PART 4

Making Standards a Springboard for Development, Rather Than a Straitjacket

Standards have never mattered more than they do today. However, they are often underappreciated or misunderstood, and sometimes they do more harm than good. Overly prescriptive mandatory standards can stifle innovation or be used to favor politically connected firms. Chapter 8 provides a set of recommendations for how policy makers in low- and middle-income countries—and elsewhere—can use standards most effectively for development.

But standards are not merely technical instruments to be applied correctly. They are also the result of power and influence, steering the direction of technological change. The global community thus faces a dual challenge. In some areas, there is *too much* standardization, resulting in a "spaghetti bowl" of standards or international standards that do not reflect the realities in low- and middle-income countries. But in other areas, there is *too little* standardization, indicating that the global community has failed to manage the worsening risks of emerging technologies and the drivers of planetary crises such as climate change and loss of biodiversity. The absence of crucial standards is often a result of corporate influence or geopolitical competition. This Report takes a renewed look at who sets what standards and who blocks them.

Policy makers in low- and middle-income countries should be sure to use *standards as a springboard for development, not a straitjacket.* This requires a clear understanding of when voluntary standards suffice and when mandatory standards are needed. In most cases, governments should allow markets to shape voluntary standards, as this benefits innovation and knowledge diffusion. Mandatory standards should be used only with respect to critical public interests such as health, safety, environmental protection, and the prevention of deceptive trade practices. Such standards are particularly useful in situations in which the benefits of prevention outweigh the costs of future damage, especially those in which potential harm, if realized, is irreversible. As this Report emphasizes, voluntary and mandatory standards form a spectrum, and combining voluntary standards with regulation often renders the best results. The Report also stresses that policy makers in low- and middle-income countries need to recognize the benefits of participating in the process of developing international standards and participate more actively in such development.

Regarding the global community, chapter 8 argues that more effort is needed to ensure that international standards align with the realities in low- and middle-income countries from the beginning of the development process. This goal can be accomplished by increasing the representation of low- and middle-income countries in the standards development process; making stronger efforts to reduce the fragmentation of standards, including by enhancing international regulatory cooperation to prevent enactment of nontariff barriers; and changing how the global community views standards in light of the growing list of global challenges, including technological risks.

8 Using Standards to Shape Development and Manage Global Challenges

Main messages

- Standards have never mattered more than they do today. For both policy makers in low- and middle-income and those in high-income countries, the ability to navigate the complex world of standards and to use them effectively has become indispensable (refer to table 8.1).
- For standards to be a springboard, not a straitjacket, policy makers in low- and middle-income countries and beyond should do the following:
  - Create favorable conditions for firms to upgrade the quality of the goods and services they provide, rather than using mandatory standards to enforce quality improvements.
  - Adapt quality standards to the ability of stakeholders to meet them and, for mandatory standards, the government's capacity to enforce them.
  - Show up and speak up in international forums for developing standards.
  - Use national quality infrastructure to realize the full potential of standards.
- To ensure that international standards work for low- and middle-income countries, the global community should take these actions:
  - Support low- and middle-income countries' participation in the process of developing international standards.
  - Promote tiered standards to match different levels of capacity to meet them.
  - Deepen international cooperation to ensure that well-intended standards do not hinder development.
- To meet the growing challenge of global risks such as artificial intelligence and environmental degradation, global action is needed to accomplish two things in particular:
  - Agree upon and implement credible standards that prevent harm.
  - Expand research and amass evidence on standards for development.

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Table 8.1 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 like testing, inspection, certification, metrology, accreditation, and standardization.

Too much? Too little? Just right?

This Report may seem contradictory at times. It tells the story of *too much* standardization: the "spaghetti bowl" of standards that act as gatekeepers to international markets. Geopolitical rivalry deepens the fragmentation that arises, be it in regard to chargers for electric vehicles, data privacy, or mandatory standards for banking. The result is that low- and middle-income countries face a growing number of more demanding requirements, from measuring pesticide residues on fruit down to the last microgram to ensuring the exact color of dyed fabrics—challenges that advanced economies did not face at similar levels of development.

It also tells a story of *too little* standardization in which the global community has failed to effectively manage the risks of technological development, be it in the realm of artificial intelligence (AI), of social media, or of the drivers of planetary crisis. This is a story of coordination failures and corporate influence that keep the world from developing and implementing credible standards to keep pace with innovation and shape it in line with societal preferences. Doing the latter has become increasingly urgent as technological and planetary risks multiply: A lack of effective standards threatens the very livability of the planet.

And then it tells a story of *just right* standardization. The global economy increasingly resembles a complex machine of interconnected technologies, people, firms, and countries. Having many standards is not a bug but a feature that keeps this complex system running. In fact, when coordination aligns with commercial incentives, actors in markets organize themselves to develop the standards they need. In such cases, standards function not as gatekeepers, but as bridges that lower transaction costs and foster diffusion.

No matter whether standards are too many, too few, or just right, they probably have never mattered more than they do today. And yet they have long been a misunderstood and underappreciated tool in development, often a technical afterthought. But for policy makers in low- and middle-income countries, the ability to navigate the complex world of standards and to use them effectively has become indispensable. Standards are reshaping the competitive landscape, and complying with them is essential for economic growth and job creation. The diffusion of international standards promises to raise the quality of products and services and enhance the welfare of countries and their citizens, building on the distilled expertise of leading specialists from around the world. And applying standards properly can significantly advance good governance and increase the cost-effectiveness of government policies.

