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Chinese standards from the ground up

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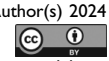

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Abstract

China's transformation from a standards-taker to a standards-maker has sent a shock wave through the global economy. While Chinese standardization is conventionally perceived and analysed as a top–down process, led by the central government and the Standardization Administration of China, this article demonstrates the merits of studying standards from the ground up. Sustained engagement with those who make, adopt, reject, and recalibrate standards reveals, first, the human face of standardization. Standards depend on people to be their advocates. The effectiveness of their implementation and the scope of their acceptance rely on practitioners who imbue standards with value and promote them within and across national borders. Furthermore, a bottom–up approach sheds light on the hierarchical nature of standards, the processes of inclusion and exclusion, and the dynamics of elevation and marginalization that hierarchies generate. Finally, it prompts us to look beyond de jure standards. As a producer of cheap commodities for developing countries, China has long been a maker of informal, or de facto, standards that grow out of repeat transactions and mutual agreements among actors along these value chains. Only by considering the human, hierarchical, and informal dimensions of standardization can we fully understand China's rise as a global standards power.

Keywords

standards, standardization, development, globalization, value chains, engineering, experts

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Taking advantage of Beijing's commitment to boost commerce with African countries, Kenya signed an agreement with China to export fresh avocados in early 2022.[1] Yet, after 10 avocado exporters had passed Kenyan inspections, Chinese authorities announced plans to conduct their own audits. While the European Union, the largest importer of African produce, demands examination only at the point of exit, Chinese officials requested inspections of the orchards and the storage and fumigation facilities – a process that can last years before the necessary approval is obtained. Seeking to increase China's imports of African agricultural products and to address trade deficits, President Xi Jinping announced plans to develop centralized clearance zones ('green lanes') to speed up inspections, in addition to granting more zero-tariff access and US$10 billion of trade finance for Chinese companies that import from the African continent.[2] But, thus far, China's stringent standards have stood in the way of realizing this ambitious plan.

Only two decades earlier, Chinese agricultural exporters had experienced similar trade barriers. Their exports were jeopardized by the Positive List System for Agricultural Chemical Residues in Food issued by European countries and Japan in the mid-2000s.[3] The list prohibits the distribution of agricultural produce that contain residues of chemicals such as pesticides above a limit of 0.01 parts per million so that the consumers' intake of agricultural chemicals does not exceed the toxicological threshold of 1.5 micrograms per day.[4] Unable to meet the standards set by the Positive List System, many Chinese vegetable growers lost their share in the overseas market. Those who sought to stay in the game had to ramp up operations to meet the new requirements.

Today, China has come full circle.[5] It has transformed from a standards-taker to a standards-maker in the global economy and it has created its own trade barriers, locking out others, such as African producers. Its rise in the world has prompted a redistribution of power in the geopolitics of standardization. As well as increasing its footprint in international standards development organizations (SDOs), such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), the Chinese government has sought to advance the uptake of Chinese standards abroad.[6] Meanwhile, it continues to commit to creating new standards through cooperation and mutual learning, especially in countries targeted by the Belt and Road Initiative (BRI).[7] This dual mission reflects tensions in Chinese policy circles between the legacy of the Bandung principles of equality and mutual respect on the one hand and Xi Jinping's 'big country diplomacy' on the other.[8] In the vein of the latter, the Xi administration has suggested establishing de novo SDOs, challenging Western hegemony in international standardization and changing the rules of the game.[9]

This special issue of *China Information* explores these shifts from the ground up. It scrutinizes and foregrounds the role of people in conceiving and applying standards. This bottom–up approach may appear counterintuitive given the common assumption of Chinese standardization as a 'top-level design' with the central government and the national standardization administration at the steering wheel. Existing scholarship on Chinese standards by and large follows this top–down approach, focusing on higher-level decision makers, such as the Standardization Administration of China, and paying more attention to standards design and development than standards implementation and recalibration.[10] In practice, however, numerous actors collaborate on, contest, and counteract the formation of standards. They test standards, translate them to fit local

circumstances, and adjust them in response to contingencies – a recursive process that is never done and dusted.

