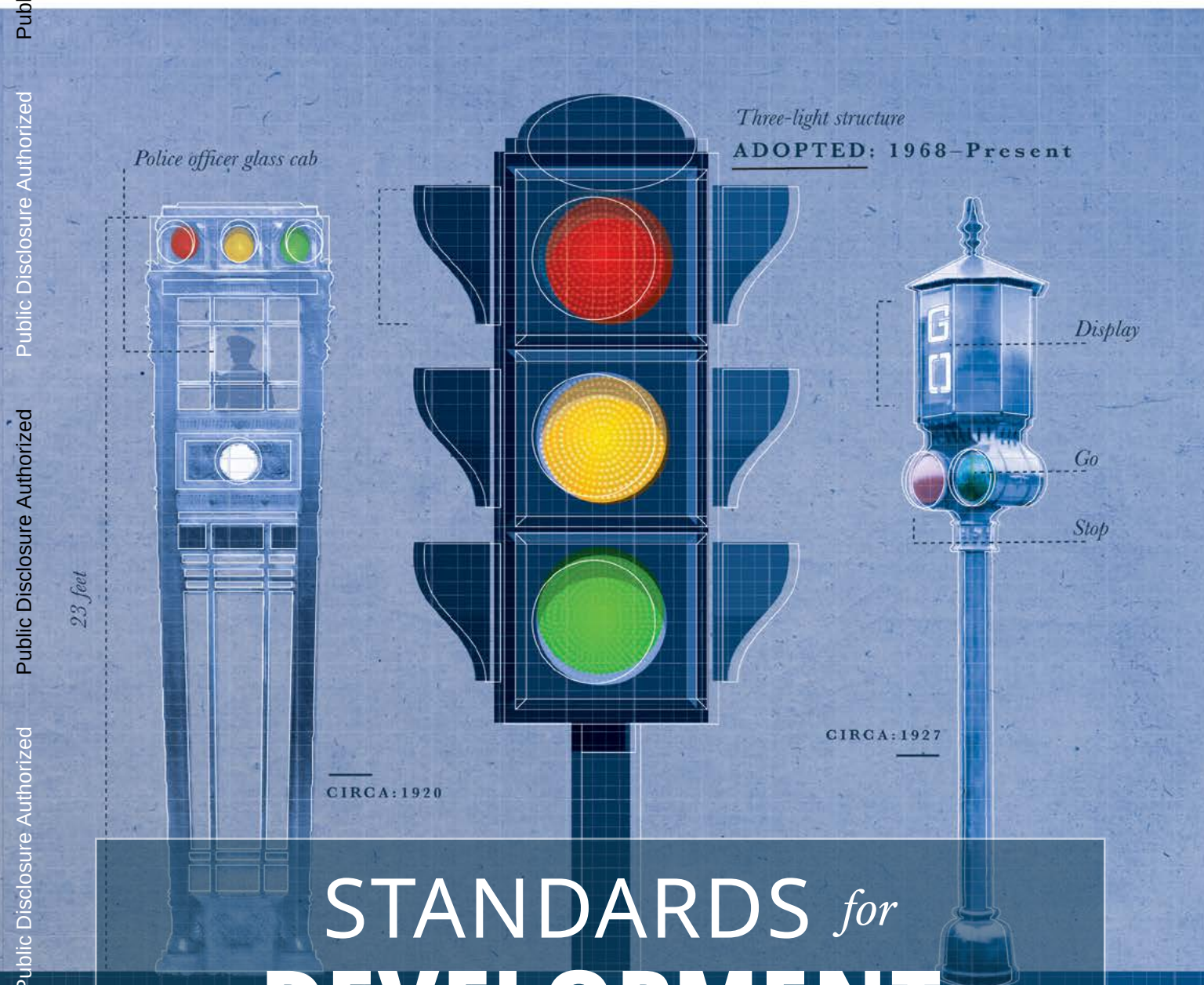
A World Bank Group Flagship Report

WORLD DEVELOPMENT REPORT 2025



STANDARDS *for* DEVELOPMENT

OVERVIEW

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STANDARDS *for* **DEVELOPMENT**

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OVERVIEW

STANDARDS *for* DEVELOPMENT

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Foreword

The world runs on silent agreements. You do not notice them when they work: the socket that fits the plug, the kilogram that weighs a kilogram in Nairobi as surely as in Nagpur, the barcode that rings up a carton of milk or registers a container at sea. Standards—the shared rules that underpin consistency, compatibility, and quality—are not mere technicalities. They are part of the invisible infrastructure of modern economies, as vital to prosperity as roads, ports, or power grids. Treat them as a springboard, and they propel development. Make them a straitjacket, and they will stifle it.

The global appetite for standards has surged. Most international standards have been minted since the turn of the century. Nontariff measures, often related to standards, now cover nearly all global trade. This reflects the complexity of supply chains, the digitalization of commerce, and the rising demand for safety in high-income countries. Complying with standards—and shaping them—has become a prerequisite for export growth, technology diffusion, and resilient public services.

Yet the bar for meaningful participation in the development of international standards remains high. Developing countries are often absent from the process. On average, they sit on less than one-third of the technical committees that determine global standards at the International Organization for Standardization (ISO) and even fewer of those committees in organizations that are not intergovernmental bodies. Absence amounts to acquiescing to the priorities of advanced economies. When lower-income countries do not participate, they relinquish vital opportunities to advance their priorities. They forgo crucial options to speed up job creation and economic growth.

This Report offers the first comprehensive analysis of the global landscape of standards today. It outlines how countries can use them to accelerate economic development, providing a practical policy framework for countries at all stages of development. Its lessons could not be more timely. Technological and geopolitical shifts are making standard setting a matter of urgency. Artificial intelligence and other innovations are racing ahead of the rulemaking capacity of countries and international standards development organizations. The result is a dangerous paradox: a cornucopia of standards for relatively inconsequential products like packaged potato chips and huge gaps for transformative, high-stakes technologies like biotechnology and artificial intelligence.

Standards are a policy instrument with a dial. Voluntary standards, led mostly by industry, can spread good practice in flexible ways. Mandatory standards, used in government regulations, can protect health, safety, and the environment. Blending mandatory and voluntary standards—and tiering them by the capacity of countries, businesses, and consumers to comply with them—maximizes efficiency while safeguarding the public interest. Tiered standards can widen participation: Small firms can start from a basic tier and climb, rather than face a cliff that only dominant incumbents can scale.

To turn standards into a springboard, governments in low- and middle-income countries must resist the urge to overregulate and instead focus on building the enablers for raising quality. Doing this includes improving their "quality infrastructure," which comprises metrology (the existence of reliable and internationally aligned measurements), conformity assessment (testing, inspection, and certification), accreditation ("checking those who check"), and standardization itself. Get this quality infrastructure system working, and businesses and consumers need not worry about quotidian routines. Firms can

focus instead on demonstrating quality at reasonable cost. Consumers can trust what they buy. Regulators can focus on outcomes.

Avoiding the potential straitjacket effect of standards requires matching ambition and capacity. It might be tempting for a country's regulators to copy the most stringent international standards on pollution, for example, to signal their sincerity and seriousness. But standards that are not aligned with a country's capacity to comply are a recipe for uneven enforcement, rampant corruption, and market concentration. Where capacity for compliance with standards is strong, governments should raise their ambition and align standards with global norms. Where it is weak, they should adapt standards to local realities while instituting mechanisms to build capacity, with full alignment of standards as the eventual goal.

Countries—and sectors within countries—should chart a realistic trajectory for standard setting that matches their stage of economic development. This Report proposes a progressive framework: *adapt–align–author*. For countries at an early stage of development, in which compliance capacity is typically low, the smartest course is to *adapt* international standards to suit domestic conditions as needed. At more advanced stages, they should aim to *align* domestic markets with international standards. At all stages, countries should *author* international standards in priority areas in which they have developed the requisite expertise. They should show up in meetings of committees of international standards development organizations, comment on drafts of standards, and convene domestic stakeholders so learning flows both ways.

Higher-income countries and international bodies have their own share of work to do. First, they need to create seats at the standard-setting table for low- and middle-income countries—and give them the support they need to succeed. Second, they should cut the duplication in the notorious "spaghetti bowl" of overlapping voluntary standards. And third, they must cooperate to minimize divergence, especially in instances in which the public interest is shared and the costs of fragmentation are high. In frontier technology, leading economies should press their top firms to set baseline standards and stress-test them with diverse stakeholders before markets harden around proprietary defaults.

This work is vital, because standards are how societies make the unseen obvious and governable. Standards reduce transaction costs, diffuse know-how, and enable scale. In low-trust environments, they substitute for reputation; in high-tech ones, they are the only way complex systems interoperate safely. When crafted well, standards lower entry barriers, expand opportunity, and protect the vulnerable. When crafted badly, they entrench incumbents and stymie progress.

Low- and middle-income countries are in a race against time. Several middle-income countries have set their sights on becoming high-income countries in a generation or less. To win the race, they will need to run a relay. Standards are the baton, passed from laboratory to factory to regulator to border and back again through feedback and learning. When standards are designed and implemented well, the whole team runs faster.

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Key Takeaways

- **Standards are the hidden foundations of prosperity.** They are the shared rules that make plugs fit sockets, medicines work safely, and digital systems connect seamlessly. Standards embody collective knowledge, build trust, and enable economies to function efficiently. When they fail, markets fragment; when they work, prosperity follows.
- **For low- and middle-income countries, standards have never mattered more.** Nearly *90 percent of world trade* is now shaped by nontariff measures, most linked to standards. From digital systems for payment to charging stations for electric vehicles, new technologies can deliver economywide benefits only when standards exist. Mastering them can enhance national competitiveness and protect against technological, financial, and environmental risks.
- **There are three types of standards.** *Measurement standards* ensure comparability and accuracy, *compatibility standards* enable interoperability, and *quality standards* define acceptable performance.
- **Most standards start as voluntary efforts, but governments make them count.** Private actors draft voluntary standards to address market or social needs. Governments amplify them by convening stakeholders and embedding critical standards into regulation when public safety is at stake.
- **Standards are a versatile tool of economic policy.** Governments can use voluntary standards to drive innovation and give technical guidance on compliance with regulations. They can also make them mandatory when uniform compliance is necessary to protect health, safety, or the environment. In addition, governments can deploy standards as an instrument of industrial policy without reference to specific technologies or firms.
- **Ambition must match capacity.** Countries should follow a trajectory that takes into account their stage of economic development, first *adapting* international standards to local realities when needed, then *aligning* with them as institutions mature, and actively participating in *authoring* standards in priority areas as capabilities grow. Rwanda's Zamukana Ubuziranenge ("Grow with Standards") program exemplifies this path, helping micro, small, and medium enterprises progress step by step toward compliance with international standards.
- **Investing in quality-enhancing infrastructure makes standards work well.** The system of testing, certification, metrology, and accreditation in a country is what makes standards effective. Such systems are expensive to build and easy to neglect. Countries should start with public provision of quality-enhancing services in key sectors, then gradually open up these services to private participation. In many places, capacity gaps are stark: Ethiopia has fewer than 100 accredited auditors for compliance with standards of the International Organization for Standardization (ISO), compared with 12,000 in Germany.