This chapter outlines recommendations for policy makers in low- and middle-income countries as to how they can use standards for development. Most of these recommendations apply to all countries, but there are nuances depending on countries' income levels. Low-income countries should emphasize building their capacity for complying with standards and enabling firms to upgrade the quality of the goods and services they produce—for example, by attracting foreign investors and encouraging spillovers of technology from multinational enterprises to domestic firms. These countries should also make it a priority to work with international partners to build basic institutions for quality, such as standards and metrology bodies, which enable other quality assurance services to develop over time. Low-income countries face the greatest need to maintain a dual regime in which they may adapt international standards when developing domestic regulations but ensure that exporting firms meet the (unadapted) international standards and provide those firms with assistance to enable them to do so. Those countries will need to be more selective regarding their participation in development of international standards, leveraging regional and international partners to strengthen their voices on the global stage.

Lower-middle-income countries should enhance their capacity for compliance with standards by building smarter public-private partnerships, especially in the area of quality assurance, such as testing and certification. Aligning domestic rules with international standards can increase safety, environmental protection, and market access. Lower-middle-income countries will also benefit from streamlining regulations across the government and from a more active private sector that can shape standards and lead in developing international standards, often in partnership with other countries.

Upper-middle-income countries should focus on adopting a more agile, innovation-friendly regulatory approach using voluntary standards to address technical gaps.[1] Increasing public-private collaboration for quality assurance can help these countries achieve policy objectives more cost-effectively. Upper-middle-income countries should also build expertise in institutions like metrology and accreditation to support more advanced industries, such as nanomaterials. These countries should also mobilize the private sector to lead standards development internationally.

There is urgency and opportunity for the global community to take standards more seriously to ensure they advance rather than hinder development. Moreover, the global community is facing a growing set of formidable risks—from AI to climate change and biodiversity loss—that standards can play an important role in mitigating or managing. History shows that standards sometimes arrive only after serious harm has occurred: a risky path given the scale of today's technological and planetary challenges. Chapters 4–7, on the economy, human capital, the environment, and governance, respectively, provide specific recommendations. Although the recommendations in this chapter are mainly addressed to policy makers, the private sector is also encouraged to take action, as outlined in box 8.1.

Box 8.1 Recommendations for the private sector

This Report highlights that the private sector develops the majority of voluntary standards to address market or societal needs. At the same time, the private sector also faces the strongest pressure from both markets and regulators to comply with these standards. Although this box does not attempt to be exhaustive, it outlines key recommendations that private sector leaders, particularly in low- and middle-income countries, should consider.

Use standards to improve firms' operations, not just to comply with regulations

Voluntary standards help firms avoid reinventing the wheel and improve collaboration with business partners. The well-known standard for quality management systems, International Organization for Standardization (ISO) 9001, is only one of many that enhance operational efficiency and product quality. Firms should use standards strategically for continuous improvement rather than viewing them merely as tools governments use to compel compliance. This is especially relevant given the digital and green transitions, which require firms to fundamentally adapt business models, processes, and products to evolving expectations.

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Box 8.1 Recommendations for the private sector *(continued)*

Engage in standards development—at national, regional, or international levels (or all three)

Participating in standards development provides opportunities for learning, networking, and shaping markets. In addition to engaging in the work of formal standards bodies at national, regional, or international levels, firms can also benefit from participating in initiatives involving voluntary standards for sustainability and the multistakeholder platforms they provide. Active engagement helps ensure that standards reflect local realities and strengthens firms' competitiveness by improving market access, strengthening their reputation, and coordinating with business partners.

Invest in capabilities for performing due diligence that are compatible with leading standards for sustainability

International buyers and regulators increasingly expect suppliers to demonstrate they have exercised social and environmental due diligence across their supply chains. Even in instances in which this is not yet mandatory, investing in such capabilities today can enhance competitiveness and market access. Aligning internal practices with recognized standards for sustainability provides a practical road map for meeting future regulatory and market requirements.

Select credible and trusted standards and certification schemes

Firms can't always select which standards or certification schemes to follow, as markets or regulations often shape these. When a choice is available, however, firms should put a priority on selecting credible standards and certifications that are transparent, independently verified, and aligned with international principles. Such a strategy boosts firms' recognition in export markets and ensures that their investments in certification bring genuine reputational and commercial advantages. When employing quality infrastructure services, firms should depend on accredited providers and confirm the validity of certifications they rely on.

Partner with peers and government to strengthen quality infrastructure

Well-functioning quality infrastructure not only supports compliance with standards but also promotes innovation and learning, through such things as product testing and calibration. Because many quality infrastructure needs go beyond the capacities of individual firms, collaboration among businesses, industry associations, and government agencies is crucial. Firms can help by sharing their specific quality assurance needs, co-investing in shared facilities, and supporting the digitalization of quality infrastructure services.

Source: WDR 2025 team.

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

Most standards are voluntary, and most voluntary standards are private, aiming for quality, compatibility, and reduced transaction costs. In most economic sectors, the private sector will therefore develop standards to address a given need. Governments should let market forces determine voluntary standards unless the process of developing standards suffers from issues related to collective action, inclusion, fragmentation, competition, or safety. Governments should use mandatory standards only to address essential public interests such as health, safety, environmental protection, and the prevention of deceptive trade practices.

