area Standards Congress 47th Annual Meeting

May 19-21, Tokyo, Japan

The PASC Annual Meeting is a key platform for fostering collaboration and harmonization of standards across the Pacific Rim. The 2025 meeting will focus on critical themes such as digital transformation and responsiveness to stakeholder needs in developing and implementing standards.

The conference will feature a series of plenary sessions, technical workshops, and networking events designed to facilitate the exchange of knowledge and standards alignment. Notably, the event will include PASC and IEC Asia Pacific Co-operation Forum joint workshops on digital transformation and increasing access and implementation of standards. For more information on the event website: **https://www.pascnet.org/events/pasc-47th-annual-meeting**

ETSI/IQC Quantum Safe Cryptography Conference 2025

June 3-5, Madrid, Spain

ETSI and the Institute for Quantum Computing are thrilled to organize the 2025 edition of their joint event, the ETSI/IQC Quantum Safe Cryptography Conference.

Designed for members of the business, government, and research communities with a stake in cryptographic standardization, this forward-looking conference facilitates the knowledge exchange and collaboration required to transition cyber infrastructures and business practices to make them safe and resilient in an era with quantum computers. It will showcase both the most recent developments from industry and government and cutting-edge potential solutions coming out of the most recent research.

This conference is a perfect opportunity to determine your next steps, learn from experts and network with others going through the process. Nowhere else can you encounter the latest research in such an actionable way, with specific tracks for both executives and technical experts. For more information on the event website: **https://www.etsi.org/events/2450-etsi-iqc-quantum-safe-cryptography-conference-2025**

AI for Good Global Summit 2025

July 8-11, Geneva, Switzerland

The 2025 AI for Good Global Summit, organized by the ITU in partnership with over 40 UN agencies and co-convened with the Government of Switzerland, will focus on practical AI applications to advance the SDGs.

This event aims to connect AI innovators with public and private sector leaders to scale impactful AI solutions globally. It also prioritizes networking, experiences, and matchmaking to stimulate collaboration efforts and to ensure trusted, safe, and inclusive development of AI technologies and equitable access to their benefits. For more information on the event website: **https://aiforgood.itu.int/summit25/**

Comparative analysis of frame strength standards for intelligent urban rail vehicles

智能城轨车辆构架强度标准对比分析

By Li Bing, Xu Hongwei, Zhang Xiangjie
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(CRRC Qingdao Sifang Co., Ltd.)

Abstract: The rapid development and application of emerging information technologies, such as big data and artificial intelligence, facilitates the development of intelligent urban rail vehicles. Architecture is an important component of intelligent urban rail vehicles and a key factor in ensuring their reliable and safe operation on various routes. In this context, it is very important to select appropriate architecture design standards. The paper reviews the relevant design standards for architecture at home and abroad, comprehensively analyzes the standards that need to be compared and analyzed, and conducts comprehensive comparative analysis in the aspects of the scope of application, load conditions, vertical static load, lateral load, and evaluation methods of the standards. Finally, it draws a conclusion that the standard JIS E 4207:2019, *Rolling stock—Bogie—General rules for design of bogie frame strength*, can meet the requirements of strength design of welded bogie frame in intelligent urban rail vehicles. It proposes the suggestions on better validating this design method in future bench and line tests of products, in order to improve the design concept of bogie frame strength and provide reference and inspiration for promoting the development of intelligent urban rail vehicles in China.
Keywords: intelligent urban rail vehicles, structural strength, standard, comparative analysis

1. Introduction

The strength of the bogie frame structure is the key to ensuring the safety of train operation. During the operation of intelligent urban rail vehicles, the actual stress borne by the main components of the bogie, such as various parts of the frame, is a continuous stochastic process, and the magnitude of this stress changes over time, which is called the stress spectrum. Under the long-term action of random stress, the structure will continuously suffer fatigue damage, endangering driving safety. Therefore, the main strength issue of intelligent urban rail vehicles is fatigue strength, with the fatigue of welded frames being the most prominent, which has become an important factor affecting the operational reliability of key parts of locomotives and vehicles[1]. In terms of the design of welded bogie frame structures, there are several standards including a standard of the International Union of Railways, UIC 615-4-2003, *Motive power units—Bogies and running gear—Bogie frame structure strength tests*[2], and a Japanese industrial standard JIS E 4207:2019, *Rolling stock—Bogie—General rules for design of bogie frame strength*[3]. These design specifications require the use of specified calculated loads and Goodman fatigue limit line diagrams to evaluate the fatigue strength of welded bogie frames in bogie frame design[4]. In order to better utilize the strength standards of bogies in design, the paper conducts a systematic comparative analysis of the Japanese and UIC standards currently used in their strength calculation and testing.

2. Comparative analysis of differences in the two standards

UIC 615-4-2003 specifies the requirements for strength load, traction impact load, and equipment installed on bogies of locomotives, freight cars, subways, light rails, and other vehicle models. The JIS E 4207:2019 and UIC 615-4-2003 adopt different fatigue strength design methods, which are typical and representative. Therefore, in this paper, JIS E 4207:2019 and UIC 615-4-2003 are compared and analyzed. Since the two fatigue strength design methods have their own advantages and limitations in certain aspects, a comparative analysis of the above standards is conducted, in order to better meet design requirements, put forward a more comprehensive fatigue strength design method for welded structures, and promote the development of intelligent urban rail vehicles.

The comparative analysis focuses on aspects of applicability, load conditions, and evaluation methods, as shown in Table 1-5.