Before we look at how standards are made and implemented, we should reflect on what standards are. In the strict sense, standards refer to technical specifications that shape products and services, from the properties of a USB cable to the dimensions of cargo containers. They are created to enable interoperability in a heterogeneous environment and across distance. At the same time, they can hinder connectivity for those who cannot afford the patents embedded in standards or refuse to abide by existing rules. What is more, universal standards may not fit all conditions. For example, some Euro-American standards, such as the technical standard for milk quality and health and safety standards for industrial workplaces, are considered by some stakeholders to be impractical in the Chinese context, or irrelevant altogether.[11]

Broadly defined, standards are institutionalized practices imbricated with cultural conventions and moral evaluations.[12] As part of the infrastructure of social life, standards are ubiquitous yet often invisible. Occasionally, crises render standards visible. The COVID-19 pandemic was one such instance. It accentuated standards and standardization in a wide range of areas, from diagnosis and treatment to hospital admission and discharge, and rendering disease and mortality statistics. Standards were also critical to public health policies devised to thwart the spread of the virus, which required unprecedented coordination.

During the early outbreak in 2020, the Standardization Administration of China joined forces with Chinese enterprises to establish new national standards. The newly developed standard GB/T38800-2020, which stipulates general technical requirements for emergency medical isolation units, is a case in point. Such units were erected at the Huoshenshan Hospital in Wuhan, which was built in a record time of 10 days.[13] The collaborative effort of standards-making aimed to provide technical guidance for domestic production and facilitate the exportation of isolation units. Having experienced the health crisis before the rest of the world and learned from the 2003 severe acute respiratory syndrome (SARS) epidemic, China became a critical standards-setter. Developing standards for the design, verification, and implementation of analytical tests, the Standardization Administration of China worked closely with the ISO and submitted standards for the latter's approval.[14] The ISO, for example, accepted the Standardization Administration of China's standard proposal for nucleic acid testing (ISO/TS 5798:2022).[15] Consequently, standards derived from local and national experiences contributed to the universal knowledge of COVID management, thus enhancing coordination amid geopolitical bickering.

At the same time, the global battle against COVID-19 was marked by clashing standards, the consequences of which were felt most acutely on the ground. The cycle threshold (CT) value of the nucleic acid (known as PCR or NAAT) testing sample is a medical measurement of viral genetic material. It records the number of cycles required to detect the virus: a low value indicates a high viral concentration. While most countries set the threshold for CT value between 30 and 35, China held it at 40 until it eased its lockdown policies. The discrepancy in standards created a contradiction where a person could test 'negative' by their own national standard but 'positive' by the Chinese standard. The CT value not only served as a metric for measuring contagiousness,[16] but also became a biopolitical instrument, restricting cross-border travel.

What can be gained from studying standards from the ground up? First, sustained engagement with those who make, adopt, and reject standards, alongside observations of the technologies and policies shaped by standards, can shed light on both the material and the symbolic nature of standards. It helps reveal the meanings of standards and the social, economic, and moral values attributed to them.

Second, studying standards from the ground up helps unpack the dynamics of inclusion and exclusion generated by these meanings and values. As Geoffrey Bowker and Susan Star remind us, each standard represents one point of view and silences another.[17] Many hidden ethical choices go into the development of standards and their transformation.[18] Extended observation, sustained interaction, and, if possible, participation can unveil the invisible governance mechanisms and processes surrounding standards.

Standards development and governance in China from Deng to Xi

Learning the ropes (1988–2001)

China experienced the exclusionary nature of standards upfront when it sought to 'join tracks with the world' in the years after the country's opening up.[19] To become a profitable exporter, it needed to ratchet up domestic standardization. Aware of the economic and political importance of standards, the Chinese government issued the 1988 Standardization Law, kicking off a national programme to establish a new standards canon. Many early Chinese standards were inspired by those of the ISO or set by foreign national standardization organizations such as the American National Standards Institute and the Japanese Industrial Standards Committee, reflecting the government's 'dual-adoption' policy.[20] However, the first decade of standards development was plagued by a lack of technological and managerial expertise, a shortage of regulatory capacity, and an unwillingness to adopt new standards.