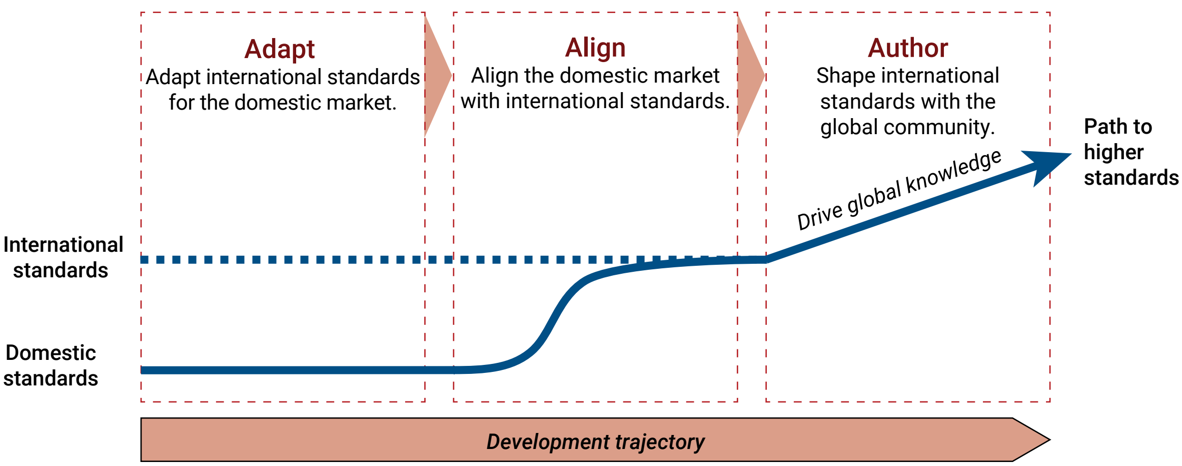
Use standards as a springboard for development, not as a straitjacket

This Report's adapt–align–author framework (discussed in chapter 2 and summarized in figure 8.1) implies that low- and middle-income countries may need to follow a dual-regime approach: in the case of exports, complying with standards for the international market that cannot be changed, but adapting other mandatory standards for the domestic market to local needs (refer to box 8.2). For example, garment exporters often have no choice but to accept the standards regarding sustainability that international fashion brands demand. But mandating that all domestic producers comply with international standards as a shortcut to upgrading quality could be counterproductive. It would overstretch government capacity for enforcing the standards, introduce costs associated with compliance that may exclude informal and smaller firms from the domestic market, and divert attention and resources from building the supportive system needed to meet international standards.

Create the conditions needed for firms to upgrade quality; don't enforce such upgrading with mandatory standards

Rather than relying on mandatory standards to enforce improvements in the quality of the goods and services firms provide, policy makers should focus on creating conditions favorable to firms' upgrading quality by ensuring access to production inputs, enhancing education in

Figure 8.1 Setting standards along the development trajectory



Source: WDR 2025 team.

their countries and the skills of their workforces, promoting competition, and increasing access to finance—along with providing incentives for the adoption of voluntary standards and promoting a quality culture among consumers. Spotlight 1 discusses lessons from Japan's experience, and chapter 3 discusses how national standards bodies can promote voluntary standards rather than act as regulators.

Similarly, international experience shows that a country's demand for standards arises not only from promoting standards, but also from a range of other development policies. Standards achieve limited results when a country's macroeconomic environment is weak and when violence and disorder are widespread. If such issues discourage investment and firm growth, why should companies adopt standards and invest in upgrades? The cases of China, Japan, and the Republic of Korea demonstrate how standards can be effective when integrated into broader industrial policies. Additionally, public awareness and citizen pressure often drive stronger environmental standards and enforcement of those standards. For example, in countries with limited infrastructure for monitoring air pollution, US embassies have publicized data on air pollution, prompting people in those countries to demand greater oversight and regulatory action (refer to chapter 6).

Box 8.2 When to use voluntary standards and when to use mandatory ones

A decision tree can help policy makers determine whether and how governments should get involved in developing voluntary standards (refer to figure B8.2.1). First, if collective action by private parties fails and no individual stakeholder has an incentive to develop a standard—despite its being better for everyone—there may be a need for government involvement. However, the government should only convene or coordinate stakeholders—possibly by funding national standards bodies—without prescribing the technical content of voluntary standards. Second, if a lack of stakeholder involvement (such as among disadvantaged groups in the population) threatens the legitimacy and effectiveness of standards, the government might need to become more involved. Third, if fragmentation of standards poses a problem, governments can unify different national standards development organizations under one umbrella or pursue other methods to reduce fragmentation, like fostering mutual recognition arrangements. Finally, government action may be necessary to prevent risks to competition associated with standards, for instance, if dominant market players use proprietary standards to restrict market entry.

Policy makers can identify whether and how governments should use mandatory standards (refer to figure B8.2.2). They need to determine whether there is a need to regulate, for example, to address market failures. If not, market-driven voluntary standards may be sufficient. Next, they need to assess whether mandatory standards are the best policy instrument for addressing the need by, for example, conducting regulatory impact assessments.