- **Adoption pays, but high costs and complexity hold firms back.** Costs of compliance and certification can amount to as much as *US$425,000 per firm* in low- and middle-income countries. Simplifying certification, recognizing regional equivalence, and reducing overlapping regulations can break the low-quality trap in which many of these countries find themselves. Harmonization and mutual recognition can dramatically cut trade costs and unlock countries' export potential.
- **Standards make services in health care and education work better.** Standards make efforts in these areas reliable, by ensuring that doctors are properly trained, vaccines are effective, and medicines and schools meet quality benchmarks. In health care, 60 percent of deaths in low- and middle-income countries stem from conditions that could be prevented or treated with high-quality care. Simple process standards like childbirth checklists for hospitals have reduced maternal deaths by nearly 47 percent in India. In education, clear standards for teaching quality helped Ceará, Brazil, lift literacy in early grades to near-universal levels within two decades of the standards' implementation.
- **Environmental and technological standards are essential for managing global risks.** Today, 99 percent of people worldwide breathe dirtier air than is considered safe under World Health Organization (WHO) guidelines, costing lives and productivity. Complying with these guidelines could add nearly two years to global life expectancy. Still, one-size-fits-all standards can burden governments that have low capacity for enforcing them. Tiered, affordable approaches, paired with monitoring and enforcement, are key to a just transition to a low-carbon economy.
- **Governance standards make governments more effective.** They are the hidden wiring that turns discretion into discipline in the public sector, now 373 million workers worldwide. Setting clear standards for hiring, pay, and procurement boosts transparency and efficiency.
- **To make standards a springboard for development, countries should do the following:**
  - Create incentives for firms to upgrade the quality of their exports rather than imposing unrealistic mandates.
  - Adapt and sequence standards to align with the national capacity to enforce them.
  - Participate actively in international forums for setting standards.
  - Invest in and share quality infrastructure resources regionally.
- **The global community, for its part, must do the following:**
  - Support participation by low- and middle-income countries in developing international standards and design tiered standards that reflect diverse capacities among countries.
  - Deepen regulatory cooperation and reduce fragmentation.
  - Develop credible standards for emerging technologies and actions to prevent or mitigate climate change.
  - Expand research and data on the economic and social impacts of standards.
- **Standards matter for development.** Countries that take them seriously are getting ahead. Countries that ignore them risk falling behind.

Overview

Who owns the standards, owns the market.
—Werner von Siemens

Standards: The quiet catalyst

Trade agreements have long greased the wheels of the global economy. They have smoothed out cross-border frictions, established predictable access to markets, and introduced standard rules into domestic regulation, so products can move at scale. But the real revolution came quietly—and relatively recently: from a US trucking entrepreneur named Malcom McLean in the mid-1950s.

Until then, goods were transported using methods that had hardly changed over the centuries. Cargo had to be loaded piece by piece, using crates, sacks, or barrels, onto carriages, trucks, trains, and ships. At each stage, everything was hauled off of one vehicle and then reloaded onto the next, usually with different types of specialized equipment. McLean standardized the humble steel box, readying it for easy loading and shipping across all forms of transportation: road, rail, air, and sea. In doing so, he crushed handling costs and delays: The cost of shipping fell by at least 25 percent. The risk of theft and damage eased. If treaties set the stage for the rise of globalization after World War II, McLean's container made the show possible.

McLean's standardization did not just tidy up shipping. Standard containers gave the world a common commercial language. A container sealed in Shanghai could roll off a ship in Rotterdam and onto a truck, rarely opened or even touched by human hands. Standards turned chaos into order, unleashing the economic miracles of just-in-time manufacturing. Ships got bigger. Supply chains proliferated. Commerce surged. McLean then turbocharged the process by granting free licenses to his container patents to the International Organization for Standardization (ISO).

In 1965, ISO codified almost everything about the containers: dimensions, stacking rules, twist locks, strength, and lifting. Suddenly, there was a single playbook—and global interoperability.

The payoff was extraordinary. Containers delivered a permanent boost to trade: a 1,240 percent cumulative jump in trade among advanced economies after 15 years: by many estimates, more than the combined effect of all trade agreements of the previous half century.[1] Across 22 industrial countries, standardized containers lifted bilateral trade by 300 percent in just 5 years and nearly 800 percent in 20. That far exceeded the 45 percent from bilateral free trade agreements over the same 20 years and 285 percent from membership in the General Agreement on Tariffs and Trade (GATT), the precursor to the World Trade Organization (WTO).[2]

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Today, trade frictions are once more on the rise across the world, but tariffs are only the most visible form of the malignancy, not the most important. Standards, in the form of nontariff measures such as requirements for product labeling and safety testing, now affect nearly 90 percent of trade, up from 15 percent in the late 1990s. They often pile problems on developing countries, intensifying the downward drift in flows of international trade from and foreign investment to these countries.

Consider just one area: climate. The European Union (EU) Carbon Border Adjustment Mechanism is designed to ensure that not only European firms, but global suppliers to the EU as well, reduce their emissions. It imposes a carbon price on imports in six sectors: cement, aluminum, iron and steel, fertilizers, hydrogen, and electricity. Firms that export their goods to the EU must measure, report, and verify the emissions their products cause, in accordance with established standards. If they cannot provide credible data at the plant level, the EU uses default values that can overstate actual emissions levels.

The Carbon Border Adjustment Mechanism constitutes the most ambitious climate policy experiment worldwide to date, an earnest effort to reduce emissions that reflects EU values regarding sustainability, fairness, and consumer responsibility. Yet it threatens to widen the global divide between rich and poor countries.

It enables firms in advanced economies with a strong machinery for compliance to gain a big edge, while boxing in enterprises in less developed economies. Mozambique, which sends nearly 90 percent of its aluminum to the EU, is particularly at risk from the policy. So is the Arab Republic of Egypt, which exports almost half its nitrogen-based fertilizers to the EU market.

Here is another example: The Basel Committee on Banking Supervision is introducing the first global standards for banks' exposure to crypto assets, covering Bitcoin, Ethereum, stablecoins, and more. Due in 2026, these standards will determine how banks calculate capital requirements for a US$4 trillion market that has so far operated in a regulatory gray zone.

The Basel standards are rewriting the rule book for banking: By setting clear charges associated with financing capital expenditures and limits on banks' exposure to risk, they aim to bring order to a volatile system. The goal is not to stifle innovation, but to anchor it in prudence: a single global framework that replaces fragmented national rules. Like a container that keeps its cargo safe from port to port, these financial standards promise predictability in instances in which instability can spill across borders.

This process of using standards to manage risks goes beyond banking. Frontier technologies, from dopamine-driven social media and artificial intelligence (AI) to mirror organisms and quantum computing, carry profound risks yet lack even the most rudimentary global guardrails. Even as the arguments about standards are becoming more heated, geopolitics is killing off the coordination the world so badly needs. This Report points to standards as a quiet catalyst not just for economic development but also for international cooperation.

Standards as springboards

Standards anchor today's biggest policy debates. When they work, they are silent. When they fail or do not exist, you cannot miss the chaos.

As the examples in the preceding section highlight, standards fix coordination problems and solve market failures resulting from bad information and externalities. They build trust among consumers. They allow producers to trade and reap economies of scale. In short, they make markets work better.

The three dimensions of standards

World Development Report 2025 identifies three critical functions of standards:

- *Measurement:* Consistency in measurement that is essential for building, testing, and certification
- *Compatibility*: Interoperability and substitutability that power scale and order
- *Quality*: Baselines for performance, safety, and reliability.

These three functions are not just abstract principles derived from economic theory. Together, they make standards a building block—sometimes even the foundation—of economic development. Consider India, the United States, and the Republic of Korea: the world's biggest democracy, its largest economy, and one of its most inventive societies, respectively.

India's history after independence shows how measurement standards forge economic unions. As a new sovereign nation in 1947, India launched its first National Sample Survey of living standards in 1950. The survey revealed a striking lack of standardization of weights and measures in the country's rural areas: 143 different systems for measuring weight, 150 different systems for measuring volume, and 180 systems for measuring land area.[3] The lack of consistency that was hobbling India's economic union paralleled the mayhem in France before the metric system established order there; in the 1700s, France had about 250,000 local weights and measures.[4]

What was the fix? "Indianize" the metric system, not cling to Imperial units or the colonial baggage associated with them. That required a massive effort: new technical standards, nationwide education, multilingual materials, and revamped curriculums.

India adopted the metric system in 1956, legalized it in 1958, and made it mandatory by 1962. The transition was painful but pivotal. Today, India is the world's fourth-largest economic union, built on the bedrock of metrological consistency.

The United States has been the world's largest economy for more than a century. Its rise as the global leader in manufacturing by the mid-twentieth century is often attributed to entrepreneurs like Henry Ford, whose models of mass production changed enterprises around the world.

But the US manufacturing edge was not just Ford's assembly line. It was also the government's drive for "simplification," initiated during World War I, to push industry toward compatibility: standard (fewer) sizes and mass production. Industrial standards in the early 1900s were mostly in house; fragmentation was rampant, fed by a tangle of state and local rules and custom-made orders. Mattresses came in 78 sizes in 1914; within a decade, that number had fallen to 4 for 90 percent of output.

Wartime agencies, working through trade associations, slashed product variety across some 250 lines in 18 months. President Hoover revived and institutionalized the effort in the 1920s, creating the Division of Simplified Practice as a neutral broker for voluntary, industrywide standards.[5] Early wins—paving bricks, mattresses, bedsprings—cut varieties by more than 90 percent. By the early 1930s, 135 Simplified Practice Recommendations were in place, growing to 173 by 1939 and 267 by 1971.[6] Each one tightened the link between design and efficiency, reducing waste, cutting costs, and freeing up capital for innovation.

Compatibility standards powered the US leap in mass production and consumption, turning variety into scale and waste into efficiency. What looked like a technical exercise was in fact an economic policy of uncommon power, one that

quietly multiplied productivity across an entire economy.

When innovation is measured by patent applications per capita, the Republic of Korea may be the world's most innovative economy today.[7] It is surely one of the most successful development stories in modern history.

Korea built its rise from postwar ruin to technological powerhouse on a foundation of quality standards. It embedded quality upgrading into its national strategy, shifting from adopting to shaping global standards, especially in information and communications technologies.[8]

To win in export markets in the 1960s, Korea built a national quality infrastructure: metrology, standardization, conformity assessment, and accreditation.[9] The country's 1961 Metrology and Industrial Standardization Acts created Korean Industrial Standards; the Korean Standards Association (KSA) spread them. The country's 1962 Export Inspection Act tied compliance to export viability. Its 1961 KS mark certification and preference in government procurement for products carrying the certification drove firm adoption.

As its heavy and chemical industries grew, supported by Germany and the United States, Korea modernized metrology via the Korea Standards Research Institute (or KSRI, now the Korea Research Institute of Standards and Science, or KRISS). A 1980 constitutional amendment mandated a national standards system, backed by the country's ten-year industrial standardization plan and subsequent five-year plans.

As Korea relentlessly upgraded its economic structure between 1996 and 2014, the country fused standardization with innovation. Private bodies gained a bigger role in drafting standards. Korea ramped up its participation in international standards development organizations (the International Organization for Standardization, or ISO, and the International Electrotechnical Commission, or IEC) and technological consortia (the 3rd Generation Partnership Project, or 3GPP, and the one Machine-to-Machine Partnership Project, or oneM2M) moving from a country that implements standards developed by others (that is, a "standard taker") to one that participates in and even leads the development of standards (a "standard maker").[10]

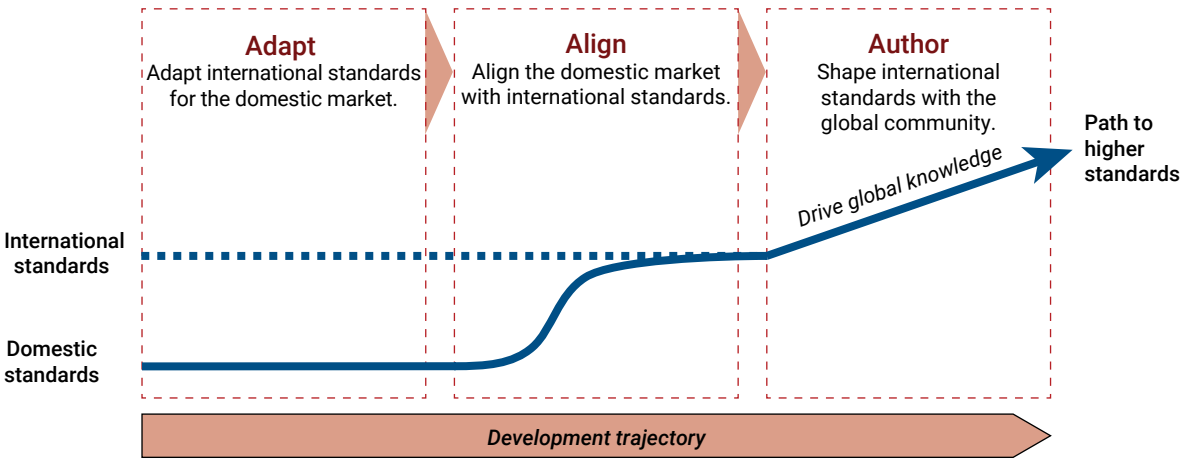
The lesson: Korea treated standards as quality-enhancing economic infrastructure. The state matched its vision with laws, institutions, and incentives (notably procurement advantages for products bearing KS mark certification), and its long-term plans and capability building sustained momentum. Korea's "stage-skipping" rapid economic advancement came from coordinated public-private investment, smart borrowing of foreign know-how, building of expertise in standardization, and making the latter a complement to industrial upgrading.[11]

Adapt–align–author: How standards support development

Development is all about transitioning toward higher-quality goods, services, institutions, infrastructure, and quality of life. As the examples in the preceding sections have illustrated, standards play a catalytic role in this journey.