JIS E 4207:2019	UIC 615-4-2003	Standard difference analysis
This standard specifies the general conditions for the strength design of steel components used in the bogie frame of railway vehicles (excluding those used for special railways) that constitute the main strength components. In addition, regarding the use of sleeper beams between the vehicle body and the bogie frame, the design of the sleeper beams can also be applied to this standard. Note: This standard does not apply to the bogie frame used on special railways such as rubber tires, but the standard may apply to the allowable stress of the materials used on the bogie frame of the above-mentioned vehicles.	A test bench test is conducted to describe the ability of the bogie frame to withstand actual operational loads.	JIS E 4207:2019 specifies the general conditions for the strength design of bogie frames for railway vehicles and is a design standard. The allowable stress of the materials used on the vehicle steering frame can refer to this regulation. UIC 615-4-2003 is mainly applicable to the strength performance test of bogie frame under working load (conducted on the test bench), and is suitable for the strength test and strength analysis of bogie frame and main components.

Table 1: Comparative analysis of application scope

JIS E 4207:2019	UIC 615-4-2003	Standard difference analysis
The load is divided into static load and dynamic load. Static load refers to the load carried by the bogie frame of the vehicle in a stopped state, while dynamic load refers to the load carried by the bogie frame of the vehicle in a running state. It is divided into the load represented by the product of static load and additional coefficient, as well as the load determined by the characteristics of the installed components. Specifically, it is divided into vertical load, horizontal load, front rear load, torsional load, etc.	The load is divided into abnormal operating condition load and simulated operating condition load. Extraordinary load refers to the maximum load that may occur during operation. Simulated operational loads refer to loads that frequently occur in practical application, including major operational load.	When conducting fatigue verification, UIC 615-4-2003 provides thirteen working conditions. When two working conditions are superimposed, the two working conditions that may produce the maximum stress amplitude are selected for consideration, so as to calculate the stress mean and stress amplitude through superposition. However, in JIS E 4207:2019, all load conditions that may cause fatigue failure are superimposed through formulas to obtain the mean stress and stress amplitude, and only static strength calculations can be performed. The results of static strength calculations can be used to evaluate fatigue strength based on the standard.

Table 2: Comparative analysis of load conditions

JIS E 4207:2019	UIC 615-4-2003	Standard difference analysis
Vertical static load refers to the load (axle spring load) carried by the bogie frame of a vehicle in a stopped state. The vertical static load is the maximum axle box spring load. This standard does not specify abnormal loads and fatigue loads, and is not applicable to abnormal loads and fatigue tests.	The vertical static load is the static load on the secondary spring, generally 1.4 times the vertical static load is used as an abnormal load. The former (vertical static load) is used for fatigue testing, while the latter (1.4 times vertical static load) is used for abnormal loads.	The main difference in the definition of vertical static load is that JIS E 4207:2019 uses a primary spring load, while UIC 615-4-2003 applies a secondary spring load.

Table 3: Comparative analysis of vertical static load

JIS E 4207:2019	UIC 615-4-2003	Standard difference analysis
Lateral load refers to the load generated by the vibration of the load bearing mass and the load generated by centrifugal force. The dynamic load coefficient specified in the standard is 0.2-0.4, usually taken as 0.3. The lateral load mainly acts on the lateral stop seat and air spring.	Lateral force $F_y(N)=0.5(F_z+0.5m^+g)$ (m+represents the mass of each bogie).	Different lateral loads: JIS E 4207:2019 adopts a dynamic load coefficient, which is a variable value applicable to different conditions of the line, and the value can be more consistent with the actual situation.

Table 4: Comparative analysis of lateral load

JIS E 4207:2019	UIC 615-4-2003	Standard difference analysis
According to 5.1 stress calculation and 5.2 allowable stress fatigue test, it is stipulated to be executed.	After the static strength test is completed, it is effective to conduct the test on the structure under typical line and speed conditions. The stress at the hazardous points discovered during the static strength test is recorded. The assessment of the possibility of cracking in the bogie uses appropriate domestic and international methods.	The fatigue strength evaluation of JIS E 4207:2019 is based on the calculation results of static strength, and is evaluated in Goodman diagram according to a certain calculation method. UIC 615-4-2003 specifies the conduct of static strength and fatigue strength tests, and the calculation or test results of static strength are also evaluated for fatigue in the Goodman diagram according to a certain calculation method. The difference between the two lies in the different calculation methods for the static strength calculation results. And in the former technical conditions, the mean stress value is processed using algebraic sum and the root mean square of the sum of squares of the stress amplitude is used, while the stress mean and amplitude in UIC 615-4-2003 are processed using algebraic sum.

Table 5: Comparative analysis of fatigue assessment methods

The above comparative analysis shows that JIS E 4207:2019 specifies the general conditions for the strength design of bogie frames, while UIC 615-4-2003 is only applicable to the strength performance test of bogie frames. From the perspective of load conditions, UIC 615-4-2003 only specifies thirteen working conditions, while the JIS standard covers all load conditions that may cause fatigue failure through formulas to calculate the stress mean and stress amplitude. The two working conditions are different. As for the definition of vertical static load, JIS E 4207:2019 applies to primary spring load, while UIC 615-4-2003 applies to secondary spring load, which are applicable to different structures. As for the horizontal load, JIS E 4207:2019 applies to different conditions of the line, and the values can be more consistent with the actual situation. From the perspective of fatigue assessment methods, JIS E 4207:2019 generally does not conduct fatigue tests for static strength, while UIC 615-4-2003 requires static strength and fatigue strength tests. Users can choose between the standards based on their actual situation.