The case of rapeseed illustrates these early struggles.[21] Following the introduction of the household responsibility system in 1978, Chinese rapeseed production boomed. This made the plant – used for producing edible oil, animal feed, and commodities such as soap – a perfect candidate for the development of export markets. Recognizing rapeseed's potential, the Chinese government developed an ambitious plan to turn it into an export crop. To bring this ambition to fruition, however, Chinese producers had to meet international standards.

Despite its investments in research into the crop, the Chinese government ran into problems when enforcing the new standards. First, technical advancement in rapeseed was focused on the crop and ignored the need for improvements in storage, transportation, and oil-processing technologies. Second, actors along the rapeseed chain lacked technical and managerial capacity. For instance, it was not uncommon for processors to mix traditional rapeseed with the new varieties in the crushing process, losing the latter's beneficial features. Third, traditional practices stood in the way. The market prices for the rapeseed varieties that met international standards were not high enough to pay for the inputs required to grow them. Worse still, the new national standard for rapeseed (GB/T

11762-1989) did not define the characteristics of superior varieties, such as the level of erucic acid and glucosinolates, as mandatory criteria. China failed to become a leading exporter of rapeseed as a result.

The case of rapeseed demonstrates the obstacles to early efforts of domestic standardization and shows, moreover, the importance of the engagement of all actors along the value chain, from exporting firms to farmers. During China's reform period, standards remained largely aspirational,[22] as compliance left much to be desired.

While Chinese producers and manufacturers found themselves locked out of global markets, Chinese scientists encountered similarly exclusionary mechanisms in international SDOs. Their lack of technological expertise in and knowledge of the existing standards canon, in addition to their unfamiliarity with the rules of the game, excluded them from communities of practice.[23] Providing a unique peek behind the curtains that conceal the informal practices as much as the formal procedures of standards development, Daniel Fuchs and Sarah Eaton demonstrate how Chinese standards experts confronted these barriers through active learning. By learning the basics through engaging experts from traditional standards-setting powers such as the United States and Germany and learning to lead by proposing standards and taking up leadership positions, Chinese experts gained a considerable foothold in international SDOs.[24]

Shaping domestic standards (2001–2013)

China's accession to the World Trade Organization in 2001 served as a major impetus to increase its involvement in standards development. The central government stepped up its efforts to align domestic with international standards in the run-up to the Beijing Olympics in 2008, when the country became subject to global scrutiny.[25] The 'California effect' drove Chinese businesses to meet standards that matched those of importing firms and international export markets.[26] Simultaneously, the government continued to develop its technological and managerial capacity and strengthen regulatory governance, facilitating standards implementation and compliance.

Earlier investments in standardization began to pay off across sectors. Throughout the 2000s, domestic consumption and demand for imported products grew, which boosted the country's leverage as a standards-maker. If markets shape standards and drive standardization, what were the consequences of the fundamental restructuring of global commodity chains resulting from increased domestic demand for standards development in China?

China surpassed North American and European countries as the major importer in many value chains.[27] However, the surge in domestic standardization and enhanced compliance coincided with the lack of standards for the growing imports of natural resources from developing countries in Asia and Africa. China's timber trade with Gabon, one of the leading global hardwood exporters, is an example.[28] The global trade in timber and wooden furniture was long dominated by France and Germany. In the 1990s and 2000s, European countries pushed for increased trade regulation of tropical hardwood in response to concerns voiced by non-governmental organizations (NGOs) and demands raised by global buyers about the sustainable management of forests and the legality of wood products.