A fundamental question is, How should countries decide what standards to use, and how will those decisions change with economic development? At low levels of development, countries may need to *adapt* international standards to local conditions, especially if they are making them mandatory standards (refer to figure O.1). But global markets do not bend: Buyers expect full compliance with international consistency (including safety), compatibility, and quality standards—no compliance, no sales. For home markets, adaptation is

Figure O.1 Standards have a great impact on development



Source: WDR 2025 team.

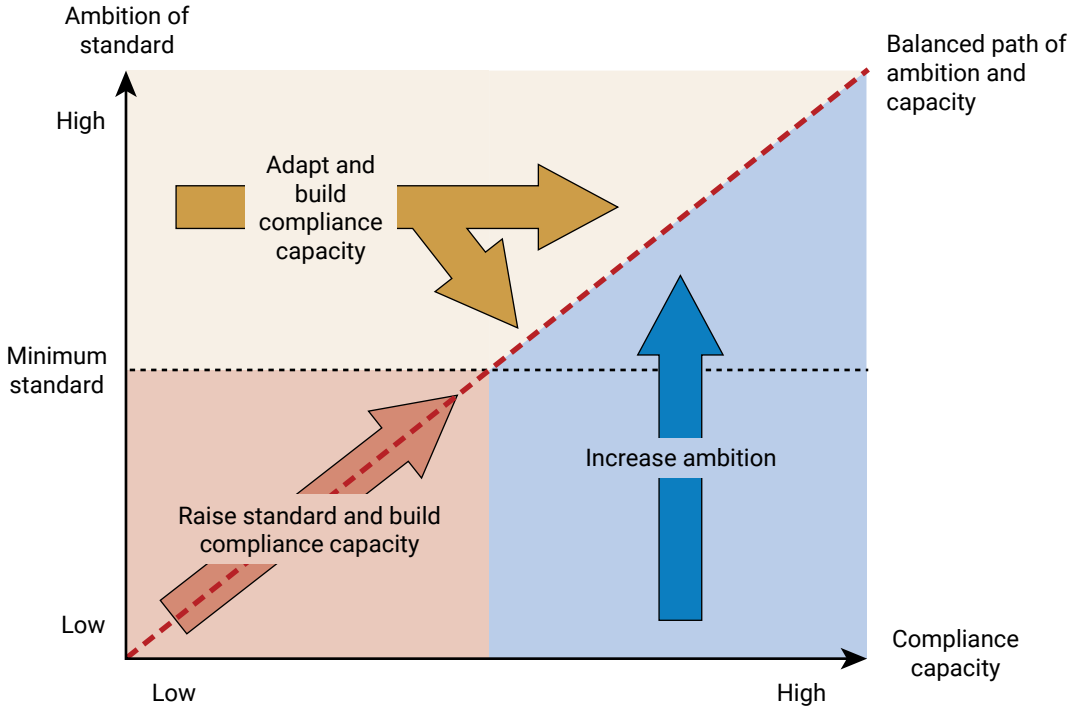
possible but risky: Industry may capture the process, watering down standards, making them hard to reverse, and locking countries into low-quality norms and lower levels of development. Deviating from international standards should therefore be a last resort, used only when firms' capacity to meet those standards cannot yet be strengthened.

As developing countries adapt international standards to local conditions, they will need to balance the standards' ambition, in terms of their stringency and the breadth of areas they cover, with the capacity of firms in the countries to comply with those standards (refer to figure O.2).

When mandatory standards are set too low, society loses out in regard to quality of education and health care, food safety, and environmental protection. When these standards are set too high and burden producers with steep compliance costs, prices spike and shut out consumers, and society loses out again. For example, setting reporting requirements beyond what small firms can meet can push the firms out of business, as in the case, for example, of stringent rules for dairy safety that only large industrial producers can afford to comply with. Worse, ambitious regulations without enforcement muscle invite uneven application and potential corruption and can alter the trajectory of a country's development forever. The central task, shown in figure O.2, is striking the right balance between ambition and ability.

As countries increase their capacity for compliance, they should *align* standards for the domestic market with international standards. This is beneficial because international standards reflect good international practices that countries can learn from. The WTO Agreement on Technical Barriers to Trade encourages alignment of national with international standards to ensure that measures that countries enact to achieve legitimate public objectives like health, safety, and environmental protection do not unnecessarily disrupt trade. Moreover, aligning national with international standards ensures that firms in a country do not need to produce one variant for the domestic market and another for export. In nontradable areas like education, health care, and public administration, standards must be more sensitive to context but have a clear pathway for improvement. In these areas, although international standards can serve as benchmarks, developing countries may need to develop their own standards. The process of standards development itself should encourage these countries to address their own priorities and capabilities within specific political and cultural contexts.

Figure O.2 Countries should match their ambitions with their abilities



Source: WDR 2025 team.

As countries become wealthier, they should deliberately become more active in *authoring* international standards, either by developing new ones or by updating existing standards based on their experience and needs. Active participation in developing international standards is important even if a country has limited technical expertise in the areas the standards govern. It allows the country to share its challenges and priorities, thereby influencing what the standards should cover. Additionally, international standards development organizations serve as learning environments and help countries gain a deeper understanding of how standards are developed through interactions with participants from other nations and stakeholders. Of course, the level of a country's participation will depend on its priorities and expertise in particular sectors.

The trajectory of standards, from adaptation to alignment to authoring, is not linear or uniform across sectors. Countries can move between the choices of adaptation, alignment, or authoring in different areas at varying speeds. For example, Ethiopia is authoring standards for production of its local grain, teff, while adapting standards in other areas. India is taking up leadership in development of international standards for low-voltage electrification while adapting standards for fuel efficiency. The transition from adapting to aligning to authoring embodies the complex interplay among scientific and technological advancements, cultural traditions, social preferences, economic pragmatism, business interests, and political ambition and power. Understanding the transition process is crucial for policy makers, businesses, and civil society as they navigate the increasingly complex global landscape of standards.

Building capacity for compliance with standards

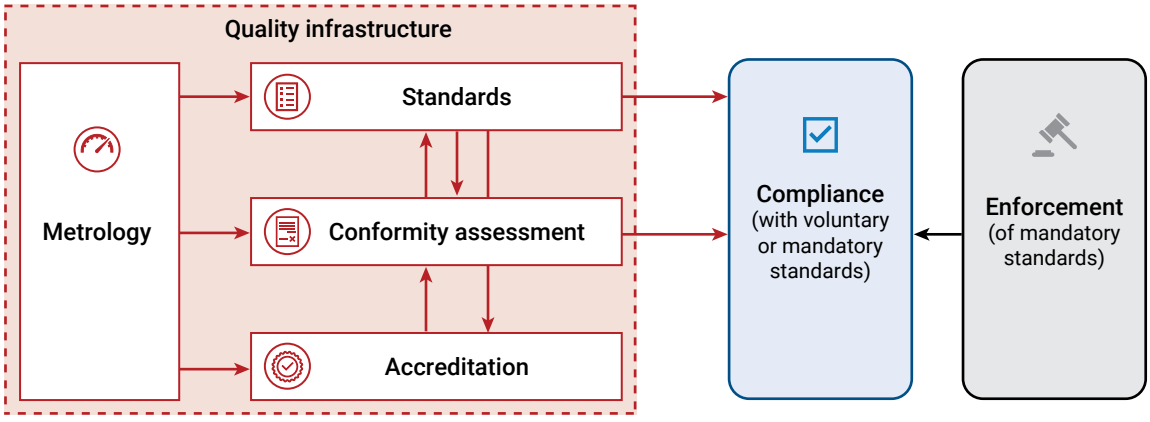
Building capacity for compliance with standards is not just about teaching firms to tick the right boxes, it is about wiring an entire system that makes quality the standard. That system of public and private institutions is called "quality infrastructure." Although it is referred to as a type of infrastructure, it should not be confused with physical structures like roads or bridges. Instead, quality infrastructure serves as the backbone or foundation of quality and consists of four components that ensure standards are implemented correctly and consistently (refer to figure O.3):

- *Standardization:* Defining technical specifications and other things like testing methodology
- *Conformity:* Demonstrating that specified requirements of a product, process, system, person, or organization are fulfilled[12]
- *Accreditation:* "Checking the checkers" to ensure that conformity assessment bodies are technically competent
- *Metrology:* Ensuring accuracy and consistency in measurement through the science and application of measurement.[13]

Together, these components serve every sector and every standard, voluntary or mandatory. A buyer-approved laboratory inside a garment factory, health inspectors in hospitals, and market surveillance teams pulling unsafe toys off shelves: All exemplify the role of quality infrastructure. When a quality infrastructure system runs smoothly, firms can prove quality, regulators can enforce rules, and consumers can trust what they buy.

In wealthier economies, distinct institutions typically handle different functions such as developing standards, ensuring accurate measurements, and checking the competence of certifiers through accreditation. Because of limited resources, developing countries often merge these roles into a single organization. Such a consolidation, however, can create conflicts of interest. The most serious conflict arises when one body is responsible for both certifying products (conformity assessment) and assessing other certifiers (accreditation). This dual role compromises impartiality and erodes trust. An organization that certifies a product's sustainability, for instance, should not also be the one to decide which other organizations are qualified to issue such certifications.

Figure O.3 Quality infrastructure ensures compliance with standards



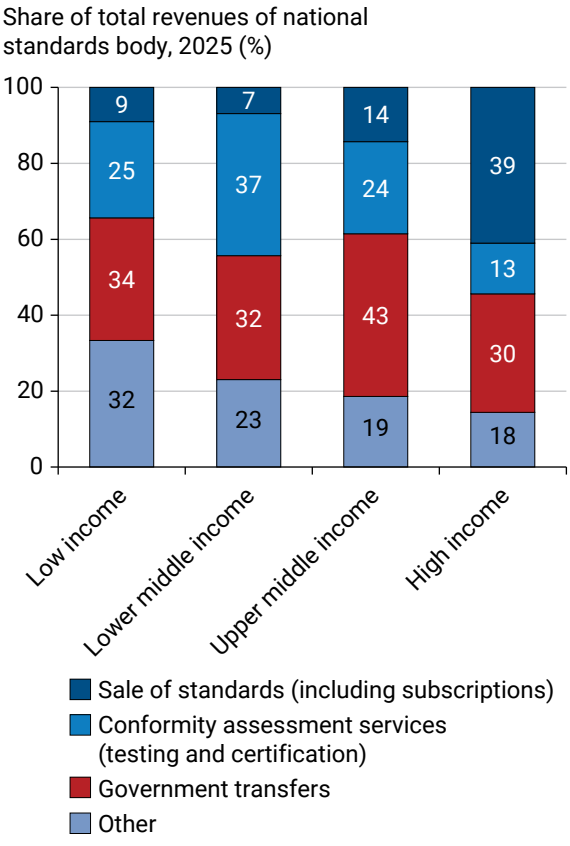
Source: WDR 2025 team.

Another conflict arises from combining standards setting and conformity assessment. This practice is particularly common in developing countries, where national standards bodies often rely on revenue from conformity assessment. In 94 percent of low-income countries and 82 percent of lower-middle-income countries, national standards bodies are involved in conformity assessment. In the latter group of countries, conformity assessment services can account for nearly 40 percent of the revenue of national standards bodies (refer to figure O.4). Although ISO guidelines require a separation between the functions of setting standards and assessing conformity with them, limited resources in developing countries often make this separation difficult to implement.