3. Countermeasures

Through the comparative analysis of the above standards, it can be seen that there are certain differences between them, which belong to different design concepts:

1) In the strength design, JIS E 4207:2019 can be used as the basis, while referring to the relevant content of UIC 615-4-2003, such as considering the abnormal load specified in UIC 615-4-2003. When calculating the strength of the bogie frame of high-speed trains and urban rail vehicles, the effect of abnormal loads can be fully considered. Through calculation, it is found that the designed structure meets both JIS E 4207:2019 and UIC 615-4-2003 in terms of strength.

2) In the framework bench test, whether the framework structure meets JIS E 4207:2019 and UIC 615-4-2003 can be fully verified. During the execution of each project, static strength and fatigue tests can be conducted in accordance with the above standards, the results of which can meet the strength requirements; For urban rail vehicles, according to the actual demands, static strength and fatigue strength tests can be generally conducted in accordance with the UIC 615-4-2003, which can also meet the strength design requirements.

Therefore, the welding structure strength design method based on JIS E 4207:2019 can meet the requirements of intelligent urban rail vehicle bogies, and it is relatively mature. It is recommended to retain the complete structure strength design concept and better verify the design method in future product bench and line tests to improve the strength design concept.

4. Conclusion

Based on the current design of the bogie structure of intelligent urban rail vehicles and the needs of future work, the following suggestions are proposed:

1) As an important component of the bogie, the structure is designed for strength using JIS E 4207:2019, which is well-established, mature, experimentally verified, and reliable. It is recommended to continue to retain the calculation and testing of JIS E 4207:2019.

2) For those who adopt UIC 615-4-2003, JIS E 4207:2019 can also be implemented simultaneously according to project needs, and relevant tests can be conducted to provide reference for the development of intelligent urban rail vehicles in China.

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About the author

Li Bing, Senior Engineer, is mainly engaged in technology management work.

Research on the construction of China's standards system of fire extinguishing agents

中国灭火剂标准体系建设研究

By Wang Shuai, Guo Ge, Chen Peiyao
文/王帅 郭歌 陈培瑶
(Tianjin Fire Science and Technology Research Institute of MEM)

Abstract: This paper discusses the importance of standards in the fire extinguishing agent industry, and highlights the vital role of the standards in promoting technological innovation. China's standards for fire extinguishing agent products have evolved significantly, aligning with industrial development, market demands, regulatory requirements, to respond to the great impact of international competition in the industry. The paper analyzes the current state of China's standards, including their composition and integration with industry growth, green development strategies, and international harmonization. Future development strategies for the standards framework should focus on valid period estimation, fire test model development, and raw material selection guidelines. By implementing these strategies, China's fire protection industry can enhance product quality, contribute to public safety, and maintain a competitive edge in the global market.
Keywords: fire extinguishing agents, standards, standards system, fire protection

1. Background

Standards represent a country's technological strength and are crucial for identifying and resolving problems[1]. Serving as vital benchmarks in industrial development, standards play a pivotal role in advancing the industry. The development of a standards system is closely linked to national interests and economic growth[2]. Standardization involves the development and implementation of standards, serving as an essential means for organizing modern production, promoting technological progress, enhancing economic efficiency, and achieving scientific management[3].

Fire extinguishing agents occupy a unique and critical position in the field of fire safety due to their specific attributes. In the past, the performance of fire extinguishing agents produced by China used to be relatively poor with low technology. However, China's products currently have comprehensive categories, advanced indicators, and increasing international recognition. The standardization of the products as well as the construction and continuous optimization of the standards system significantly contribute to the development of fire extinguishing agents and the industry.

2. Necessity for the research

2.1 Market-driven updates and technological innovations

With the rapid development of various industries in China, the emergence of new business forms and products poses unprecedented challenges for the development of new fire extinguishing agent products. While continuously adjusting the performance of existing products, new fire extinguishing agent products are emerging, urgently requiring standardization in product quality assessment and testing methods.

2.2 Regulatory and industry supervision requirements

The quality of fire extinguishing agents directly determines the outcome of initial fire control. In recent years, frequent exposures on market supervision and random inspections of fire extinguishing agents have revealed issues in inspection methods and analysis of inspection results, which have more demands for sectoral standards. For instance, the primary issue of insufficient active ingredient content in fire extinguishing agents necessitates the development of relevant standards of the production to provide guidance for enterprises in selecting raw materials and to support rapid initial on-site screening of product conformity for major inspection items.

2.3 International influences and competition pressures

With growing global awareness of environment, environmental requirements for the production and use of fire extinguishing agent products are becoming increasingly stringent[4]. International environmental conventions such as the Stockholm Convention on Persistent Organic Pollutants have imposed stricter restrictions on persistent organic pollutants (POPs) and other harmful substances, requiring countries to phase out and replace these substances.

China's foam fire extinguishing agents are already facing this situation. Since the Kigali Amendment to the Montreal Protocol came into force in China on September 15, 2021[5], China has begun to strengthen the regulation of non-carbon dioxide greenhouse gases such as heptafluoropropane and hexafluoropropane. This indicates that the field of clean fire extinguishing agents will soon undergo in new technological innovations and product adjustments.

3. China's standards and the integration with industrial development

3.1 Analysis of China's standards in this field

China's fire extinguishing agents encompass solid, liquid, and gaseous fire extinguishing agents, and relevant standards have undergone continuous revision, integration, and improvement in accordance with market demands, see Table 1.