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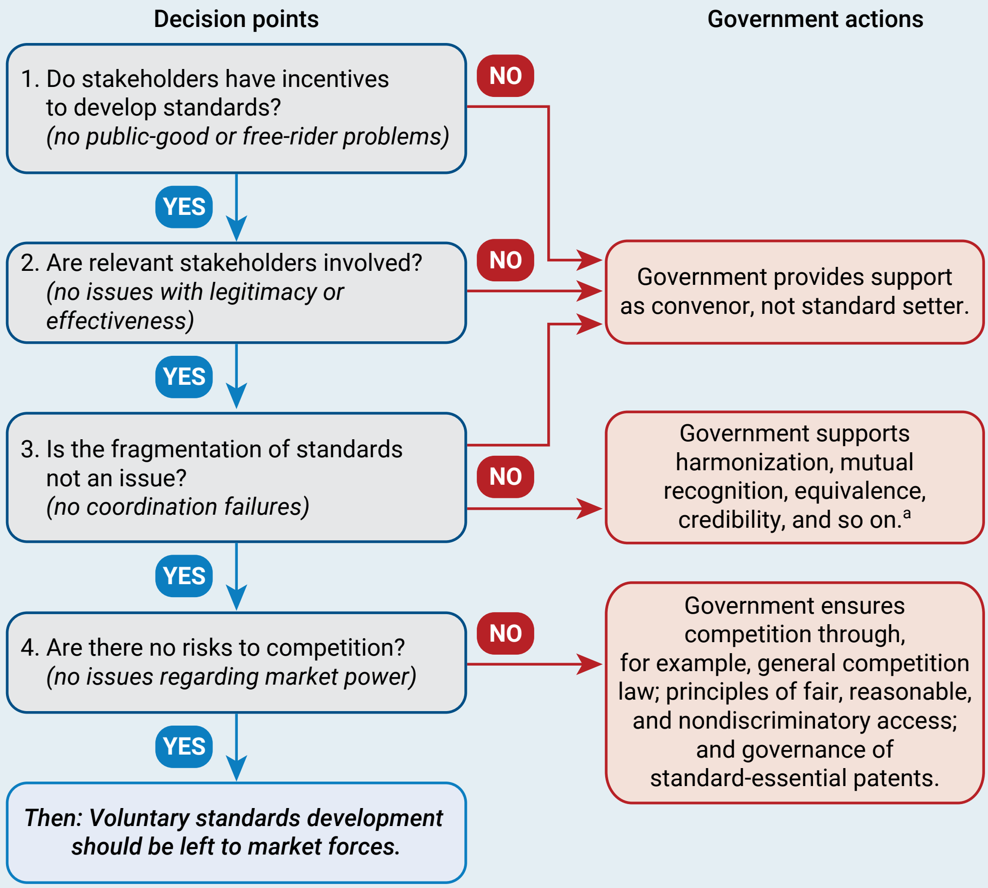
Box 8.2 When to use voluntary standards and when to use mandatory ones *(continued)*

Then they should ask whether an international standard fulfills the need and can be complied with and enforced. If not, they should adapt the standard or increase firms' capacity for compliance with it. Often, a mixed approach, in which regulation sets the broad requirements and technical details are left to voluntary standards, is most effective (refer to chapter 2).

Figure B8.2.1 Decision tree for voluntary standards: When they can be left to market forces



Source: WDR 2025 team.

a. Aside from such government support, private initiatives can help address the fragmentation of standards. For example, the Global Food Safety Initiative benchmarks food safety standards to promote equivalence.

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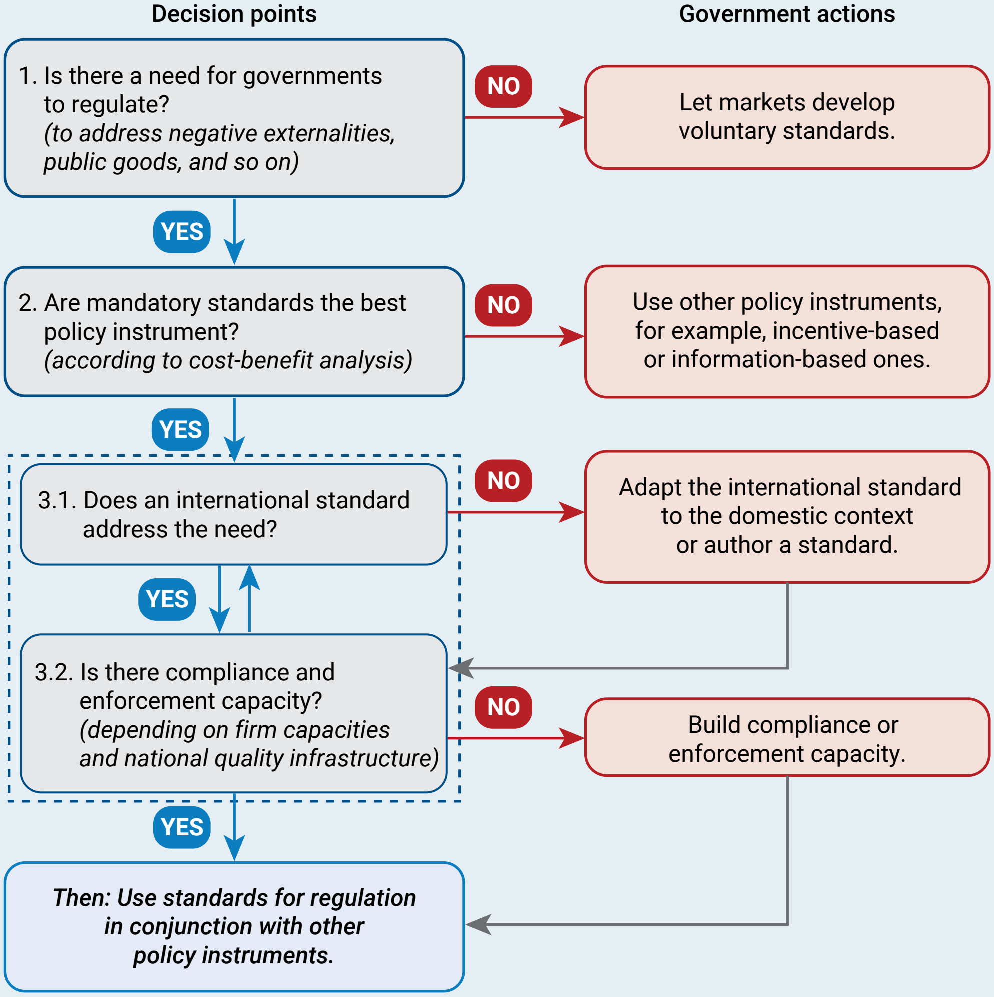
Box 8.2 When to use voluntary standards and when to use mandatory ones *(continued)*