As countries develop, their approach to building capacity to comply with voluntary and mandatory standards must evolve. Early on, countries need to build the *basics*, by investing in foundational quality infrastructure like metrology. The public sector typically takes a leading role at this stage in providing testing and certification services, because private markets are not yet deep enough. Governments also need to accord priority to mandatory standards on life-and-death activities like construction and medicine.

As countries climb the development ladder, they can *broaden* the objectives of their public quality infrastructure to cover more areas as they enable more private testing, inspection, and certification bodies, whose trustworthiness the government may oversee via accreditation. Eventually, countries' quality infrastructure covers public objectives more comprehensively. At this stage, countries should *balance* their approaches to developing quality infrastructure, with the government assuming the role of a "referee" while the private sector handles most matters related to compliance.

Figure O.4 Lower-income countries depend too much on revenues from services related to assessing conformity with standards



Source: WDR 2025 team, based on World Bank and ISO 2025.

Note: The figure shows revenue sources of national standards bodies as of 2025. The survey sample includes 116 national standards bodies: 13 in low-income countries, 28 in lower-middle-income countries, 34 in upper-middle-income countries, and 41 in high-income countries. "Other" includes revenues from accreditation, metrology, partnerships or donor funding, and training and consulting services. Shares of components within bars may not sum exactly to 100 because of rounding.

When building quality infrastructure across these three stages, countries should sequence their investments according to market and societal needs and prevent institutional conflicts of interest. Although the division of roles between the public and private sector is a key concern,

developing countries can leverage their compliance capacity by working with civil society organizations like consumer groups or professional bodies.

Although companies establish most voluntary standards to ensure the quality and safety of their inputs, products, and processes, this Report puts emphasis on voluntary standards developed by national and international standards organizations through consensus among different stakeholders, including industry, academia, government, consumers, and civil society (refer to box O.1).

Box O.1 Governments dominate national standards bodies in developing countries

Most countries have a national standards body that coordinates standards development and represents the country in international standards development organizations like the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and the International Telecommunication Union (ITU). Many national standards bodies are autonomous governmental organizations created through the legislative process, such as those in Bangladesh and South Africa.[a] In some countries like the United States, national standards bodies are nongovernmental organizations that the government recognizes as national standards bodies.[b] A survey by ISO and the World Bank for this Report shows that whereas almost all national standards bodies in developing countries are government institutions, only 56 percent in advanced economies are. In many countries, national standards bodies take on a coordinating function among multiple national standards development organizations. For example, the Bureau of Indian Standards works with sectoral standards development organizations such as the Telecommunications Standards Development Society, India (TSDSI).

In addition to their different legal setups, national standards bodies have different models for financing that vary greatly between developing countries and advanced economies, with consequences for the roles they play. In high-income countries, national standards bodies generate nearly 40 percent of their revenues from selling standards, reflecting the private sector's greater demand for standards and greater capacity to pay for them. Conversely, in developing nations, these bodies get only about 10 percent of their revenues from the sale of standards. Notably, in developing countries, national standards bodies offer a wider range of services beyond standards development, such as testing, inspection, and certification, which account for nearly one-third of their revenues on average. Additionally, they are more likely to participate in regulatory functions: 75 percent of national standards bodies in developing countries are involved in setting technical regulations (mandatory standards), compared with just 35 percent in high-income countries.

These differences seem unremarkable, but they can fundamentally alter the dynamics of standards development. In many developing countries, national standards bodies play a

(Box continues next page)

Box O.1 Governments dominate national standards bodies in developing countries *(continued)*

central role in testing, inspecting, and certifying mandatory standards that, as government entities, they help develop, risking a shift from being service providers to being compliance auditors for voluntary standards demanded by the private sector. This also raises potential conflicts of interest.

Source: WDR 2025 team.

a. The national standards body in Bangladesh operates as an autonomous government institution. For details, refer to Bangladesh Standards and Testing Institution (BSTI) (dashboard), BSTI, Ministry of Industries, https://bsti.gov.bd/. The South African national standards body was established in 1945 under the country's Standards Act. For details, refer to SABS [South African Bureau of Standards] (dashboard), SABS, Department of Trade, Industry and Competition, https://www.sabs.co.za/.
b. The US standards body is a private nonprofit organization founded in 1918 that represents the United States in international standards development organizations, such as ISO and the IEC. For details, refer to ANSI [American National Standards Institute] (dashboard), ANSI, https://www.ansi.org/.

Who develops standards?

It makes sense to leave the drafting of voluntary standards to their primary users: private businesses. Automobile manufacturers, for instance, were indispensable to shaping ISO 26262, which governs the safety of electronic systems in road vehicles. Because standards rely on detailed technical know-how, the specialized expertise of industry is essential to their development.

Yet participation in developing standards is not purely a technical exercise. Steering a standard in one's own direction creates competitive advantage. Voluntary standards influence commercial behavior when firms reference them in contracts and drive demand when governments embed them in rules governing public procurement. Furthermore, voluntary standards can become compulsory once written into national law.

In some cases, products developed by a single dominant firm—examples include IBM's PC architecture, Microsoft Windows, and Adobe PDFs—become de facto industry standards because the network effects of having many users on a single platform create high barriers to entry for competing systems. In many cases standards emerge from a market contest, not a neutral search for "the best" design or idea. Standard-setting bodies must therefore continually balance two objectives: drawing on the knowledge of stakeholders and avoiding regulatory capture by the largest or most politically connected firms.

That balancing act is getting harder. Products' technical complexity is increasing, and private sector expertise now far outpaces that within governments. The challenge is acute in many developing countries, where formal private sectors are small and often dominated by a handful of well-connected firms, some of which are state-owned enterprises.

Multinational corporations also work the system: By joining multiple national standards bodies (each of which enjoys one vote in intergovernmental forums), they can amplify their influence.

Reports suggest that some large technology companies are following this playbook to shape emerging standards for AI, even hiring local consultancies in countries where they have no physical presence. Because legislation such as the EU's Artificial Intelligence Act will rely on voluntary benchmarks, winning the standards race can confer a major edge.

In contrast to the private sector's dominance in establishing voluntary standards, governments set mandatory standards. Beyond achieving the right balance between ambition and capacity, as discussed earlier, a key issue for governments is time horizons. Benefits from higher levels of compliance often show up only in the medium term, with at least one election cycle elapsing between enactment and benefits. Building laboratories to test for heavy metal contamination in soil, for example, yields health gains that may be invisible—or politically irrelevant—when the next election arrives.

Ideally, the core principles of openness, balance, and consensus should drive standards development. But developing standards is also about power, incentives, and governance. In some cases, it reflects different societal preferences and cultural norms, as shown in strong disagreements in areas such as genetically modified crops and standards for meat and dairy. Getting it right requires transparent processes, broad stakeholder participation, and rigorous assessment of standards' economic and distributional effects.

More broadly, the research conducted for this *World Development Report* suggests the following principles:

- Demand should drive standards development, with standards enacted only in instances in which there is a strong market or societal need.
- In most economic sectors, the private sector should set voluntary standards.
- Governments should step in regarding the development of voluntary standards only when collective action fails or inclusion, fragmentation, and competition are problems—and even then, it should act only as convenor, rather than determining the technical content of voluntary standards.
- Mandatory standards should be reserved for essential public interests in areas such as health, safety, environmental protection, and preventing deceptive commercial practices.

Standards for growth, well-being, and stability

Standards can be leveraged for development in four ways. First, every developing country needs *economic growth*. Standards can be powerful drivers for diffusing good practices, increasing efficiency, and realizing economies of scale by connecting countries through trade and investment. Second, development is ultimately about improving individual *well-being*. Standards contribute directly here by helping to improve health and education, which, in turn, underpin economic growth. Third, standards are important tools for *risk management*—a necessity, given that unchecked economic growth can precipitate serious risks, from financial crises to the destruction of the environment. Lastly, all three of these areas require *government capacity*, which itself is buttressed by standards in areas ranging from budget and procurement processes to the recruitment and remuneration of government officials.

Economic growth: Standards increase efficiency and quality and enable scale

Geopolitical tensions, trade fragmentation, assertive industrial policies, and the long-term pressures of climate change increasingly constrain developing countries' growth through trade,

spillovers from foreign direct investment, and technology diffusion: the channels that carry the know-how embedded in standards. To respond, these countries need to start at home: They should create conditions that encourage firms to invest in upgrading to better standards in domestic markets. Industrial policies should be carefully calibrated so as not to shield firms from competition or alter their incentives in ways that could discourage rather than encourage them to upgrade quality. If industries are protected from the consequences associated with lack of quality, why would they invest in quality?

Aligning public and private incentives and ensuring competition are essential to enable the "infusion" and diffusion of know-how.[14] Standards by themselves will not deliver technological upgrading, but inconsistent policies and regulations can certainly derail it.

Market realities also matter. Most firms are too small to justify spending money on the fixed costs of compliance with standards and obtaining certification that they have complied with them.

Developing countries should therefore follow a practical four-part strategy for upgrading quality in domestic production:

1. Give high priority to medium-size enterprises that are ready to adopt standards.
2. Support firm growth to create a virtuous circle of capability and compliance.
3. Strengthen links between large firms and smaller suppliers in supply chains to spread standards.
4. Invest in quality infrastructure and lower service costs to broaden access.

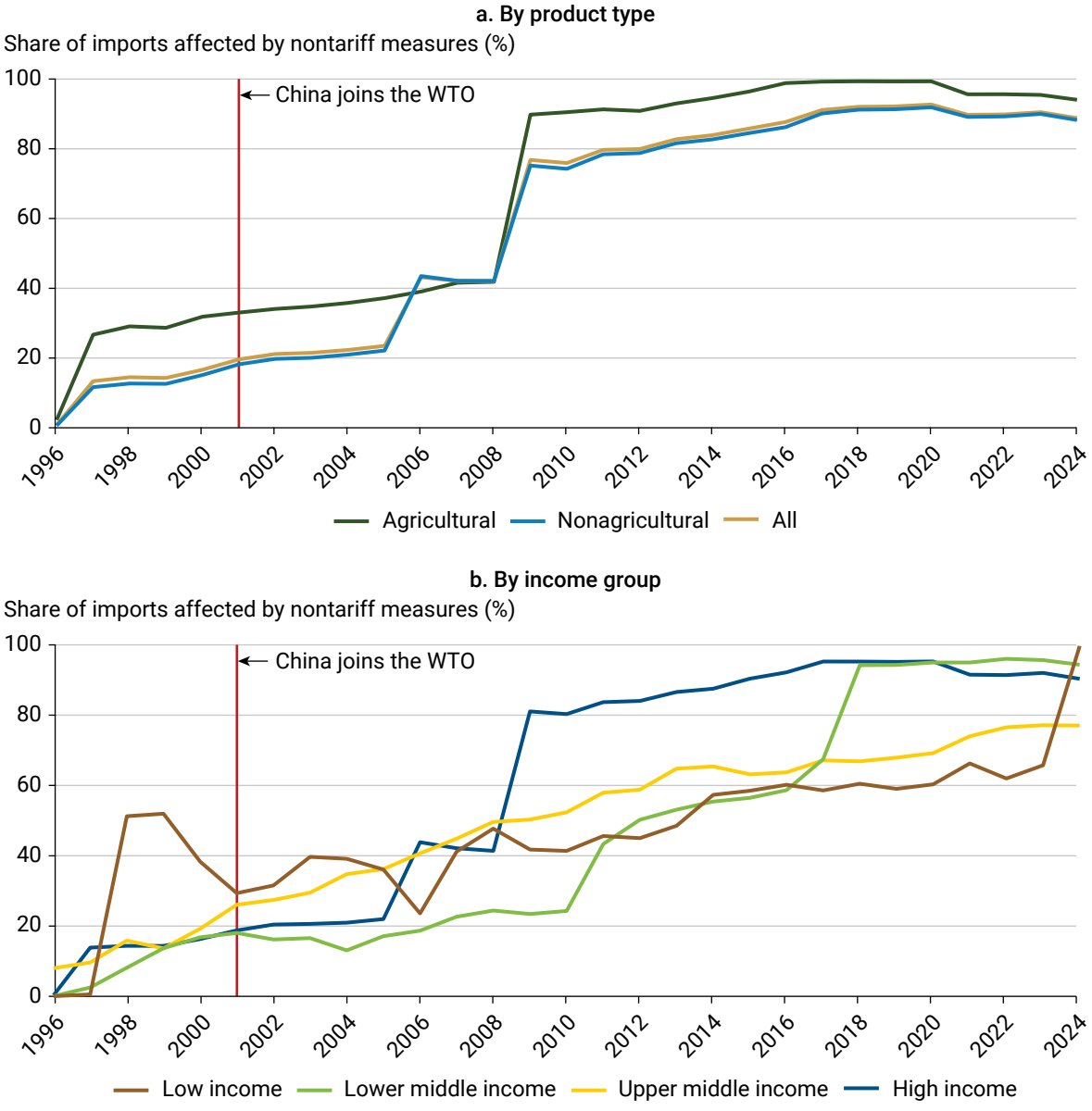
East Asia's experience underscores common success factors in using standards to promote economic growth: an export orientation, a culture of quality, strong participation by the private sector, and sustained investment in quality infrastructure, both physical and human expertise—all tied to tapping external knowledge.