No.	Type	Standard Number	Title	Year of publication
1	Mandatory national standards	GB 4065-1983	Fire extinguishing agent—bromochlorodifluoromethane	1983
2	Mandatory national standards	GB 4066-2017	Powder extinguishing agent	2017
3	Mandatory national standards	GB 4396-2024	Carbon dioxide extinguishing agent	2024, to be implemented in December 2025
4	Mandatory national standards	GB 6051-1985	Fire extinguishing agent of bromotrifluoromethane	1985
5	Mandatory national standards	GB 15308-2006	Foam extinguishing agent	2006
6	Mandatory national standards	GB 17835-2024	Water-based extinguishing agent	2024
7	Mandatory national standards	GB 18614-2012	Fire extinguishing agent heptafluoropropane (HFC227ea)	2012
8	Mandatory national standards	GB 20128-2024	Inert gas extinguishing agent	2024, to be implemented in December 2025
9	Voluntary national standards	GB/T 20702-2006	Test method for extinguishing property of gaseous extinguishing agent	2006
10	Mandatory national standards	GB 25971-2010	Fire extinguishing agent hexafluoropropane (HFC236fa)	2010
11	Mandatory national standards	GB 27897-2024	Class A foam extinguishing agent	2024, to be implemented in December 2025
12	Mandatory national standards	GB 35373-2017	HFC fire extinguishing agents	2017
13	Mandatory national standards	20201879-Q-450	Perfluorohexanone fire extinguishing agent	To be published
14	Mandatory sectoral standards	XF 578-2023	Superfine powder fire extinguishingagent	2023
15	Voluntary sectoral standards	XF/T 636-2006	Test and evaluation method for the toxicity of gaseous fire-extinguishing agents	2006
16	Mandatory sectoral standards	XF 979-2012	Fire extinguishing agent-D powder	2012
17	Mandatory sectoral standards	XF 982-2012	Working condition evaluation of halon extinguishing system	2012
18	Mandatory sectoral standards	XF 1025-2012	Fire products-requirements for fire safety	2012
19	Voluntary sectoral standards	XF/T 3006-2020	Technical requirements for rapid identification of fire extinguishing agents and fire retardant products	2020
20	Mandatory sectoral standards	XF 3007-2020	Water-based extinguishing agent for class F fire	2020
21	Voluntary sectoral standards	XF/T 3020-2023	Determination of perfluorooctane sulfonate (PFOS) in extinguishingagents	2023
22	Voluntary sectoral standards	XF/T 3021-2023	Acute toxicity test methods for aquatic organism of foam extinguishing agent	2023

Table 1: China's current national/sectoral standards for fire extinguishing agent products (up to December 2024)

3.2 Standards' integration with industrial development

3.2.1 Alignment with industrial evolution

The standards for fire extinguishing agents have consistently kept pace with the evolution of China's fire extinguishing agent industry. The development of these standards has significantly promoted the industry's growth. Numerous chemical ingredients, such as heptafluoropropane, hexafluoropropane, and perfluorohexanone, have been applied in the production of fire extinguishing agents. Meanwhile, relevant national standards have been developed and implemented, for example, GB 18614-2012 for heptafluoropropane (HFC227ea), GB 25971-2010 for hexafluoropropane (HFC236fa), and the mandatory national standard project for perfluorohexanone. The implementation of these standards has been closely monitored by fire products manufacturers. As a result, both the total output of the agents and the number of manufacturers have increased rapidly. Currently, China has become a major global production center for gas-based fire extinguishing agents.

3.2.2 Incorporation of green development strategies

The ongoing integration of green principles into fire protection standards, along with the accelerated domestic implementation of international conventions and China's policies of resource conservation and environmental protection, has given rise to a range of method standards. Prominent examples are the standards for assessing the aquatic toxicity of foam extinguishing agents (XF/T 3021-2023) and for testing PFOS (XF/T 3020-2023). These standards have promoted the development and adoption of new, effective, and environmentally friendly fire extinguishing agents. They have also led to the orderly phase out of high pollution products such as Halon and PFOS, guiding the sustainable and healthy development of the fire protection product industry. Simultaneously, by adhering to international environmental conventions, these standards have enhanced China's influence in this field.

3.2.3 International harmonization and trade facilitation

Thanks to the continuous dedication to contributing to ISO standard work, some Chinese national standards for fire extinguishing agents have gradually been recognized by the international community, and some have already been used in the drafting of ISO standards. For example, the performance and test methods of fluidity and moisture content in China's mandatory national standard for powder and superfine powder extinguishing agents have been adopted by ISO 7202:2018, *Fire protection—Fire extinguishing media—Powder*[6]. The adoption not only demonstrates the recognition of China's standard but also plays an important role in facilitating international trade.

4. Suggestions for development of standards

Future standards development should continue to focus on the inert properties of the fire agents, as well as the application. Fire extinguishing agents are typical emergency reserve supplies, which calls for special properties of the agents, such as long-term storage and single use. It is essential to ensure that the fire extinguishing agents in service remain in an effective state at all times. Future standards

development will also involve sustainable development of the agents and full life cycle quality traceability.

· Estimating the validity period

The validity period of fire extinguishing agents, especially water-based ones, is a top concern in the fire protection industry. Currently, there is no scientific method to accurately estimate the valid period of an agent. However, this knowledge is extremely important for both extinguishing system producers and end users. They need to know the validity period to predict the overall performance of the products.

· Developing fire test models at different scales

This development is based on the diverse performance of fire extinguishing agents. Currently, national standards serve as the baseline for products. These standards require the use of a standardized method and platform to test the performance. The development of these scaling models is in response to the market demands from fire extinguishing agent producers.