Soon after, however, Europe's dominance in global wooden furniture exports began to erode and China took over, leading to what critics called 'the collapse of standards'.[29] Initially sourcing mainly low- and medium-quality timber, following a 'low-cost/low-price' rationale that reflected the still modest spending power of Chinese consumers, importers disregarded the standards on labour, health and safety, and environmental protection previously promulgated by European NGOs and companies. Worse yet, many enterprises engaged in illegal logging. Following several incidents, the Chinese government signed a memorandum of understanding with Gabon to promote sustainable forest management, combat illegal logging, and develop the forestry sector. This commitment to sustainability standards in the timber sector is representative of a general shift that initiated a new phase in standards development and governance.

Becoming a world standards power (from 2013)

In the past decade, the Chinese government has sought to streamline domestic standardization and strengthen its position internationally to become a 'world standards power'. This new phase of standardization, marked by China's transformation from a standards-taker to a standards-shaker and a standards-maker, comes with increased responsibility – signalled, for instance, by the promotion of sustainability standards at home and abroad.[30]

Sustainability standards are not new in China. Their development was driven by domestic initiatives to counter the negative effects of China's economic boom, such as abusive labour conditions and environmental pollution, and Chinese firms' increased engagement in global markets.[31] China is one of the few countries that has made sustainability standards a legal requirement.[32] The first sustainability guidelines for outbound investment were issued in 2013 after the launch of the BRI, encouraging Chinese enterprises to respect local laws, engage in capacity-building, and adopt international best practices.[33] The main drivers of Chinese corporate social responsibility (CSR), May Tan-Mullins and Peter Hofman demonstrate, have been political will and global pressure. As representatives of the state, large state-owned enterprises – China's 'national champions' – are the frontrunners in CSR implementation.[34]

Yet not just state actors are involved in promoting and adopting sustainability standards. So, too, are private actors, as Si Chen shows in her work on the cobalt supply chain.[35] Chinese private firms such as Huayou Cobalt actively collaborate with other actors to improve labour standards and safeguard the protection of human rights. CSR standards typically emerge from a combination of international, national, and local standards, driven by commercial, political, social, and diplomatic considerations.[36] Yet, Chinese enterprises overseas show mixed enthusiasm for sustainability standards, especially where local regulatory systems are weak. Xiaoyang Tang points to a bifurcation in the commitment to CSR policies among Chinese firms in Africa.[37] At one end of the spectrum, large state firms have designated CSR departments and they publish regular sustainability reports. Conversely, small fly-by-night companies regularly flout local regulations and engage in environmentally and socially irresponsible practices.

Of course, sustainability standards make up only a fraction of the standards canon. All the while, the development of technical standards has proceeded apace, while Chinese standards developers continue to increase their footprint in international SDOs.[38] The

cursory overview in this section will be complicated as we consider the development, promulgation, enforcement, and maintenance of Chinese standards from the ground up.

The co-creation of standards

Conventional descriptions of standardization in China as a centralized, top–down, and state-driven process discount its intrinsically collaborative nature. Standards are not the products of technical committees alone, even if these committees are responsible for the final design and dissemination of standards. In China, like elsewhere, standards development depends on the input of a wide range of actors familiar with the different sides and locations of the supply chain or production process. They are *co-created* in and beyond administrative offices.[39]

Early observers, such as Scott Kennedy, described standardization in China in precisely those terms: as a collaborative endeavour.[40] Kennedy records the efforts of Chinese experts to develop standards for home networking in the 2000s. These successful attempts were overshadowed by the fiasco of WAPI, China's wireless local-area network (WLAN) Authentication and Privacy Infrastructure standard. WAPI failed to acquire a critical mass of support, owing to geopolitical rivalries and competition from powerful Western multinationals.[41] Other Chinese homegrown initiatives in information technology were more successful and approved as international standards, such as Super VCD (a digital standard for storing videos on compact discs)[42] and TD-SCDMA (a standard for the air interface in mobile telecommunications),[43] as were the standards developed for home networking.