Coherence of a country's policies involving regulations is as important. The recent surge in nontariff measures is not restricted to advanced economies; such measures are increasingly common among developing countries and can choke trade between countries, hurting consumers and preventing firms from scaling up (refer to figure O.5). Priorities in this area include regulatory alignment among countries, building capacity among a country's firms, and facilitation of trade.

Governments should base technical regulations on international standards wherever possible and deepen cooperation through mutual recognition agreements: arrangements that allow trading partners to accept the results of one another's testing, inspection, and certification. Such agreements prevent firms from having to prove compliance twice (once in the originating country, then again in the destination country), lowering costs and speeding up the entry of products into markets.

Engaging the private sector helps clarify the role of private standards, and digital portals and transparency tools can help firms anticipate and adapt to regulatory changes. Private standards have enabled outsourcing and improved sustainability practices, but their proliferation has created a "spaghetti bowl" of overlapping requirements that increase certification costs and fragment markets. Often spurred by stringent regulations in advanced economies (such as those surrounding food safety), private standards can inadvertently entrench the power of large global buyers and exclude smaller producers unable to shoulder the burden of complying with them.

Figure O.5 Technical nontariff measures are now the main impediment to trade globally



Sources: WDR 2025 team calculations, based on data from TRAINS [Trade Analysis and Information System] (portal), United Nations Trade and Development, https://trainsonline.unctad.org/home; WITS: World Integrated Trade Solution (database), World Bank, http://wits.worldbank.org/WITS/.

Note: The figure plots the share of imports regulated by technical nontariff measures: sanitary and phytosanitary measures, technical barriers to trade, and preshipment inspections. The sample includes all countries surveyed for the TRAINS database since 2020 and all nontariff measures enacted since 1996. WTO = World Trade Organization.

To ensure that regulations protect consumers without morphing into protectionism, advanced economies should simplify technical regulations and make them more transparent. Doing so would lower compliance costs for producers in developing countries, an urgent task as tariffs and other trade barriers rise.

The benefits of well-designed standards extend beyond trade and competitiveness: Well-designed standards also shape the quality and inclusiveness of employment. As standards raise productivity and product quality, they also generate better jobs. By reducing uncertainty and facilitating trade and investment, they fuel firm growth and, with it, demand for labor. Upgrading to higher standards brings new technologies, better management, and new skills, creating learning and employment effects along the value chain. In services in which trust depends on certification, skills standards and professional accreditation help workers move across firms, sectors, and borders, aligning training systems with employer needs and making labor markets more inclusive. Yet a familiar challenge remains: Can countries raise standards for decent work without setting the bar so high that firms or workers retreat into informality?

Well-being: Standards for health and education

Developing countries can improve health and education by strengthening standards for measurement and input, supported by relevant components of quality infrastructure, to make outcomes in these two areas reliable and enable them to be compared. Although international standards in these two areas that embody best practice can serve as benchmarks, they need to be adapted to specific national contexts, given differing needs and resource constraints. In environments with limited resources, ambitious standards will not be achievable at scale. The more likely result is rationing of health and education services, benefiting the privileged.

Rather than by adopting international standards unchanged, countries achieve their desired outcomes in the area of human capital when they align their standards with enforcement capacity and update them as their capacity grows—that is, by adapting them to domestic needs and capabilities. National medicine lists are a good example. In compiling these lists, countries adapt the World Health Organization (WHO) Model Lists of Essential Medicines not only to their health needs but also to the compliance capacity of domestic firms. As countries' income per capita increases, the number of medicines from the WHO list on the countries' national essential medicines lists increases.[15] Thus, lower-income countries adapt the list to a lower standard to minimize the potential gap in compliance among firms, then continue to adapt it to higher standards as those firms' capabilities progress.

Successful practices in Brazil, China, and South Africa show the effectiveness of the adapt–align–author sequencing in standards development discussed earlier in this overview, sensibly matching countries' ambitions to their abilities while ratcheting up both. A great example of progressing to higher standards through an adaptive approach to standard setting is the "barefoot doctors" scheme in China. In 1965, China shifted its health policy to focus on rural areas, reallocating resources to train and provide a paramedic, popularly referred to as a "barefoot doctor," for each village. Instead of the standard medical school curriculum, training for barefoot doctors focused on basics like disease prevention, diagnosis and treatment of common symptoms, family planning and birth attendance, women's and children's diseases, and first aid. As China's system matured, the country gradually raised its standards, in 1984 requiring barefoot doctors to pass a new set of professional tests to become "village doctors."[16] WHO later praised the model for providing the greatest health benefits with the least amount of investment.[17]

In education, the achievements of the state of Ceará in Brazil illustrate the recommendation "adapt what you adopt as you implement." Initial education reforms in Ceará (1997–2000) successfully increased school enrollment but not student learning. In response, the state launched a second phase based on clear standards for foundational learning, integrating this goal with updates to systemwide standards, including reforms to the curriculum focusing on basic literacy and numeracy, professional development for teachers aligned with new instructional methods, and regular state-level assessments to track student progress. Although local adaptation was promoted, meeting state benchmarks for literacy and numeracy became a requirement for accessing additional state funds. Within two decades, Ceará achieved nearly universal literacy by the end of grade 2.[18]

As developing countries attempt to leverage digital technologies to increase human capital in remote areas, they need to pay greater attention to the standards underpinning these technologies. Telemedicine potentially allows millions of people living in remote areas to access medical services. As an example, Telemedicine Africa operates a virtual telemedicine consultation center that makes specialists and general practitioners available to patients across Limpopo, South Africa's poorest province, saving the rural population millions of dollars each year on travel to urban hospitals.[19] Similarly, digital technologies are extending instructional support to millions of learners.[20]

Elsewhere, Uruguay's Ceibal program has helped position the country as a global leader in digital learning.[21] Realizing the promise of initiatives like Ceibal and Telemedicine Africa, however, requires clear standards for digital infrastructure to ensure that all service providers, as well as patients and students, have secure access to devices, internet connectivity, and digital platforms.

Stability and safety: Financial and environmental risks for resilience

As noted earlier in the section, economic growth is essential for developing countries. But it brings with it risks that can undermine stability and resilience, from financial bubbles to the erosion of natural wealth to societal risks arising out of new technologies like AI. It is increasingly evident that without the guardrails that standards provide for managing risks robustly, risks can undermine the fruits of economic growth, turning it into something uneconomical.[22]

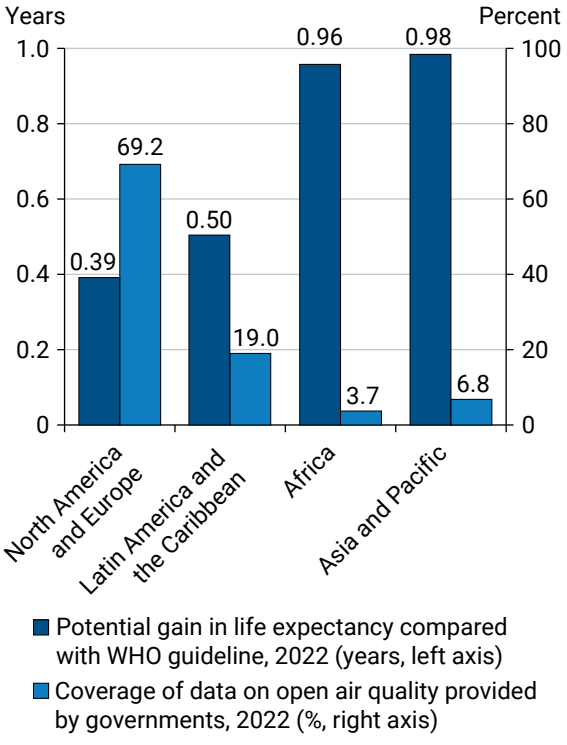
Weak or absent financial standards and lax enforcement of standards when they do exist have been the one constant in the recurrence of human folly in the form of financial crises for nearly a millennium, afflicting both high- and low-income countries.[23] Financial standards underpin a country's financial and economic stability. But these standards need to be calibrated for risk, the way the standards embodied in the Basel Capital Accords are. As with standards in other areas, financial standards need to evolve as a country's financial system develops and new technologies emerge. On the one hand, the anti–money laundering standards of the Financial Action Task Force (FATF) have curbed money laundering, but their lack of calibration to accommodate situations in individual countries has also made it much more difficult (and expensive) to send remittances to conflict-ridden countries.[24] For example, in Pacific Island countries, the withdrawal of correspondent banking relationships by international banks has sharply reduced access to cross-border financial services, constraining trade, tourism, and remittance flows. On the other hand, other FATF standards, such as those relating to customer due diligence measures, can be expanded to cover virtual assets such as cryptocurrencies, although their decentralized and transboundary nature will require new approaches for implementing and

enforcing them effectively. Experience with the Basel framework has shown that standards need to be transparent and adapted (specifically, using a tiered approach) to enable effective monitoring and supervision; similar principles should be applied to standards for the multitude of nascent virtual assets.

A mounting threat to countries' resilience comes from growing environmental stress. For low-income countries, the immediate priority is economic growth and poverty alleviation; environmental concerns understandably rank lower on their policy agendas. Given the well-known negative effects of pollution—to focus on the most potent among the environmental stresses countries are facing—on health, worker productivity,[25] and human capital[26] and so ultimately on long-term economic growth, middle-income countries have strong incentives to avoid the "develop first, pollute, and then clean up" pathway of today's developed countries.[27] Additionally, recent examples, such as China's quick rise to global leadership in electric vehicles and renewable energy, show that developing countries can leapfrog polluting technologies, especially in key sectors like energy and transportation.

No meaningful action can be taken to address environmental issues such as pollution, however, without accurate measurement standards. Most of the world's population lives in areas that lack reliable data on their exposure to pollution (refer to figure O.6). Only 3.7 percent of governments in Africa, 6.8 percent of those in Asia, and 19 percent of those in Latin America provide dependable data on air quality.[28] Similarly, more than 3 billion people worldwide are at risk of disease as a result of the unknown quality of the water in rivers, lakes, and groundwater, largely because of insufficient monitoring.[29] Data on soil contamination are even more scarce. Expanding and improving systems for monitoring the environment is therefore critical for identifying challenges and strengthening the enforcement of standards.

Figure O.6 Most of the world lives in places for which reliable data on pollution exposure are lacking



Source: Hasenkopf et al. 2023.

Note: The figure creates "potential gain in life expectancy compared with WHO guideline" as a measure of air pollution to account more effectively for differences in population exposure across locations. Specifically, it measures the potential gain in life expectancy, in years, if levels of particulate matter with a diameter of 2.5 micrometers or less were reduced to the WHO guideline of 5 micrograms per cubic meter. For example, high levels of particulate matter in uninhabited parts of the Sahara may have limited impacts on outcomes relating to human health and economies because there is no population to experience the negative effects, whereas they can have devastating impacts on highly populated areas. Refer to AQLI: Air Quality Life Index, EPIC Clean Air Program, Energy Policy Institute, University of Chicago, https://aqli.epic.uchicago.edu/. WHO = World Health Organization.