· Standardizing guidelines and directives on raw materials

The quality of raw materials directly influences the performance of fire suppressants. Given the lack of unified national or industrial standards, it is essential to establish standardized quality requirements for production materials. These requirements should mainly address critical characteristics such as chemical composition, performance stability, and physical properties that significantly impact fire suppression efficiency.

5. Conclusion

The construction of a standards system for fire extinguishing agents is a crucial guarantee for promoting the sustainable development of China's fire protection industry. Faced with the challenges and opportunities brought by increasing environmental protection requirements and technological innovation, the research on environmental protection indicators should be strengthened to improve the standards system, and facilitate technological innovations. Through the implementation of these standards, the quality of China's fire extinguishing agents can be continuously improved, making greater contributions to safeguarding people's lives and property, as well as social stability.

At the same time, the changes in international standards for environmental protection and technological development trends should be paid attention to, so as to promptly adjust and optimize the direction and key tasks of constructing China's standards system for fire extinguishing agents, to ensure that China's fire protection industry maintains meet the needs of the global market.

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Preliminary exploration of constructing a standardized process for prognostic biomarker discovery based on genetic big data

基于遗传大数据的预后标志物挖掘标准流程构建初探

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Abstract: The paper utilized a standardized methodology to identify prognostic biomarkers in hepatocellular carcinoma (HCC) by analyzing transcriptomic and clinical data from The Cancer Genome Atlas (TCGA) database. The approach, which included stringent data preprocessing, differential gene expression analysis, and Kaplan-Meier survival analysis, provided valuable insights into the genetic underpinnings of HCC. The comprehensive analysis of a dataset involving 370 HCC patients uncovered correlations between survival status and pathological characteristics, including tumor size, lymph node involvement, and distant metastasis. The processed transcriptome dataset, comprising 420 samples and annotating 26,783 genes, served as a robust platform for identifying differential gene expression patterns. Among the significant differential expression genes, the key genes such as FBXO43, HAGLROS, CRISPLD1, LRRC3.DT, and ERN2, were pinpointed, which showed significant associations with patient survival outcomes, indicating their potential as novel prognostic biomarkers. This study can not only enhance the understanding of HCC's genetic landscape but also establish a blueprint for a standardized process to discover prognostic biomarkers of various diseases using genetic big data. Future research should focus on validating these biomarkers through independent cohorts and exploring their utility in the development of personalized treatment strategies.

Keywords: standardized process, genetic big data, prognostic biomarkers, Kaplan-Meier survival analysis, hepatocellular carcinoma

1. Introduction

In the era of big data, the exponential growth of genetic information, particularly in transcriptomics, has transformed biomedical research. This trend indicates an unprecedented opportunity for the discovery of prognostic biomarkers, which is essential for advancing personalized medicine and enhancing the treatment effects of patients. Prognostic biomarkers offer critical understanding and prediction of disease progression and treatment responses, thereby improving clinical decision-making[1-3].

The Cancer Genome Atlas (TCGA) has been a pivotal initiative, providing a comprehensive genomic landscape of major cancer types, including HCC. As the most prevalent primary liver cancer, HCC is a significant global health challenge due to its high mortality rate and limited treatment options. This study leverages TCGA's HCC transcriptomic and clinical data to develop and validate prognostic biomarkers, which could facilitate early intervention, treatment strategies, and patient monitoring[4].

Despite the potential, it is complex to extract clinically relevant prognostic biomarkers from vast genetic datasets. It necessitates meticulous data preprocessing, multi-omics data integration, rigorous statistical analysis, and independent cohort validation. The reproducibility and robustness of identified biomarkers depend on standardized methodologies and stringent scientific practices.

This study aims to establish a standardized workflow for prognostic biomarker identification using normalized genetic big data, with a focus on integrating TCGA's HCC data. The objective is to demonstrate a systematic approach applicable to various cancer types and genetic datasets. By employing advanced bioinformatics tools and statistical methods, it identifies a panel of genes significantly associated with patient survival outcomes. Once validated, these genes could serve as novel prognostic biomarkers for HCC, guiding personalized treatment plans and improving patient care.

2. Materials and methods

2.1 Data acquisition and preprocessing protocols

Standardized data retrieval: The study systematically

retrieved transcriptomic and clinical data for the Liver Hepatocellular Carcinoma (LIHC) project from TCGA database using the standardized TCGAbiolinks R package, to ensure dataset consistency and integrity[5].

Standardized gene nomenclature conversion: As a critical step in the standardized process, gene IDs were systematically converted to gene names to facilitate cross-platform and cross-dataset analysis.

Standardized expression matrix filtration: A standardized filter was applied to the expression matrix, eliminating genes with low or undetectable expression across more than half of the samples, thereby enhancing the signal-to-noise ratio for subsequent analyses.

2.2 Differential expression analysis workflow

Standardized expression data normalization: Expression levels were standardized across samples by converting raw counts to TPM (Transcripts Per Million) format.

Standardized sample stratification: Samples were systematically classified into tumor and normal groups based on a standardized criterion using the 14th and 15th digits of the sample IDs.

Standardized statistical analysis: Employing the limma R package, the voom function was utilized to transform RNA-Seq count data into log2-counts per million (logCPM) and estimate the mean-variance relationship[6]. This process stabilizes the variance and assigns appropriate observation-level weights, enabling a standardized comparison of gene expression differences between tumor and normal tissues.

Standardized gene significance criteria: Stringent, standardized criteria were implemented for gene significance, including an absolute logFC greater than 1 and a p-value less than 0.05.