In 1999, the former State Economic and Trade Commission, as chronicled by Kennedy, approved 12 Chinese enterprises to draft a new home networking standard.[44] The working group established for this purpose made little progress until the home appliance company Haier took over the helm. Meanwhile, the then Ministry of Information Industry set up its own working group and more companies joined, including Lenovo, Hisense, and Shanghai Bell. Dissatisfied with the group's direction, however, the private computer manufacturer Lenovo persuaded the ministry to allow it to engage in a separate initiative. In July 2003, Lenovo, TCL, Konka, Hisense, and Great Wall formed an independent industry alliance. The ministry's only stipulation was that, given its own group's focus on home appliances, the new working group should concentrate on the office and business environment. In March 2004, the new group submitted Intelligent Grouping and Resource Sharing (IGRS) Device 1.0 for approval, while the original group, still led by Haier, created the ITopHome Alliance just a few months later.

Apart from revealing the centrality of businesses and their initiatives in standards development, this case demonstrates the oft-ignored collaborative and cross-sectoral dimension of standards development in China. The IGRS and ITopHome consortia managed to expand their alliances. By 2004, the IGRS Alliance had almost 60 members, including companies from South Korea, Japan, and Taiwan, defying the common assumption that domestic standardization in China has been an exclusively national endeavour. Haier's ITopHome consortium had 244 members but attracted fewer foreign participants. In 2005, the standards proposals of both groups were approved by the Ministry of Information Industry.

A grounded perspective renders visible the collaborative nature of standards development in China in the past as much as the present. Marianne von Blomberg offers a pointed present-day example[45] by demonstrating how national standards for credibility assessment – accounting for compliance with laws, the observance of contracts, and moral integrity – are negotiated outcomes involving a range of parties, from platform companies and industry associations to research institutes and authorities at the national and local levels. These standards are part of the latest innovations in social credit governance, which is likewise often misread as an exclusively top–down project. Non-state actors, who call for the use of these standards for credibility appraisals and to share their results to inform regulators, also participate in their creation. Since the standards containing credibility appraisal methods are collaboratively developed by regulating agencies and other implementers of standards, including platform companies such as Alibaba, Tencent, and Ctrip, they are more likely to be adopted as a result. Von Blomberg shows that by making non-state actors co-regulators in the Chinese market, credibility appraisal standards offer practical tools to bring central-level concepts of credibility-based regulation to the ground.

Recent standards developed for Chinese overseas economic activities also require close collaboration, because actors in China are often unaware of or unfamiliar with local conditions abroad. One example, elucidated by Si Chen in this special issue of *China Information*, is the development of CSR standards governing labour practices, human rights, and the environment for Chinese firms with overseas mining operations. For example, in response to accusations of the use of child labour and of other labour abuses lodged against Chinese companies involved in cobalt mining in the Democratic Republic of the Congo, the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters (hereafter CCCMC), the sector's industry association, engaged actors along the cobalt chain to develop a set of industry-specific CSR guidelines.

CCCMC's engagement, as Si Chen demonstrates, has been proactive and its approach explorative. While developing the guidelines, it collaborated with local non-state actors and Western counterparts, including intergovernmental and non-governmental organizations. To illustrate, the Chinese Due Diligence Guidelines for Responsible Mineral Supply Chains were inspired by existing Western CSR standards and resulted from close cooperation with the Organization for Economic Co-operation and Development (OECD). The Cobalt Refiner Supply Chain Due Diligence Standard was launched with the Responsible Minerals Initiative, an international industry association that supports and creates awareness of responsible mineral sourcing worldwide. These fascinating examples of the collaborative nature of standards development challenge dominant assumptions of rivalry and opposition between Chinese and Western actors.[46]

Furthermore, standards are mutable, before and *after* their promulgation and publication, as Megan Tracy shows in her insightful analysis of the contention over the raw milk standard in China.[47] Standards are made and interpreted by a wide range of actors, from industry representatives to activists and journalists to consumers. Tracy uses the concept of *transduction* – the conversion of signals from one medium to another – to describe the recalibration of standards across scales and media. More specifically, she shows how a technical standard for the quality of raw milk changed from being a guarantee by

experts of food safety to a space for demanding transparency and accountability by consumer advocates in a period when China was still reeling from the 2008 milk scandal.[48] Tracy's case study shows that people endow standards with different meanings depending on their stakes in, and interpretation of, them.[49]

The human face of standards

Standards are made to function without human intervention. They enable trade between sellers and buyers without face-to-face interaction[50] and make interoperability possible without continuous human adjustments. JoAnne Yates and Craig Murphy map the community of standards experts who had a significant impact on the institutionalization of standards since the 19th century.[51] The professional commitment and unique personalities of these 'standardization entrepreneurs' were indispensable to the formation of national and international standards-setting bodies. As the contributions in this special issue equally demonstrate, people are involved at each stage in the life of standards, from conception and design to implementation and recalibration.