In addition to increasing capabilities for monitoring in order to provide more comprehensive data, developing countries need to strengthen the standards that form the foundation for building systems that monitor pollution, as well as those that ensure the quality, consistency, and

transparency of pollution data. The last of these, transparency, is important for raising awareness and thereby fostering action, not only by governments and polluters, but also by individuals, to push governments to take stronger measures to rein in pollution. It also empowers individuals to adopt adaptive behaviors to mitigate harm, such as avoiding pollution hot spots or using filters to clean their water.

Standards will be central to confronting the twin challenges of meeting the rising demand for energy and reducing local pollution and mitigating emissions. Measures to adapt to climate change, such as greater reliance on air conditioning to cope with extreme heat, will also boost electricity consumption. To curb the growth of demand for energy, developing countries need to use standards across the energy supply and usage chain, for areas ranging from generating power to transmission and distribution lines to the energy efficiency of buildings and household appliances.

Although environmental standards should be embedded within a broader coordinated framework to balance competing objectives, there is a clear tension between a "fit-to-context" approach and justifiable fears of a race to the bottom. Differences in standards across jurisdictions can—and do—lead to pollution leakage, in which polluting activities shift to jurisdictions with weaker standards regarding pollution, thereby undermining environmental goals. Coordinated international efforts, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, that regulate flows of materials like plastics and prohibit trade with countries that are not parties to the convention can mitigate such leakage.

Making it happen: Standards to strengthen governments

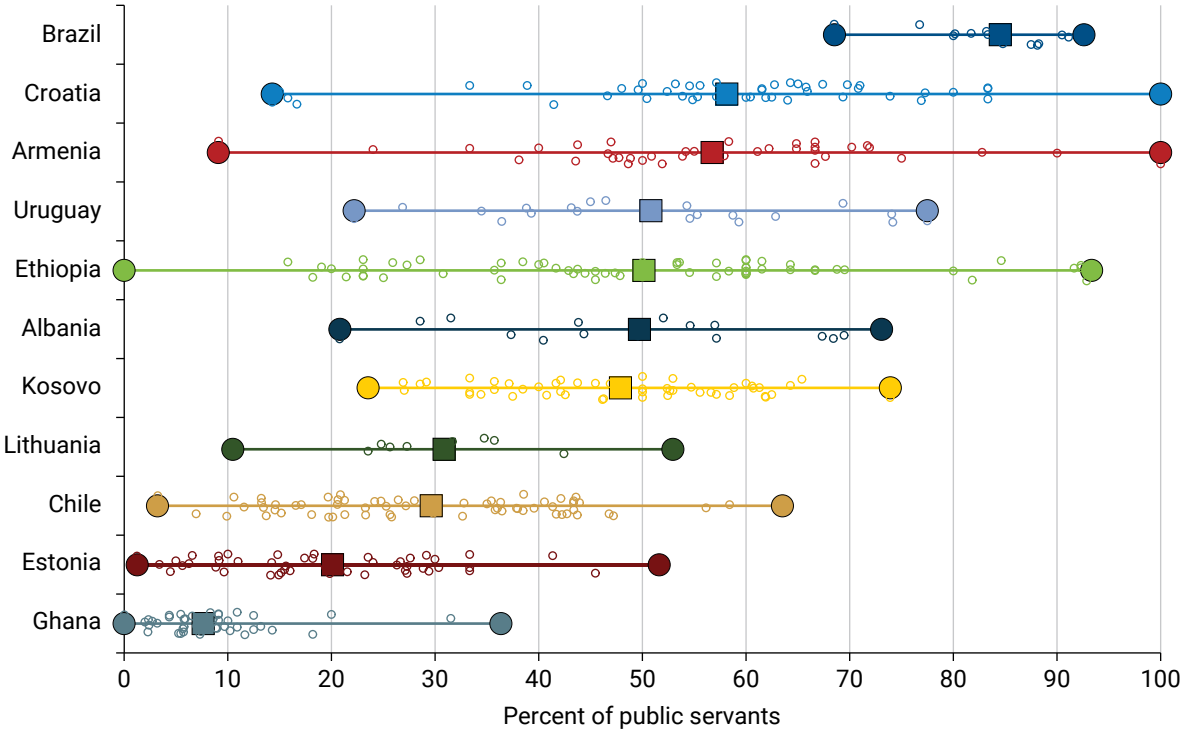
To design standards effectively and ensure compliance, governments must put their own houses in order. They can do so by using standards to strengthen their governance of public institutions responsible for implementing policies.

Standards-based governance ensures that three sets of standards, encompassing organizational functions common to all public institutions, are established according to a government's ability to comply with them. The first set are *budget standards,* which ensure that payments are disbursed on time and consistently measured. The second set are *recruitment standards* that build competency by ensuring personnel are selected through objective assessments (such as written examinations; refer to figure O.7). The third are *procurement standards* that uphold the transparency and competitiveness of government tenders.

Standards-based governance ensures a consistent approach to the classification and measurement of government activities. For instance, budget standards such as the United Nations Classification of Functions of Government set a unified framework for classification and measurement within budgets. *Quality standards* should codify procedural requirements and guidelines for institutions and their personnel to apply in their organizational routines. For example, a procurement standard can specify that government tenders require competitive bidding (that is, an open tender).

Setting and implementing standards for governance comes with a cost, however. For instance, the administrative burden of complying with standards reallocates scarce institutional and personnel time from implementation to compliance. To mitigate operational costs and amplify benefits, governments need to assess the organizational impact of standards regularly and put standards into practice through an iterative approach driven by priorities. This requires collecting and analyzing survey and administrative data on organizational processes, as well as listening to the voices of

Figure O.7 Governments have no standard criteria for recruiting talent



Source: WDR 2025 team calculations, based on data from Global Survey of Public Servants, Data Downloads, Bureaucracy Lab, Development Impact Group and Governance Global Practice, World Bank, https://www.globalsurveyofpublicservants.org/data-downloads.

Note: The figure reports the latest data available by country. Each small hollow circle in the figure represents an organization-level share of respondents in a particular country who were selected through a written examination, whereas the range of each horizontal line indicates the minimum and maximum shares (large bullets) observed in organizations in that country. The blocks represent national average shares at the organizational level.

institutions, public sector employees, and citizens using particular government services. Through this approach, governments should pragmatically put a priority on enacting and practicing standards that work better for the main stakeholders, rather than general "best practices."

Despite the costs, however, governments that adapt governance standards to national needs and resources reap big dividends. For example, the government of Viet Nam adapted International Public Sector Accounting Standards as a tailored national framework, the Viet Nam Public Sector Accounting Standards.[30] Recognizing the significant costs of implementing and the complexity of a full-scale overhaul of the government's accounting system, Viet Nam rolled out the new accounting standards gradually over multiple years and targeted specific aspects, such as assets, using a modular approach. The Public Expenditure and Financial Accountability framework offers an evidence-based assessment that governments can use to understand public financial management; the assessment draws on policy reviews, data analysis, and engagement with government officials.[31] This contextual information enables governments to take a more tailored approach to implementing standards in their governance.

Priorities for policy makers

Historically, given their weak technological capabilities, developing countries have been standard takers rather than participating actively in the development of international standards, in which they have been significantly underrepresented. Whereas low-income countries participate in just 7 percent of all active ISO technical committees, high-income countries participate in 84 percent of them.[32] In other words, most international standards are developed with scarcely any representatives from developing countries at the table. Even more strikingly, developing countries also send far fewer delegates to meetings at which international standards are developed. On average, advanced economies send 525 delegates to ISO meetings per year. Low-income countries send only 9, lower-middle-income countries merely 14, and upper-middle-income countries just 65. It is no wonder that some international standards fail to address the needs of developing countries: These countries have not been effectively involved in their development.

But with massive technological changes underway, developing countries risk being locked into costly or ill-fitting technological trajectories and relegated to reduced policy autonomy if they remain passive adopters of standards created by advanced economies and multinational corporations. These countries must become more active participants in shaping standards relevant to the countries' priorities, including standards for interoperability and compatibility standards in emerging technologies. Such engagement is not just defensive but strategic: It allows developing countries to ensure standards are tailored to local realities, such as connectivity challenges, privacy needs, risk management, and language diversity, while building the capabilities necessary to compete in fast-evolving global value chains.

Priorities for low- and middle-income countries (that other countries may also want to consider)

For standards to be a springboard for development, policy makers in developing countries should follow the adapt–align–author model discussed earlier in this overview. They will need to start by tailoring standards to local realities (the adapt phase), move toward convergence with global standards as capacity grows (the align phase), and ultimately help write them (the author phase). Done well, the adapt–align–author sequence turns standards into market access, investment, and increases in living standards.

Table O.1 summarizes the priorities for developing countries.

Use standards as springboards

Upgrading quality without defaulting to mandatory standards will need to be the starting point in developing countries. Governments will need to embed standards in economic policy so that certification opens doors: to public contracts, export promotion, schemes for supplier development, and cheaper finance. When buyers and financial institutions reward the use of standards, entrepreneurs will aim for the badge on their own. For instance, Japan's diffusion of total quality management owed more to peer learning and procurement signals than to edicts. Further, India's shift from incandescent bulbs to lighting that employs light-emitting diodes succeeded because voluntary standards aligned incentives across the supply chain, with selective certification to help gain consumer trust.

Next, governments in developing countries will need to adapt quality standards to bring them in line with the compliance capacity of stakeholders. Setting the bar too high merely drives firms into the shadows. It is better to publish tiered

Table O.1 Main policy recommendations regarding standards for development

RECOMMENDATIONS FOR LOW- AND MIDDLE-INCOME COUNTRIES (THAT OTHER COUNTRIES MAY ALSO WANT TO CONSIDER)		
Use standards as a springboard for development, not as a straitjacket.	Learn to use the full toolbox of standards for policy, not just the hammer.	Use quality infrastructure to realize the full potential of standards.
Create the conditions needed for firms to upgrade quality; don't enforce such upgrading with mandatory standards. Improve fundamentals (macroeconomic environment, rule of law) in the country to create demand for standards. Integrate standards into broader industrial policies. **Adapt quality standards in line with the capacity of stakeholders to comply with them.** Overly ambitious standards that cannot be met create risks. But if standards need to be adapted to the local context, do so systematically to avoid creating hurdles for that country and others. A tiered approach involving standards with varying degrees of strictness may help with systematic adaptation of standards. **Show up and speak up in international standards forums and share findings at home.** Attend international meetings of organizations such as ISO and the IEC to influence international standards, and use the process as an opportunity for learning. Virtual participation, often now possible, helps reduce travel costs.	**Use standards as a flexible tool in public policy.** Combine voluntary standards and regulation to pursue innovation-friendly policy approaches. **Require all sectoral regulators and other government bodies to use quality infrastructure[a] consistently.** Using uniform approaches to compliance across the government and sharing facilities like testing laboratories save public resources and avoid creating nontariff barriers to trade.	**Sequence the development of quality infrastructure[a] according to market demand and country preferences.** Infrastructure (such as laboratories) can be expensive and should grow together with countries' demands in order to optimize use of quality infrastructure resources. **Develop capacity for compliance as a public-private partnership.** It is often more cost-effective for the government to oversee compliance with standards than to carry out all compliance checks in government facilities. **Focus on the availability of quality infrastructure, not the location.** Not all quality institutions need to be physically located in each country. Share costly laboratory infrastructure with regional partners. **Leverage digital tools for better quality infrastructure.** Low- and middle-income countries can benefit from leveraging digital technologies to make quality infrastructure more accessible and cost-effective.
RECOMMENDATIONS FOR THE GLOBAL COMMUNITY		
Develop international standards that better serve low- and middle-income countries.	Ensure that well-intended standards do not become barriers to development.	Tackle global challenges.
Support low- and middle-income countries in the process of developing international standards—or risk low uptake. Inclusive processes for developing standards should include voices from low- and middle-income countries. Support is needed to make international standards truly international. **Promote tiered standards to match different capacities.** From the design stage, standards should integrate varying capacity levels of countries.	**Deepen international regulatory cooperation.** Regulation grows more complex over time, creating the risk that standards become barriers to trade. Early cooperation on regulations helps prevent this. **Tidy up the "spaghetti bowl" of standards.** Even if standards are voluntary, fragmentation (multiple standards for the same product or service) has become a problem in some areas. Consolidating by building trust and mutual recognition is key. **Amass more data and evidence.** Standards are an underappreciated and underresearched topic. More data and evidence are important to inform regulatory impact assessments and guide policy makers.	**Set and comply with standards now—or face crises later.** The risks of unchecked technological progress like artificial intelligence and environmental degradation grow exponentially, outweighing the benefits. Standards are essential to align technological development with societal preferences.