2.3 Prognostic biomarker screening process

Standardized survival analysis: The standardized Kaplan-Meier survival analysis was adopted to evaluate the prognostic significance of each gene, assessing the correlation between gene expression levels and patient survival probabilities in a systematic manner.

Standardized statistical significance assessment: The statistical significance of gene expression-survival correlations was determined by a standardized approach based on p-values from the survival analysis graphs.

2.4 Result visualization techniques

Standardized visualization tools: The standardized R package ggplot2 was used for visualizing analysis results, including volcano plots to illustrate gene expression differences and significance, and heatmaps to depict the expression patterns of significantly differentially expressed genes across samples[7].

Through these detailed steps, the study established a standardized process that is not only applicable to HCC but can also be generalized to other cancer types and genetic datasets. The standardization of this approach enhances the reliability of biomarker discovery and provides a blueprint for future research in the field of precision medicine.

3. Results

3.1 Overview of patient clinical characteristics and transcriptome data

Analysis of the processed dataset, which includes 370 hepatocellular carcinoma (HCC) patients (121 females, 249 males), has revealed correlations between survival status and pathological features, as well as age, as shown in Table 1. Among these patients, 240 survived (70 females, 170 males), and 130 deceased (51 females, 79 males). The tumor size, categorized by the AJCC pathological T staging, showed that approximately 50% of patients had smaller tumors (T1-T2), while the T3-T4 categories, particularly T4, had higher

	Alive		Dead		Overall	
	female (N=70)	male (N=170)	female (N=51)	male (N=79)	female (N=121)	male (N=249)
ajcc_pathologic_t:						
T1	35 (50.0%)	99 (58.2%)	22 (43.1%)	24 (30.4%)	57 (47.1%)	123 (49.4%)
T2	18 (25.7%)	44 (25.9%)	11 (21.6%)	19 (24.1%)	29 (24.0%)	63 (25.3%)
T2b	1 (1.4%)	0 (0%)	0 (0%)	0 (0%)	1 (0.8%)	0 (0%)
T3	5 (7.1%)	12 (7.1%)	6 (11.8%)	22 (27.8%)	11 (9.1%)	34 (13.7%)
T3a	7 (10.0%)	10 (5.9%)	7 (13.7%)	5 (6.3%)	14 (11.6%)	15 (6.0%)
T3b	1 (1.4%)	2 (1.2%)	0 (0%)	3 (3.8%)	1 (0.8%)	5 (2.0%)
T4	2 (2.9%)	1 (0.6%)	4 (7.8%)	6 (7.6%)	6 (5.0%)	7 (2.8%)
T2a	0 (0%)	1 (0.6%)	0 (0%)	0 (0%)	0 (0%)	1 (0.4%)
TX	0 (0%)	0 (0%)	1 (2.0%)	0 (0%)	1 (0.8%)	0 (0%)
Missing	1 (1.4%)	1 (0.6%)	0 (0%)	0 (0%)	1 (0.8%)	1 (0.4%)
ajcc_pathologic_n:						
N0	45 (64.3%)	123 (72.4%)	34 (66.7%)	49 (62.0%)	79 (65.3%)	172 (69.1%)
N1	2 (2.9%)	0 (0%)	1 (2.0%)	1 (1.3%)	3 (2.5%)	1 (0.4%)
NX	23 (32.9%)	47 (27.6%)	16 (31.4%)	28 (35.4%)	39 (32.2%)	75 (30.1%)
Missing	0 (0%)	0 (0%)	0 (0%)	1 (1.3%)	0 (0%)	1 (0.4%)
ajcc_pathologic_m:						
M0	53 (75.7%)	128 (75.3%)	32 (62.7%)	52 (65.8%)	85 (70.2%)	180 (72.3%)
M1	1 (1.4%)	0 (0%)	2 (3.9%)	1 (1.3%)	3 (2.5%)	1 (0.4%)
MX	16 (22.9%)	42 (24.7%)	17 (33.3%)	26 (32.9%)	33 (27.3%)	68 (27.3%)
age:						
<=59	28 (40.0%)	87 (51.2%)	20 (39.2%)	34 (43.0%)	48 (39.7%)	121 (48.6%)
>60	42 (60.0%)	82 (48.2%)	31 (60.8%)	45 (57.0%)	73 (60.3%)	127 (51.0%)
Missing	0 (0%)	1 (0.6%)	0 (0%)	0 (0%)	0 (0%)	1 (0.4%)

Table 1: Statistics of sample raw data information

mortality rates. Over 65% of patients had no lymph node involvement (N0), with the N1 category showing a similar mortality rate to N0, though the sample size was small. More than 70% had no distant metastasis (M0), while the M1 category had a higher mortality rate. The prognosis for the MX category, with unknown metastasis status, may differ. Patients aged 59 and below had a slightly lower survival rate than those over 60, with a modest increase in mortality with age. Although male patients outnumbered females in all categories, and some categories showed higher mortality in females, overall gender differences were not significant. These findings indicate that pathological features are the primary factors influencing HCC patient survival, with age and gender having a lesser impact, emphasizing the need for personalized treatment plans based on these factors.

The processed transcriptome dataset included 420 samples (370 tumor tissues and 50 normal tissues), and annotated with 60,660 genes, totaling 25,477,200 matrix data points. After filtering, 26,783 genes remained, reducing the data to 11,248,860 points. This comprehensive and curated dataset provides a solid foundation for the identification of differential gene expression and the discovery of prognostic biomarkers in HCC.