Standards depend on people to be their advocates. People bear the responsibility for promoting standards within and across national borders, which ultimately determines the success of their application and the scope of their adoption. The Chinese standards experts, dairy scientists, environmental advocates, hydropower engineers, corporate strategists, and social credit system developers discussed in this special issue of the journal carry standards by their passionate advocacy, professional expertise, translation practices, and geographic mobility. As advocates and bearers of standards, people are tasked with demonstrating their standards' superiority over existing and potentially competing standards. Sometimes they must fight for their standards' survival, confronted as they are with multiple spheres of influence. Chinese technical standards and the engineers who introduce them in Central Asia, for instance, meet dominant Western standards, lasting Soviet standards, or newly promoted Russian standards alongside national standards. This requires experts to make a case for one standard over another.[52]

In their study of knowledge production and dissemination in a renewable energy project in Israel, Zhuo Chen, Bryan Tilt, and Shaozeng Zhang reveal the barriers Chinese hydropower engineers face in promoting Chinese standards in a situation in which their Israeli and European colleagues swear by their own standards.[53] While they are not automatically accepted or, worse, are routinely rejected, standards become imbricated with people's professional and personal lives. Embracing the mission set out by the central government, the Chinese hydropower engineers sought to promote Chinese standards through careful testing and translation practices in everyday work, because more direct and radical approaches had proven unsuccessful.[54]

Nevertheless, considering the indispensable role of people in the transmission of engineering practices and expertise, the Chinese engineers expressed concern about the lack of successors who would be prepared to fight for the promotion and implementation of Chinese standards on the ground. Younger generations are less inclined to work on international projects, which separate them from their families for long periods. The more realistic option has been to adapt to the Western system and attempt to achieve gradual acceptance of Chinese standards. Chen, Tilt, and Zhang bring into sharp relief

the importance of humans as standards-bearers and the unequal relations between humans inscribed in standards practice.[55]

The success or failure of standards depends not only on the input of foreign experts and engineers, but also on the personal preferences and institutional goals of standards-takers, as Ruiyi Zhu shows in her contribution.[56] Zhu illustrates how some Mongolian stakeholders favour Western standards over Chinese ones – a choice reinforced by Mongolia's apprehension about China's economic growth and political influence since the 1990s. Choosing which foreign standards to adopt reflects geopolitical alliances and strategies as standards come to represent their makers and advocates. Suspicion of and aversion to standards-bearers can get in the way of the reception and adoption of standards. As Zhu's case illuminates, along with political preferences and personal aspirations, human sentiments assume a central role in the making and taking of standards, lending standards a human face.

However, like humans, non-human actors can also carry standards across borders. Chinese models and blueprints enable the circulation of standards across distance. When brought to places as far afield as Africa and the Middle East, these models transfer standards combined in packages or 'containers'. Standards embedded in building specifications, for instance, interact with environmental and electrotechnical standards. Indeed, as Lawrence Busch reminds us, standards prompt further standardization.[57] Standards are built and based on other standards. Yet, standards are never equal, and neither are those who make and adopt them.