Figure B8.2.2 Decision tree for mandatory standards: When to use them



Source: WDR 2025 team.

Source: WDR 2025 team.

When industrial policy becomes necessary, governments can leverage standards in at least three ways. First, they can use their convening power to gather stakeholders and help them solve coordination problems, enabling them to adopt higher standards. Second, they can leverage their purchasing power to encourage the adoption of quality standards through public procurement. Third, they can use standards to facilitate a technological transition, for example, by promoting interoperability standards. Although other policy tools like incentives are generally preferable, especially where capacity for compliance with standards is low or during urgent technological shifts, standards can still be helpful. For example, banning the import of mobile phones with the 2G standard in South Africa sped up the adoption of phones with faster mobile internet. In India, voluntary standards played a key role in the transition from incandescent light bulbs to more energy-efficient lighting using light-emitting diodes. Although there was no nationwide ban on light bulbs, mandatory certification for light-emitting diodes helped build consumer confidence and guided public procurement.

Adapt quality standards in line with the capacity of stakeholders to comply with them

This Report underscores the need to balance the ambition of high standards of quality against capacity for complying with them, which includes the ability of stakeholders to meet the standards and, for mandatory standards, the government's capacity to enforce them. For example, many lower-income countries set stringent standards for air pollution but are not able to enforce them (refer to chapter 6). Higher standards can be a worthy aspiration, but they risk becoming ineffective or even counterproductive if the compliance gap is too wide. Overly ambitious mandatory standards may push firms into informality or lead to partial and uneven public enforcement, opening the door to corruption. Policy makers in low- and middle-income countries should thus adapt quality standards, particularly mandatory standards, to their countries' compliance capacity. They can consider local adaptation of voluntary international standards, such as the voluntary GLOBALG.A.P. standard for good agricultural practices. For example, in countries like Kenya, there have been efforts to provide simplified requirements for GLOBALG.A.P. to match the capabilities of domestic producers and enable farmers to gradually improve their practices in regard to quality, access markets, and prepare for eventual full compliance with international standards.[2]

Adapting quality standards to local contexts may also be necessary because preferences regarding and tolerance for risk vary across societies (usually as a function of income) and because people in low-income countries may not be able to afford compliance with the standard. High standards can even be a case of "the best being the enemy of the good." As shown by the example of China's barefoot doctors, expanding access to health care for the many using providers that have less advanced credentials can yield better health outcomes in the aggregate than using highly credentialed professionals only and thus limiting access to a few people (refer to chapter 5). Finally, setting high standards can simply be a case of copying a high social or environmental standard to engage in virtue signaling.

Although this Report emphasizes adapting mandatory standards to local contexts, low- and middle-income countries should strive to use international standards without adaptation whenever possible, in line with the Agreements on Technical Barriers to Trade and on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization (WTO). Relying on a single recognized standard reduces compliance costs for sellers and simplifies verification of compliance for buyers and regulators. In contrast, multiple overlapping standards dilute the signaling effect of standards, especially when the standards are not widely known or trusted. To address the proliferation of competing standards, countries should adopt existing international standards whenever possible and contribute to developing them with international partners, to ensure that the standards adequately consider local needs and thus can be adopted without adaptation.

If countries need to adapt international standards, it is important that they do it systematically, following clear criteria. For example, it is important to use the same terminology and structure as an international standard and note any required deviations systematically. The International Organization for Standardization's (ISO's) Policy on Global Relevance outlines ways to integrate differences in markets (such as social conditions, trade patterns, and market needs) and essential differences among countries (such as those involving climate and technological infrastructure) into international standards.[3] But more efforts and guidance are needed to ensure that national standards bodies adapt standards in a coherent manner. For example, national standards bodies can consistently inform international standards development organizations about national adaptations. To date, it has often been difficult to assess deviations between national and international standards, creating unnecessary barriers to trade. Developing more international standards as tiered standards that provide different levels of stringency—for example, classes of energy efficiency—can also help make adaptations less disruptive to trade (refer to "Promote tiered standards to match different capacities" later in this chapter).