3.2 Differential gene expression analysis between tumor and normal groups

In the analysis of transcriptome data from tumor and normal tissues, the study identified 5,794 (3,104 downregulated, 2,690 upregulated) genes, as shown in Figure 1 with differential expression and pinpointed the top 10 most significantly upregulated and downregulated genes, as shown in Table 2.

Statistical overview of differentially expressed genes: The analysis encompassed various statistical metrics including logFC, AveExpr (average expression level), P-value, adjusted P-value (adj.P.Val), providing a comprehensive profile of gene expression differences. The logFC values ranged from -9.06 (greatest downregulation) to 5.51 (greatest upregulation), indicating significant gene expression disparities between tumor and normal tissues. The AveExpr values spanned from -5.58 to 14.95, further highlighting the broad variation in expression levels across different genes.

Top 10 most significantly upregulated genes: EBF2 was notably upregulated in tumor tissues with a logFC value of 4.70. Despite its relatively low average expression level, it had a t-statistic of 20.35 and very small P-value and adjusted P-value, confirming its significant differential expression in tumor tissues. Along with EBF2, nine other genes—AL391845.2, SFTA1P, GABRD, OR51E1, AC134043.3, PLVAP, FBXO43, HIGD1B, and HAGLROS—showed significant upregulation with logFC values between 2.70 and 3.65, and their P-values, and adjusted P-values all achieved statistical significance.

Top 10 most significantly downregulated genes: Conversely, a set of genes significantly downregulated in tumor tissues was identified, including LINC02446 with a logFC value of -1.32, indicating decreased expression. It had a small P-value and adjusted P-value, validating its significant differential expression. Additionally, nine other genes—TRIM15, P2RX6, GLIS1, APCS, CRISPLD1, MGC32805, LRRC3.DT, ERN2, and LINC01010—also demonstrated significant downregulation with logFC values ranging from -1.02 to -1.55, and their P-values, and adjusted P-values all reached statistical significance.

3.3 Impact of differentially expressed genes on prognosis in HCC patients

Kaplan-Meier (K-M) survival analysis was conducted to evaluate the impact of 20 significantly differentially expressed genes on the prognosis of patients with HCC, as shown in Figure 2. The statistical significance of the relationship between gene expression levels and survival probabilities was determined based on the p-values provided in the corresponding graphs. FBXO43 (p=0.0074) was

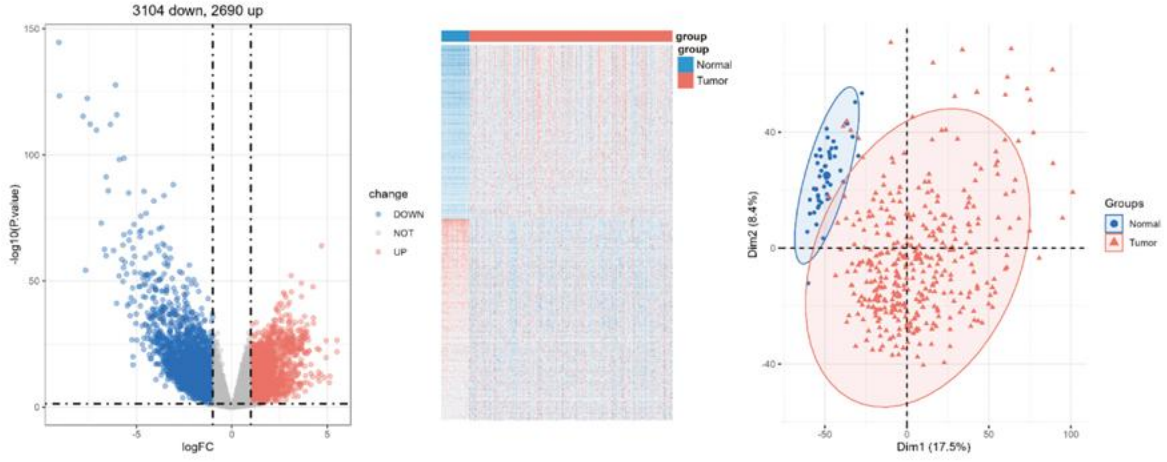

Figure 1: Differential gene expression plots

Gene	logFC	P.Value	adj.P.Val	Change
EBF2	4.704041	1.19E-64	9.08E-62	UP
AL391845.2	3.109269	7.15E-53	2.73E-50	UP
SFTA1P	3.647283	7.99E-50	2.58E-47	UP
GABRD	4.253047	1.97E-48	5.75E-46	UP
OR51E1	3.125514	2.03E-46	5.09E-44	UP
AC134043.3	2.703282	4.16E-46	1.02E-43	UP
PLVAP	2.776898	2.02E-45	4.79E-43	UP
FBXO43	3.65167	1.53E-44	3.53E-42	UP
HIGD1B	2.829147	2.72E-44	6.12E-42	UP
HAGLROS	3.017304	3.15E-42	6.54E-40	UP
LINC02446	-1.31747	8.78E-06	2.74E-05	DOWN
TRIM15	-1.21226	4.90E-06	1.60E-05	DOWN
P2RX6	-1.2015	8.81E-06	2.75E-05	DOWN
GLIS1	-1.10549	8.80E-06	2.75E-05	DOWN
APCS	-1.55179	3.97E-06	1.31E-05	DOWN
CRISPLD1	-1.02395	8.47E-06	2.65E-05	DOWN
MGC32805	-1.4167	7.48E-06	2.36E-05	DOWN
LRRC3.DT	-1.13164	9.74E-06	3.02E-05	DOWN
ERN2	-1.3952	9.50E-06	2.95E-05	DOWN
LINC01010	-1.37997	9.48E-06	2.94E-05	DOWN