Hierarchies of standards

As much as standards aim to improve interoperability and interchangeability, they do not make the world flat. The rhetorical openness and inclusivity of SDOs belie the fact that standardization is a game with entry requirements, historical hierarchies, and geographical divisions. The hegemon gains a competitive edge on its own products and generates revenue from patented technology. Historically, multinational companies from the Global North have dominated technical standards-setting in global SDOs by reaping the advantage of being the first movers.[58]

Learning from standards developed elsewhere involves being disciplined by others.[59] As a latecomer to the club of technical standardization, China has dealt strategically with the formal and informal entry barriers. In their contribution, Daniel Fuchs and Sarah Eaton trace the evolution of China's standards-setting practice since the domestic reforms. They identify four stages: from learning the basics and learning within the region to learning to lead and learning to build. China's rise as a 'standards power' has drawn scrutiny and contention. The ongoing geopolitical contestations over the fifth-generation technology standard for broadband cellular networks, better known as 5G, evinces the attempt by Chinese firms such as Huawei and national standards-setting bodies to claim first-mover status, and the advantages that come with it, within the fourth industrial revolution.[60] While some standards powers prefer to pursue friendly relations with China and show support, others take a battle position.[61]

Struggles over which standard will become 'the' standard are often fierce because, as Robert Schaeffer suggests, 'it is not about "intrinsic" qualities [of standards], but about

profit, market share, premium prices, consumer loyalty and monopoly rents'.[62] Amid geopolitical rivalry, as the case of Chinese standards reveals, it is also about strategic loyalty and political clout, especially in situations of contact. There is no guarantee that the 'best' standard wins – if there is a technically established 'best standard' in the first place. The Greenwich Meridian, for instance, was selected in 1884 as the global standard for civil time over 30 other sites once used as the prime meridian – a selection that was not based on technical reasons.[63] The adoption of Greenwich Mean Time (GMT, also Coordinate Universal Time) can be largely attributed to the standard's advocate, the British Empire, which was then one of the main political centres of the world. Like empires and countries, people and their relationships with others embody global hierarchies.

In sum, hierarchies of standards reveal parties' diverse interests in the standards-making process and the weight they assign to each standard. Standards are a signifier of power and a ground for consolidation and contestation.

Informal standards

Apart from formal standards, many standards are not officially recognized, bureaucratically backed, nor, if mandatory, legally enforced. Rather than being agreed on by committees of experts and incorporated in standards canons, these informal standards are developed at the grassroots. They develop through practice and persuasion. Informal standards grow out of repeat transactions and mutual agreements among actors in mostly informal trade networks. De facto rather than de jure standards,[64] they emerge when formal standards are too costly due to patented elements or fail to fit local conditions. Informal standards can be powerful in shaping global business transactions and trade, and warrant further research.

Until recently, China was the breeding ground of informal standards. While the formal standards canon expanded throughout the 1990s and 2000s, young entrepreneurs in metropolitan areas like Shenzhen began to address the exclusionary tendencies of markets.[65] The promise of making, endorsed and encouraged by state policies during the Hu–Wen administration, envisioned an alternative course of technological progress. Embracing an ethos of collaboration and innovation, Chinese designers and self-made programmers and engineers began developing products for the growing market of migrant workers who had less to spend than their urban counterparts. In the spirit of inclusivity, makers soon began developing products for places further afield in South-East Asia, Africa, Latin America, and the Caribbean.[66] Initially known for its fake, or *shanzhai* (山寨), products, Shenzhen grew into an innovation hub,[67] becoming the birthplace of smartphones accommodating two SIM card slots and equipped with radio-tuning capabilities, built-in power banks, and flashlights that could carry users in developing countries through power outages.[68] These makers set new product standards that were open, flexible, and inclusive, defying the formal standards adopted by Western tech giants.

Many of these informal standards – whether technological, aesthetic, or otherwise – were products of the collaborations between Chinese producers and African traders. The standards that govern the centuries-old trade in green tea between China and Mali, West Africa, described by Ute Röschenthaler serve as an illustration.[69] Chinese tea used to arrive in Mali in wooden boxes that had been transported first to Morocco by

sea, carried by donkeys to the south of the country, then by camels across the Sahara. The size of the boxes was made to fit their mode of transport. Donkeys could carry two boxes and camels six. Each wooden box had a standard weight of 30 kilograms, allowing the pack animals to sustain the load over long distances. After Mali's independence in 1960, the government began importing tea directly from China. Gradually, new packaging standards emerged in response to altered modes of transport, changing consumer markets, and innovative adaptations to cultural practices.