Some standards are inherently universal. For many measurement standards, the advantages of universal adoption are evident, especially for those based on universally accepted scientific units derived from natural constants such as an electric volt. Likewise, most compatibility standards require some degree of universality. This does not imply they are perfect, even if developed through expert consensus. However, the effort and resources needed to generate alternatives and the high chance of becoming isolated from prevailing standards if a different standard is adopted strongly encourage countries to adopt international compatibility standards. Universal compatibility standards can maximize the overall benefits of such standards, but initial competition among different standards can still be advantageous. For instance, mobile phone chargers vary not only in plug shape but also in aspects of quality like rate and accuracy of data transfer, safety, and convenience, creating a gray area between compatibility and quality standards. Therefore, early competition in compatibility standards can promote innovation, even though establishing a long-term standard generally benefits everyone. The European Union (EU), for example, played a key role in establishing USB-C as the universal charging standard by integrating consumer protection with environmental aims. Concerned about electronic waste and the fragmentation of charging standards, the EU initially encouraged voluntary agreements among manufacturers. When these efforts stalled, it introduced legislation in 2022 requiring USB-C chargers for phones, tablets, cameras, and other devices by 2024 and for laptops by 2026. Because of the EU's market size, companies found it impractical to produce separate versions for Europe, effectively creating a global standard, which prompted even Apple to switch from its proprietary Lightning connector standard.

In contrast, some measurement standards address matters that are more subjective, based on values, or hard to quantify—such as outcomes in education or inequality—in which one size does not fit all.

Show up and speak up in international standards forums and share findings at home

High-income countries on average participate in a far greater number of ISO technical committees than low- and lower-middle-income countries, sometimes by an order of magnitude (refer to spotlight 2). High-income countries send between 30 and 60 times the number of delegates to those meetings that low- and lower-middle-income countries do. Small wonder many international standards do not reflect the realities of life in the developing world: Experts from low- and middle-income countries are seldom even at the table when the standards are being developed. The global community does need to step up to better support the involvement of low- and middle-income countries, but policy makers in these countries should acknowledge the importance of showing up, listening, and speaking up in forums in which international standards are developed. This includes participation in long-established international standards development organizations like Codex Alimentarius and ISO, as well as those developing standards in new technologies, like the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF). In addition to involving themselves in the development of international standards, low- and middle-income countries should also actively participate in international forums related to quality infrastructure, for example, those in accreditation and metrology.

Several challenges hinder low- and middle-income countries in participating more effectively in international standards development organizations. First, resource constraints and limited technical expertise impede their involvement in these organizations' technical committees. Traveling to multiple in-person meetings, engaging domestic stakeholders for input, and preparing technically sound positions require time and money. Second, policy makers in low- and middle-income countries often have low awareness of standards development and pay little attention to it, especially given the recent rapid increase in standards. Third, standards from private organizations are expanding quickly, with even fewer formal mechanisms for participation by low- and middle-income countries. These countries could, in theory, refuse to recognize such standards, but doing so could shut them out of lucrative trade opportunities, because many private standards have essentially become gateways to international markets.

Each low- or middle-income country should put a priority on participating in development of the standards that are most relevant for its own economy and people. Increased coordination among national standards bodies, government ministries, industry associations, and research institutions, along with support from donors and international organizations, can bridge gaps in capacity to comply with global trade standards and strengthen low- and middle-income countries' roles in shaping these standards. Regional forums for developing standards, such as the African Organisation for Standardisation (ARSO) and the Association of Southeast Asian Nations (ASEAN) Consultative Committee for Standards and Quality, can pool technical expertise and amplify collective bargaining power in global forums.

Engaging in development of international standards is not just about having a seat at the table when future rules of global commerce are being written. The real opportunity for low- and middle-income countries lies in sending experts who not only speak up for national interests but also listen closely, capture insights, and bring them home. Too often, the insights from development of international standards remain with individual delegates but are not disseminated properly. National standards bodies can make these individual experiences available for a wider audience, enabling technical discussions and learning to take place. But policy makers first need to change the way they think about these bodies. Rather than considering them a regulator, they should view them as convenors of knowledge and promoters of innovation. National standards bodies, for their part, should not view themselves as technical research institutes. Instead, they should work with researchers to develop state-of-the-art standards.

Given the rapid pace of technological change, low- and middle-income countries have a strategic interest in taking an active role in shaping standards involving interoperability. These standards increasingly form the backbone of digital infrastructure, global trade, and access to emerging technologies. If low- and middle-income countries do not participate in the development of these standards, they risk becoming passive adopters of rules set by wealthier nations and multinational firms, locking them into technological dependencies that constrain innovation, increase long-term costs, and limit policy autonomy.

To maximize the benefits of participation, low- and middle-income countries should focus their engagement on the standardization of general-purpose technologies that enable digital transformation, such as digital identity systems, e-payment systems, protocols for data exchange, AI, and devices for the Internet of Things. The standards for these foundational technologies will shape how countries access innovation, finance, and public services in the decades ahead.