Table 2: Top 10 upregulated and downregulated genes with significant expression differences

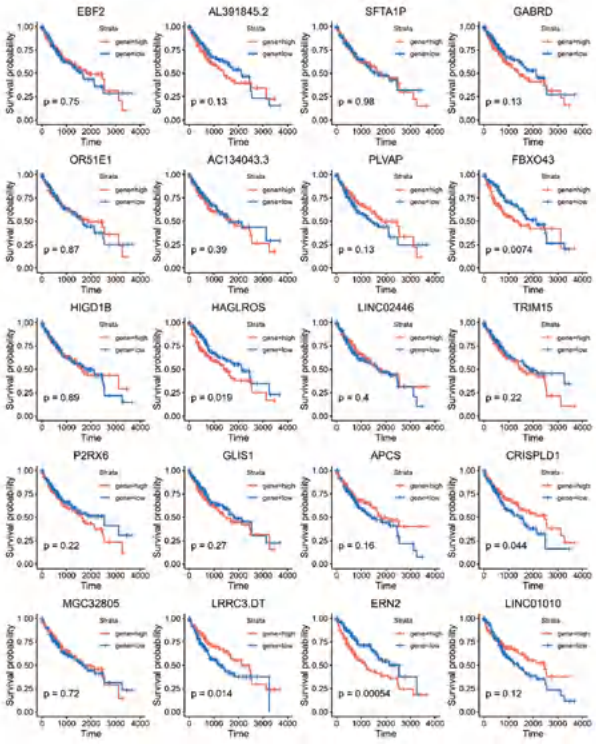

Figure 2: K-M plots of genes

associated with a poorer survival prognosis in patients with higher expression levels. HAGLROS (p=0.019) showed a significant association with survival, linked to a less favorable prognosis. CRISPLD1 (p=0.044) and LRRC3.DT (p=0.014) were linked to better survival outcomes, suggesting positive prognostic indicators. ERN2 (p<0.00054) demonstrated a strong negative association with survival, with higher expression levels associated with worse survival prognosis. These findings underscore the potential of these genes as prognostic biomarkers in HCC, guiding patient management and treatment strategies.

4. Discussion

Standardized approach to HCC biomarker discovery

The study exemplified the application of a standardized approach to identify prognostic biomarkers in Hepatocellular Carcinoma (HCC) by analyzing transcriptomic and clinical data from the TCGA database. This methodology, which includes stringent data preprocessing, differential expression analysis, and Kaplan-Meier survival analysis, has shed light on the genetic landscape of HCC and underscored the importance of standardization in biomarker discovery.

Impact of standardization on methodological rigor and data preprocessing

The adoption of the TCGAbiolinks R package for data retrieval and preprocessing was pivotal in ensuring a high-quality dataset for the analysis. Standardizing the conversion of gene IDs to gene names and filtering the expression matrix to include only genes expressed in over half of the samples were critical steps that likely contributed to the robustness of the findings. These standardized procedures not only enhance the reliability of the results but also facilitate the reproducibility of the methods across different datasets and research groups.

Standardization in differential expression analysis

The application of the limma R package and the voom function for variance stabilization transformation, coupled with stringent criteria for gene significance (absolute logFC greater than 1 and a p-value less than 0.05), allowed confidently identifying differentially expressed genes from a total of 26,783 genes. This standardized approach ensures that the genes focused on were significantly altered in HCC, providing a solid foundation for further investigation into their roles as potential biomarkers.

Standardization in prognostic biomarker identification

Kaplan-Meier survival analysis, a standardized tool in survival research, was instrumental in identifying several genes, including FBXO43, HAGLROS, CRISPLD1, LRRC3.DT, and ERN2, which showed significant associations with patient survival. The standardization of this process not only validated the findings but also proved them as reliable candidates for prognostic biomarkers in HCC.

Clinical relevance and personalized treatment in the context of standardization

The identification of these biomarkers through a

standardized process could have significant implications for personalized treatment strategies in HCC. For instance, patients with higher expression levels of FBXO43 and HAGLROS might benefit from targeted therapies, while those with higher expression levels of CRISPLD1 and LRRC3. DT might have a more favorable prognosis, facilitating less aggressive treatment plans. The standardization of biomarker discovery processes is crucial for the clinical translation of research findings into personalized medicine.

Significance of standardization in biomarker discovery process

The study represents an initial exploration into constructing a standardized process for prognostic biomarker discovery using genetic big data. The combination of advanced bioinformatics tools and statistical methods has proven effective in identifying potential biomarkers. The standardization of this approach can be generalized to other cancer types and genetic datasets, providing a blueprint for future research in the field of precision medicine.

Future directions in standardized biomarker research

While the study has identified several potential biomarkers, further validation through independent cohorts and functional studies is necessary to confirm their role in HCC progression. The integration of multi-omics data and exploration of the interaction between genetic and environmental factors could enhance the understanding of HCC and lead to the discovery of novel therapeutic targets. The standardization of these future research directions will be crucial for the consistent advancement of precision medicine.

5. Conclusion

The study systematically identified potential prognostic biomarkers in HCC using TCGA data through a stringent and standardized approach. It focused on 5,794 differentially expressed genes, with notable genes like FBXO43, HAGLROS, CRISPLD1, LRRC3.DT, and ERN2 showing significant associations with survival. This work sets a foundation for personalized HCC treatment and underscores the importance of standardized biomarkers in improving patient outcomes. Future efforts will be made to validate these findings and explore their role in precision medicine, building upon the standardized process that have been established.

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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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