Green-tea packaging experienced an innovation following the market's opening to private trade in 1991, when a Malian of Lebanese origin began producing 25-gram sachets. The consumption of tea is a social occasion in which groups of men gather to drink and chew over the latest news. Observing this practice, the trader established 25 grams as the quantity of tea for one tea ritual. He named his tea Thé Baro ('conversation' in the vernacular spoken in Mali's capital, Bamako) and packed the sachets in boxes of 30 kilograms, respecting the existing standard. The dried tea leaves could be put into the teapot without needing to touch them, making the 25-gram sachet more hygienic and practical. Sales picked up, and sachets of 25 grams became the standard. Consumers in other African countries, however, preferred different quantities, ranging from 62.5 to 500 grams. The most popular amount in Morocco – the largest African importer of Chinese tea – was 250 grams, for instance, as Moroccan teapots are bigger. Indeed, the packaging standard was adjusted to the size of teapots.

Information technology, especially WeChat, has furthered the development of new informal standards in trade between China and Africa.[70] Yet, can informal standards be called standards at all? And what makes informal standards different from their formal counterparts? Common definitions of standards suggest that they can be established 'by authority, custom, or general consent'.[71] Informal standards developed and endorsed by a wide range of actors who reach a consensus are standards, too. They agree on certain specifications, mainly to accrue profit through customization. The trade of green tea between China and Mali attests to this.

Informal standards are even less visible than formal standards and demand a grounded approach. They do not carry patented technologies and are not necessarily endorsed by the authorities. Another difference lies in scale. Agreed on among a limited number of actors, informal standards are necessarily more local, if not less global, as the case of green tea illustrates, encompassing a limited number of communities of practice. Yet, this makes them arguably more flexible, pragmatic, and inclusive. One example is the function developed by TECNO Mobile to capture quality shots of dark-skinned subjects in low lighting – a feature standardized for phones targeting African markets.[72] Like these, informal standards operate alongside formal ones and regularly defy them.[73]

Conclusion

China opened its market to the world only four decades ago. Its subsequent rise to a global power has evoked a range of emotive responses, from awe to disbelief. The Chinese economy is the second largest in the world by nominal gross domestic product, and the country gained its reputation as 'the factory of the world' over a period of rapid industrialization. The scale of its political economy has propelled China to the front of the

global stage. Its swift transformation draws attention to the country's capacity to catch up with the first movers who established the rules of the game and, perhaps one day, to overtake them. Through the BRI, China has become an exporter of capital, labour, practices, norms, and standards.[74] As a latecomer to the table, it has expanded its role from a standards-taker to a standards-shaker and standards-maker. This shift raises important questions. Will China join tracks with the rest of the world? If so, when, where, and how?

International China watchers take various stances on this question. Observers at one end of the spectrum emphasize the intrinsic otherness of China, the reluctance of its government officials to adapt to existing norms, and their eagerness to create a separate sphere of influence. Observers at the other end take the opposite view and underline commonalities shared by all nation-states which seek to protect the interests of domestic companies. The rest draw attention to the importance of dialogue and compromise.[75] All three positions resonate with opinions in China, refracted through the domestic political prism. The perception of China's impact in the global economy is hence not purely a technical or an economic question, but also a social and political one.

Standards, both narrowly and broadly defined, foreground the processes of China's engagement with the global economy and its domestic ramifications. The contributions in this special issue on standards powerfully illustrate the symbolic and material nature of standards, the wide spectrum of actors who take part in standardization, the dynamic tension between local and global forces, and the recursive interaction between theory and practice in standardization. They demonstrate standards as enablers of inclusion and exclusion, with Chinese actors finding themselves on both sides. Global China, we show, is a project carried out by on-the-ground practitioners as much as top-level designers. To this end, standards render visible the processes of governance, ventures, and encounters in what has been coined the Chinese century.

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Notes

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