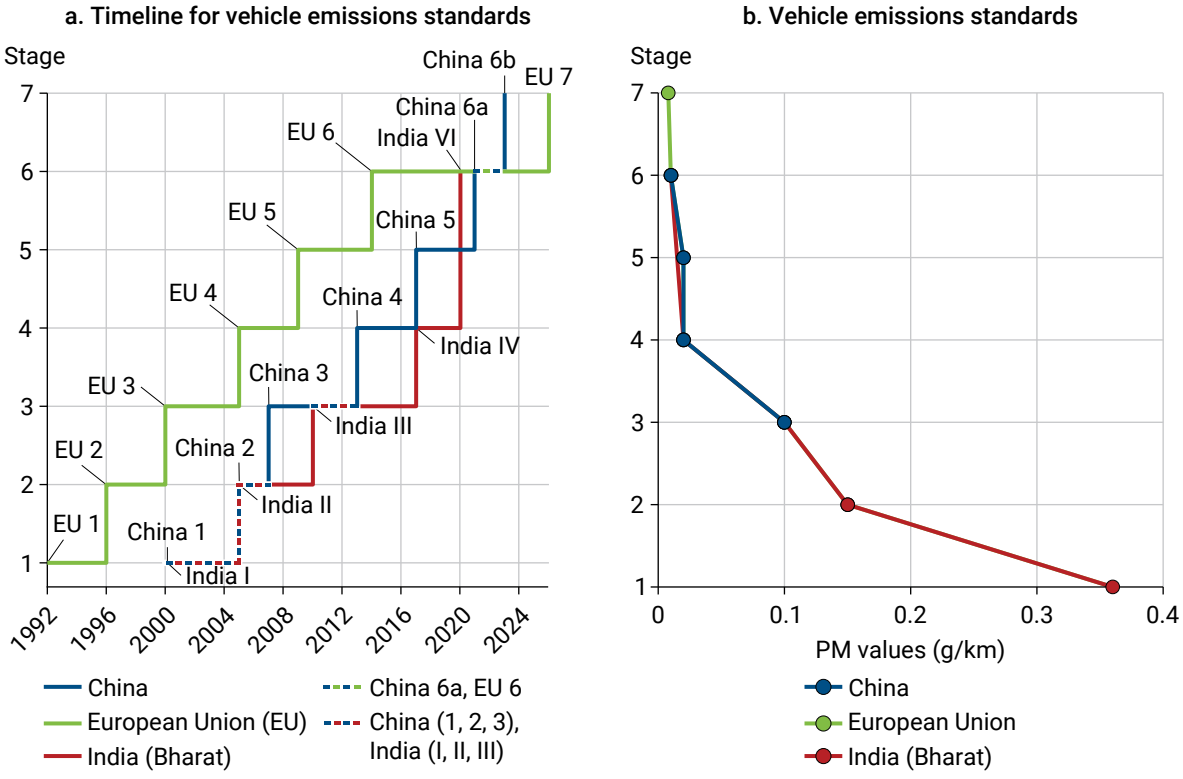
Source: WDR 2025 team.

Note: IEC = International Electrotechnical Commission; ISO = International Organization for Standardization.

a. "Quality infrastructure" refers to a system of public and private organizations and policies that provide services such as testing, inspection, certification, metrology, accreditation, and standardization.

requirements, pursue performance-based criteria for evaluating compliance, and allow generous transition periods that map an escalator from today's abilities to tomorrow's ambitions. For instance, in countries like Kenya, there have been efforts to provide simplified requirements for GLOBALG.A.P. that let smallholders use good agricultural practices that actually stick, while keeping in sight the target of producing commodities of sufficient quality for export.[33] Large economies have long since mastered the art of sequencing: Think of how China, India, and the EU ratcheted up rules governing vehicle emissions over time, letting industry invest and regulators sharpen their teeth (refer to figure O.8). The message: Calibrate, then climb.

Figure O.8 Standards governing vehicle emissions and air pollution in China, India, and the European Union followed a tiered approach to stringency



Sources: China: Emission Standards, China: Heavy-Duty Engines (dashboard), DieselNet, https://dieselnet.com/standards/cn/hd.php; ICCT 2017. European Union: Emission Standards, EU: Heavy-Duty Truck and Bus Engines (dashboard), DieselNet, https://dieselnet.com/standards/eu/hd.php. India (Bharat): Emission Standards, India: Heavy-Duty Truck and Bus Engines (dashboard), DieselNet, https://dieselnet.com/standards/in/hd.php; data as of September 7, 2017, from Vehicular Exhaust (web page), Central Pollution Control Board, Ministry of Environment, Forest and Climate Change, India, https://cpcb.nic.in/vehicular-exhaust/.

Note: The emissions standards in the figure are those for heavy-duty vehicles (those with compression ignition engines) for steady-state testing. EU = European Union; g/km = grams per kilometer; PM = particulate matter.

Standards need to be adapted to local circumstances especially in the case of nontradable services like education, health, and public administration. Simply importing high standards can lead to *isomorphic mimicry*, in which countries set high standards without expecting to enforce them. Standards far above what local administrative systems can implement create "premature load bearing": overly optimistic assumptions about progress and increasing capability that place excessive stress on systems and cause them to weaken or even collapse.[34]

Developing countries should consider operating a dual regime to serve both exporters (by offering them assistance in meeting international standards) and domestic consumers (by adapting those standards for domestic markets). For exporting sectors, full compliance with (unadapted) international standards is critical for competing in export markets, as is expanding access to accredited testing and certification. Most domestic firms in developing countries, by contrast, are very small and serve consumers who are highly sensitive to prices and thus put a priority on affordability over quality. These firms need adapted, graduated requirements to avoid being excluded. Policies that help firms grow are likely the best way to enable them to cover the fixed costs of adopting standards. Korea's early schemes for inspecting exports, used judiciously to protect brand reputation, and South Africa's decisive ban on 2G phones to accelerate adoption of mobile internet show how dual tracks can be calibrated.

Developing countries will also need to show up and speak up in meetings in which international standards are developed—and bring the learning home. For countries that trade, the rules of the game are increasingly written not just in ISO, IEC, and ITU committee rooms, but in other global standards development organizations like the Internet Engineering Task Force (IETF, internet), 3GPP (mobile communications), Institute of Electrical and Electronics Engineers (IEEE, multiple technical domains), and SAE International (aerospace).[35] Developing countries will need to pick the committees that matter for prominent sectors in their economies—say, those involved in developing standards for off-grid renewable energy systems, food safety, or digital technology—and fund expert participation in them. They will also need to mirror these committees in national organizations to help translate the deliberations of these committees into domestic guidance and curriculums.

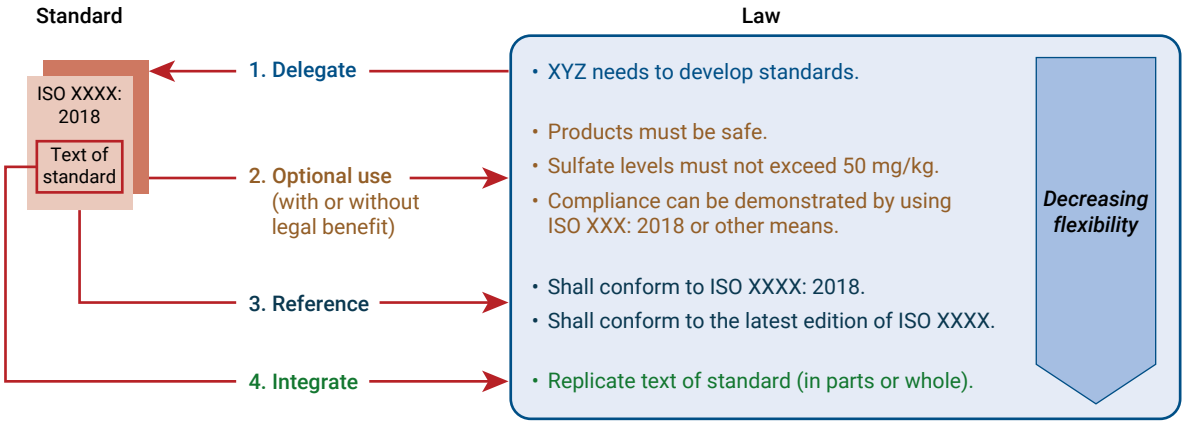
China's reforms of its standards during the country's post-1978 reform era, which shifted standards from a basis in bureaucratic fiat to a regime more driven by the market while leaning into international forums, show how active engagement shapes both domestic modernization and the global rule book. Influence travels with attendance, and so does know-how.

For standards to truly work as springboards for development, governments need to use mandatory standards sparingly, in instances in which risk is clear and enforcement credible. Essential public interests such as health, safety, and air or water quality are obvious examples. However, before mandating, countries need to be self-disciplined and ask: Is there a material risk or market failure, are benefits likely to exceed costs, and can the requirements be enforced? And importantly: Can voluntary standards and regulation be combined in a mixed approach that fosters innovation while achieving the objectives of public policy?

Use the full toolbox of standards, not just the hammer

Policy makers in developing countries will need to combine regulation with voluntary standards, because regulation cannot and should not specify every technical detail involved in compliance. Doing so would create compliance burdens, overwhelm government capacity and technical expertise, and make regulations too rigid to allow for innovation.

Figure O.9 Standards can be used in regulation in a variety of ways



Source: WDR 2025 team.

Note: ISO = International Organization for Standardization; mg/kg = milligrams per kilogram.

Laws should be written for outcomes that society cares about: product safety, privacy, and energy efficiency, for example. Standards should define technical details regarding how to achieve these outcomes (refer to figure O.9). This enables countries to keep policy current as technology changes and allows fast-track updates to referenced standards without excessive legislative churn.

The EU has long practiced this art: Firms in EU member countries can meet "essential requirements" using harmonized standards or evidence of equivalence. The EU's regime regarding AI takes the same tack, making risk management mandatory for high-risk systems while leaving technical specifics to voluntary standards. For developing countries, this approach trims administrative burdens and keeps domestic rules aligned with those for global markets, but it requires increases in government capacity for things such as market oversight and enforcement.

The use of quality infrastructure consistently by all regulators will cut costs. Policies committing sectoral regulators to accept results from accredited laboratories and inspection and certification bodies are of particular importance. Agencies can share costly facilities—general testing laboratories and metrology equipment, for example—through service-level agreements rather than duplicating capacity. This averts the creation of a spaghetti bowl of duplicative checks that drive up compliance costs and act like a hidden nontariff barrier.

Private standards and third-party assurance of conformity should be leveraged where they help meet public goals. Governments should recognize (indeed, encourage) private initiatives for quality assurance, subject to transparency and oversight, and let accredited third-party assessment of conformity extend the reach of thin inspectorates. The United Kingdom's "earned recognition" approach—reducing inspection burdens for operators achieving certain certifications—demonstrates how public authorities can focus scarce resources on actors that present higher levels of risk while maintaining adequate levels of protection. The key is to anchor recognition in accreditation and publish performance data so that competition and trust reinforce one another.

Although governments with sufficient capacity can enforce compliance with safety standards, in many cases, developing countries do not have such robust enforcement capacity. When this is the case, private instruments like insurance might be feasible alternatives, as demonstrated by the history of standards regarding boiler safety.[36]

The toolbox of standards can be applied to fast-moving digital technologies in such a way that only high-risk applications of these technologies face mandatory standards, whereas lower-risk uses rely on voluntary standards, documentation, and postmarket surveillance. Developing countries can adopt relevant standards for a specific technology and build pathways for conformity—testing protocols, audit criteria, templates for technical documentation—so that innovators know how to comply with the standards. Regulatory sandboxes—in which regulatory requirements are relaxed to enable learning regarding policies—tied to programs of work in areas of standardization should be developed to ensure that lessons from pilot programs flow back into clearer guidance and better standards.