Active participation should go hand in hand with promoting open and inclusive standards. When standards incorporate technologies covered by standard-essential patents licensed under fair, reasonable, and nondiscriminatory terms, countries can adopt mechanisms such as patent pools or patent intermediaries to ensure that the licensing for these technologies is affordable and predictable regarding, for instance, conditions and costs. This may particularly benefit small and medium enterprises, as well as public institutions.

Finally, low- and middle-income countries should align their participation in development of standards for interoperability, as well as their processes for determining their priorities in regard to such participation, with their broader development strategies, concentrating on sectors in which interoperability can generate the greatest benefits, such as health, agriculture, and education.

Learn to use the full toolbox of standards for policy, not just the hammer

Use standards as a flexible tool in public policy

The strength of using standards as a tool for public policy lies in their flexibility. Too often, policy makers view standards solely as command-and-control tools for meeting regulatory goals. In fact, standards can be combined with other instruments. Market-based approaches like emissions-trading schemes are enhanced by having uniform standards for measuring, reporting, and verifying emissions. In public procurement, government standards establish best practices for processes involved in competitive bidding, and standards can also set specifications for the goods and services to be purchased. In Germany, the government promoted the creation of a voluntary Green Button label for textiles, which certifies that garments meet specified social and environmental standards, helping consumers make informed choices regarding the sustainability of clothes they purchase.

An advantage of voluntary standards is that they keep compliance voluntary while supporting regulation. Such standards can fill regulatory gaps and can enable firms to achieve higher performance beyond minimum regulatory requirements. In the area of food safety, private standards often develop in response to public regulations (refer to chapter 4). In 2015, China's government reformed its standards system to reduce the number of government-led standards and create a regulatory foundation for market-driven standards to spur innovation and competition that would surpass regulatory requirements (refer to spotlight 1).

Combining regulation with voluntary standards is also beneficial because regulation cannot and should not specify every technical detail required for compliance. Doing so would create compliance burdens, overwhelm policy makers' capacity and technical expertise, and make regulations too inflexible to allow innovation and accommodate societal changes. Best practices regarding regulations involve drafting them in broader terms and leaving technical specifics to voluntary standards that address regulatory gaps.[4] For instance, under the EU's New Legislative Framework, legislation sets out only "essential requirements" for the protection of public interests such as safety or health, whereas technical details are managed through voluntary standards, known as "harmonised standards." For example, to prevent pieces of electrical equipment from interfering with each other, one of the essential elements of the corresponding EU law broadly requires that any "electromagnetic disturbance generated does not exceed the level above which . . . equipment cannot operate as intended."[5] For technical guidance on how to achieve this in practice, companies can—but are not required to—follow the harmonised standard EN 55014-1, which helps them ensure electromagnetic compatibility in household appliances and similar equipment.[6]

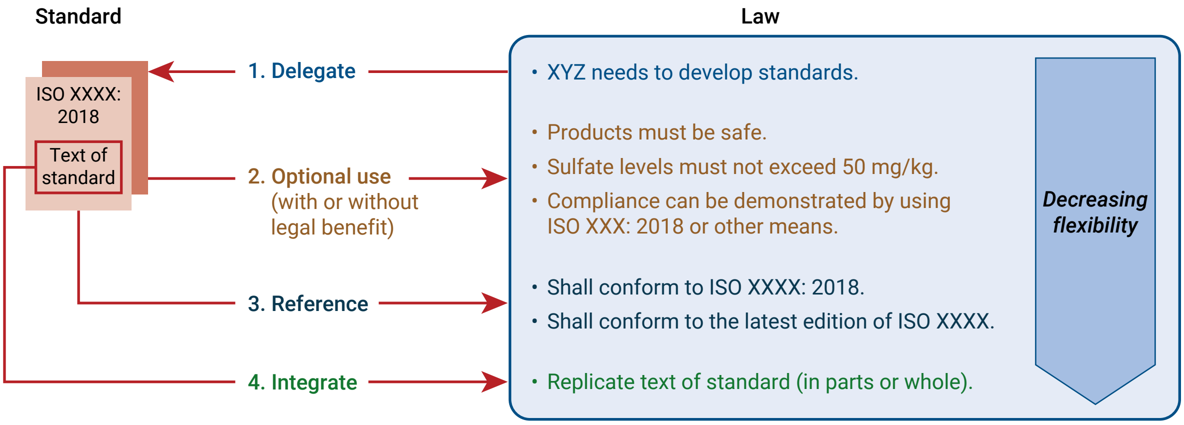
The EU's Artificial Intelligence Act adopts this approach. For high-risk AI systems, like those used in recruiting personnel or credit scoring, the act requires the implementation of a risk management system but leaves the details to interpretation. Such details will be clarified through voluntary standards, giving companies flexibility in how they design their risk management systems. Nevertheless, the act encourages firms to use harmonised standards developed by the European standardization organizations—the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC), and the European Telecommunications Standards Institute (ETSI)—by providing firms that adopt them with a "presumption of conformity," which eases their burden of demonstrating compliance during conformity assessments. This approach aims to be both adaptable and supportive of innovation while promoting the adoption of common European standards.[7]

Policy makers in low- and middle-income countries should leverage private standards and third-party systems for quality assurance to make compliance easier and strengthen enforcement. The use of voluntary private standards for regulation can best be understood through the idea of a *regulatory regime* that combines both public and private mechanisms for governance. The United Kingdom's Earned Recognition Scheme, for instance, reduces the number of inspections required for firms certified under the program, and the Codex Alimentarius guides governments in evaluating third-party systems for quality assurance. Low- and middle-income countries can adopt such a complementary approach to enhance regulatory functions and strengthen capacity for compliance with standards. However, regulators need the institutional ability to assess and oversee private systems for quality assurance. Without robust oversight of these systems, there is a risk of their fragmentation or overreliance on private schemes with limited accountability.