The enormous potential of digital technologies for transforming development rests on digital public infrastructure, the shared and extensive digital systems and platforms that enable essential services to be delivered on a large scale.[37] It is important that the core layers of digital public infrastructure be built on open standards (that is, standards that are generally accessible to all potential adopters without restrictions on use) as opposed to closed standards (that is, standards under the control of a single firm or consortium, which may impose licensing fees or constraints on their use) to avoid locking countries into a single vendor or development trajectory. A number of governments, including those in Brazil, India, and South Africa, have adopted policies requiring open standards for digital public infrastructure.[38]

At the same time, governments need to recognize that in certain technology domains, the most advanced standards may involve some patented technology. In these domains, a hybrid approach based on principles is the most pragmatic: Use open standards wherever possible, particularly in regard to interfaces, but consider adopting proprietary technology if it serves the public interest and does not undermine the overall openness of a system.

Build compliance capacity with quality infrastructure

Quality infrastructure needs to be matched with demand for it, not desire for it. Policy makers should start with the essentials: a capable national standards body; basic metrology; and practical access to testing, inspection, certification, and accreditation (on a regional basis, if need be). Specialized laboratories can be added when markets justify them, with equipment for cross-sector use the highest priority. Models for recovering costs and e-metrics for service quality should be developed from the inception of quality infrastructure in a country, so that institutions are rewarded for delivery, not just buildings. Regional mutual recognition arrangements and centers of excellence can give firms credible test results without every country buying the same expensive machines and then finding they lack the human capital to operate them.

Next, compliance capacity should be developed as a public-private partnership and evolve as markets mature. When private providers are thin on the ground, the state may need to fill gaps, carefully separating the roles of regulator and service provider to avoid conflicts. For instance, Codex offers guidance on overseeing such systems in food safety.

The focus should be on the availability of services, not the postal codes where they are located. What firms need is timely, credible results, whether from a laboratory downtown or one across the border in the next country. Policy makers should lean on international and regional arrangements for accreditation, so that buyers accept test reports where products are sold regardless of where they are made, and access needs to be negotiated with regional laboratories for pricey, specialized tests. Logistics in shipping and customs clearance need

to be streamlined so that turnaround times are predictable. Africa's push for harmonized technical regulatory frameworks points to the gains from regional thinking along these lines. Building regional quality infrastructure will anchor it in more robust foundations. And as the EU's embrace of USB-C plugs has shown, alignment and recognition of standards often matter more than duplicating infrastructure at home.

Finally, countries should broaden their enforcement tool kits beyond inspectors. Insurance and tort law can complement state enforcement of safety, and universities and professional societies can help keep standards current and relevant. Consumer protection groups can act as public watchdogs, running comparative tests that keep producers honest and consumers informed. In settings in which capacity is thin, such pluralism is not a luxury: It is how credibility scales faster than the civil service can.

How the global community can help

Develop international standards that better serve developing countries

The first responsibility for developed countries is to open up and actively support the participation of developing countries in developing international standards. As discussed earlier in this overview, representation in international standards development organizations is structurally imbalanced: High-income economies and China sit on far more technical committees and send many more delegates to the meetings of these organizations, so the standards coming out of these committees often miss the realities in lower-capacity settings. This is understandable at one level, given the deeper pools of expertise in more developed countries. Advanced economies should provide funding, mentorship, and technical assistance to ensure experts from developing countries are at the table, both to improve the quality and legitimacy of standards and to increase uptake of them. This is an act not of charity, but of pragmatism: Standards that are cocreated are more likely to be implemented consistently across markets, reducing frictions and enhancing global interoperability.

A second, design-centered role for developed countries is to promote tiered or modular standards that match the different capacity levels of countries and firms. By embedding graduated stringency in the standards they develop, international standards development organizations can enable gradual adoption and upgrading without disrupting trade. Designs that follow such a development model recognize heterogeneous regulatory and firm capabilities and create clear pathways for convergence with international standards over time.

Deepen international cooperation regarding mandatory standards

A key area for global focus is deepening international cooperation so that well-intended mandatory standards built into regulation in advanced economies do not hinder development elsewhere. As regulation becomes more complex—across climate, deforestation-free supply chains, digital markets, and product safety—the risk of conflicting requirements from one country to the next increases. Early coordination on common terminology, baseline principles, and mutual recognition of compliance mechanisms can prevent standards from turning into de facto trade barriers. Building trust is central here, as mutual recognition depends on confidence in other countries' systems for assessing conformity.

The global community also needs to move faster to agree upon and implement credible standards that mitigate global technological risks. In areas like AI, biotechnology, and digital platforms, innovation outpaces governance, shifting externalities from new technologies onto societies

and ecosystems. Unilateral action is insufficient to address global technological risks and can fuel a race to the bottom; collective agreement on guardrails is required to align technological development with societal preferences and to avoid crises that are far costlier to manage after they have already occurred than when they are merely risks.

Standards remain underappreciated and underresearched, partly because they take many forms and act alongside other policies. The global community, including international organizations, standards development bodies, and academia, should invest in better data regarding standards: firm-level surveys that capture uptake across sectors and firm types, richer metrics regarding quality infrastructure, and accessible administrative data sets. The stronger evidence base that results from these additional data will help refine tiered designs for standards and evaluate what models of cooperation prevent fragmentation most effectively.

Although developed countries should do more to share the table and redesign the tools, the global community needs to strengthen the overall framework—cooperating early, governing emerging risks credibly, and building the evidence needed to make standards a true instrument of rapid economic development.

The paradoxical landscape of global standards

The global standards landscape is full of paradoxes. On the one hand, standards are proliferating—especially across environment, social, and governance domains—spanning measures as well as international rankings, ratings, and indexes.[39] Although many standards in these domains are formally voluntary, they have become de facto mandatory, and compliance with them imposes heavy demands on developing countries given their current capacities.

On the other hand, emerging, transformative technologies have few guardrails in the form of international standards. Despite their potentially grave implications for human safety and well-being, intense geopolitical rivalries have precluded prompt establishment of the necessary safeguards in these areas. When a bag of chips has about as many international standards as AI, which can upend the lives of billions, it is a sober reminder that the global community is "pitying the plumage but forgetting the dying bird."[40]

Amid the strong gusts of the winds of global disorder and societal distrust, standards offer a safe harbor, anchoring order and trust. Without them the task of development becomes much more arduous.

Epilogue: Standards in development economics

World Development Report 2025 has been written by a team of development economists. In concluding this overview, the team looked within standards in the development economics profession.

A striking finding in recent research is the severe underrepresentation of developing countries in development economics, with the severity increasing for journals with higher ratings in academic quality or prestige: the ones that really matter for recognition within the field. According to one study, "Fields such as international or development economics where global diversification may have been expected have not experienced much increase in developing country authorship. These results are consistent with a general increase in the relative supply of research in the rest of the world. But they also indicate authors from developing countries remain excluded from the profession's top-rated journals."[41]

Is this because these journals have high standards for publication of studies and researchers from developing countries are unable to clear the bar?

If so, this may reflect a lack of talent and expertise or point to resource constraints. For instance, if the journals' standards favor a certain type of methodology that requires a great deal of resources, such as randomized controlled trials, then the substantial costs of conducting research that employs such methodology might be a formidable entry barrier for researchers working on economic development who are based in developing countries.

However, in science, technology, engineering, and mathematics, in contrast to economics, the share of articles from developing countries in leading journals has been steadily increasing, with the surge led primarily by China, but also India and several other countries.[42] High standards in academic publications alone would not explain these contradictory trends. A more likely explanation is that compared with publication in scientific fields, publication in top social science journals is a more discretionary process in which the tastes of the editors and those reviewing potential articles matters more. In other words, it is less about meeting standards than about the ambiguity of the standards themselves. Standards, as defined by this *World Development Report*, need to be precise. Enormous efforts are made in the process for developing standards to achieve this goal.

The absence of precision in standards can have exclusionary consequences. Because publication in top journals is the entry ticket to highly sought-after clubs in the field of development economics, the absence in these journals of articles by researchers based in developing countries means those researchers are absent from these clubs as well. Take the Bureau for Research and Economic Analysis of Development (BREAD), which is dedicated to encouraging research and scholarship in development economics. Despite its goal, less than 2 percent of its affiliated fellows are based outside Europe and the United States. Less than 5 percent of the academic faculty members affiliated with the Abdul Latif Jameel Poverty Action Lab (J-PAL), the most influential global center for research employing randomized controlled trials, were based in developing countries, even though all the data used in their work are gathered there, with no representation from institutions in East Asia, the most successful region in regard to economic development. Just 6 percent of the 98 editorial board members of the *Journal of Development Economics* (whose title clearly states its objectives) are based in developing countries (and none in Africa).

This matters for development, as the views and voices of development scholars from emerging market and developing economies are not shaping global debates on development policy and perhaps even important questions specific to circumstances in their own countries. The development challenge is most pressing in Africa, making the exclusion of Africa-based voices even more glaring.

Notes

1. Bernhofen et al. (2016).
2. *Economist* (2013).
3. Kapur and Subramanian (2025).
4. Alder (1995).
5. Feiker (1922); Hoover (1922); Priest (1926).
6. Dunlavy (2025).
7. World Bank (2024b).
8. Choi and de Vries (2013); Lee and Kim (2025).
9. Choi and Choi (2019).
10. Refer to IEC: International Electrotechnical Commission (dashboard), https://iec.ch/homepage; oneM2M [one Machine to Machine]: The IOT Standard (dashboard), oneM2M Partners, https://www.onem2m.org/; 3GPP [3rd Generation Partnership Project] (dashboard), 3GPP Mobile Competence Center, European Telecommunications Standards Institute, https://www.3gpp.org/. oneM2M is a global partnership initiative among eight of the world's leading standards development organizations for developing specifications that ensure the most efficient deployment of machine-to-machine communication systems and the Internet of Things.
11. Lee and Lim (2001).
12. As defined in ISO and IEC (2020).
13. For the definition, refer to BIPM (2021, 7).

14. World Bank (2024b).
15. Based on data from Global Essential Medicines Database (data set), https://figshare.com/articles/dataset/GlobalEssentialMedicinesDatabase_xlsx/7814246?file=14541080; Persaud et al. (2019).
16. Fu (2025); Yiwen (2017).
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19. Tinsley and Agapitova (2018).
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21. Luna-Bazaldua et al. (2025).
22. Costanza et al. (1990).
23. Reinhart and Rogoff (2009).
24. Refer to World Bank (2023) for information about a World Bank survey of documentation requirements among financial authorities around the world.
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26. Isen et al. (2017).
27. Damania et al. (2025).
28. Hasenkopf et al. (2023).
29. UNEP (2021).
30. World Bank (2024a).
31. Many assessments using the Public Expenditure and Financial Accountability framework are publicly available. For more information, refer to PEFA [Public Expenditure and Financial Accountability], Assessments, World Bank, https://www.pefa.org/assessments.
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33. Park and Gachukia (2021).
34. Pritchett et al. (2012).
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36. Fressoz (2025).
37. Sankritik and Shetty (2025); World Bank (2016).
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Contents of the *World Development Report 2025: Standards for Development*

Standards make everyday life run smoothly. You rarely notice them: the credit card that works in any corner of the world, the Wi-Fi signal that connects a remote village to the cloud, or the vaccine vial that fits syringes from Dakar to Delhi. When standards work, they build trust. They free people and firms to focus on creating, trading, and innovating, confident that the systems around them will hold. When standards fail, the effects are immediate and draining. Payments are declined, signals drop, vaccines spoil—and instead of being productive, people spend their energy just meeting their basic needs.

Standards, in short, are the hidden infrastructure of modern economies—and they have never been more important. Developing countries today must contend with a thicket of increasingly stringent international standards, a product of globalization and rapid technological change. Using standards—and shaping them—is now a prerequisite for export growth, technology diffusion, and the efficient delivery of public services. Yet standards are too often overlooked by policy makers, especially in developing countries.

World Development Report 2025: Standards for Development provides the most comprehensive assessment of the global landscape of standards today and how they can be used to accelerate economic development. It offers a practical framework for countries at all stages of development. Countries at the earliest stage should *adapt* international standards to suit local conditions when needed, whereas at more advanced stages, they should aim to *align* domestic markets with international standards. Meanwhile, all countries should *author* international standards in priority areas.

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