If countries decide to use standards for regulations, there are four ways of doing so (refer to figure 8.2). The choice of approach matters greatly in regard to ease of compliance, particularly with respect to the flexibility it accords to regulated entities.[8]

- First, governments can *delegate,* by mandating the use of standards without specifying their content and leaving their development to others. For example, the EU's Corporate Sustainability Reporting Directive assigned a multistakeholder advisory group to draft standards companies must meet in reporting their actions to promote sustainability.
- Second, governments can use standards as an *optional* mechanism to facilitate compliance with legislation by allowing laws to remain general and delegating technical specifications to standards, as with the EU's Artificial Intelligence Act.
- Third, the legal text of legislation may *reference* standards (ideally, international standards), either in whole or in part, making compliance with those standards mandatory.

Figure 8.2 Four ways of using standards in regulation



Source: WDR 2025 team.

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

- Fourth, a law may also directly *integrate* text from a standard and thereby make it mandatory.[9] This may be useful in regard to certain definitions but makes it difficult for the law to keep pace with revisions of the standard.

Among these options, delegation provides the highest degree of flexibility, whereas integrating the text of a standard into a law provides the least. With less flexibility, regulators may need to update laws more frequently when technical aspects change, and regulated entities may have fewer choices in deciding how to comply, stifling innovation.

To promote innovation and lower the risk that any particular technology will become dominant and entrenched, policy makers should generally favor performance-based standards that specify what outcomes must be achieved, such as targets for emissions levels or energy efficiency, rather than how to achieve them, such as mandates for specific technologies. But in instances in which enforcement is difficult or scale is large, technology standards may be more practical. For example, to control emissions from vehicles, a country might either mandate catalytic converters (a technology standard) or set emissions limits (a performance standard). Technology standards are easier to comply with and enforce, because verifying the presence of a component in a product made by a handful of manufacturers is simpler than measuring emissions in countless vehicles. Technology standards work best when technologies are mature and widely available. In contrast, performance standards offer firms flexibility and can encourage innovation, especially when options for achieving the standards vary. But their effectiveness depends on robust systems for monitoring compliance.

Regulatory impact assessments evaluate the effectiveness of mandatory standards, the costs of complying with them and enforcing them, and their impacts on competition, among other aspects. A good regulatory impact assessment uses a risk-based approach to assess disproportionate burdens on small firms or favoritism toward incumbents (refer to box 8.3). It examines the nature of requirements, alternatives like market-based policies, and whether a country's quality infrastructure can support assessment of compliance.

Box 8.3 Conducting cost-benefit analyses to assess the regulatory impact of mandatory standards

When are standards and technical regulations effective policy instruments? There are two rules of thumb regarding when mandatory standards may be preferable to other policy instruments. One is when uniform compliance is needed (especially in regard to safety standards, to avert costly risks). The other is when enforcing compliance and achieving compliance are easier with the help of standards. Of course, the decision to use mandatory standards is more difficult in low-capacity environments. One of the most common and useful instruments for assessing regulatory impact is cost-benefit analysis, a systematic way of quantifying, in monetary terms, and comparing the total expected costs and benefits of an intervention.[a] Countries should systematically conduct cost-benefit analyses before deciding to employ mandatory standards and use the analyses for policy evaluation after the standards have been introduced.

Mandatory standards have a reputation for being overly prescriptive, costly to implement, and difficult to enforce.[b] However, depending on the costs they prevent, they can still be the most cost-effective policy instrument. Cost-benefit analysis helps in making the necessary assessments to decide whether this is the case in any particular situation. A proper cost-benefit analysis can be demanding, because it requires reliable data, trained officials, and a commitment to using its findings in policy making. Figure B8.3.1 provides an overview of the main types of direct and indirect costs and benefits that should be included in an analysis of the impact of mandatory standards.

Five key choices are important when comparing mandatory standards with policy alternatives through cost-benefit analysis. The first is deciding how much to value the future versus the present, reflected in the "discount rate." The choice made here can be significant, especially in regard to long-term costs like those associated with climate change.[c] Second, policy makers must determine and assign a value to society's risk tolerance. Third, they need to assign a "price tag" to nonfinancial costs and benefits. For example, how much is it worth to save one human life from a risk or disease or one species from extinction? Fourth, as shown in the central part of figure B8.3.1, many costs and benefits are indirect, and policy makers must decide to what extent these indirect effects are included: the "boundaries of analysis." Although indirect effects often are not fully included in a cost-benefit analysis, this can lead to underestimating of systemic risks.[d] It is important to understand the limitations of the cost-benefit analysis in this regard. Fifth, policy makers need to decide whether and how to account for distributional effects, because cost-benefit analyses typically indicate only the overall net benefits of a policy choice.

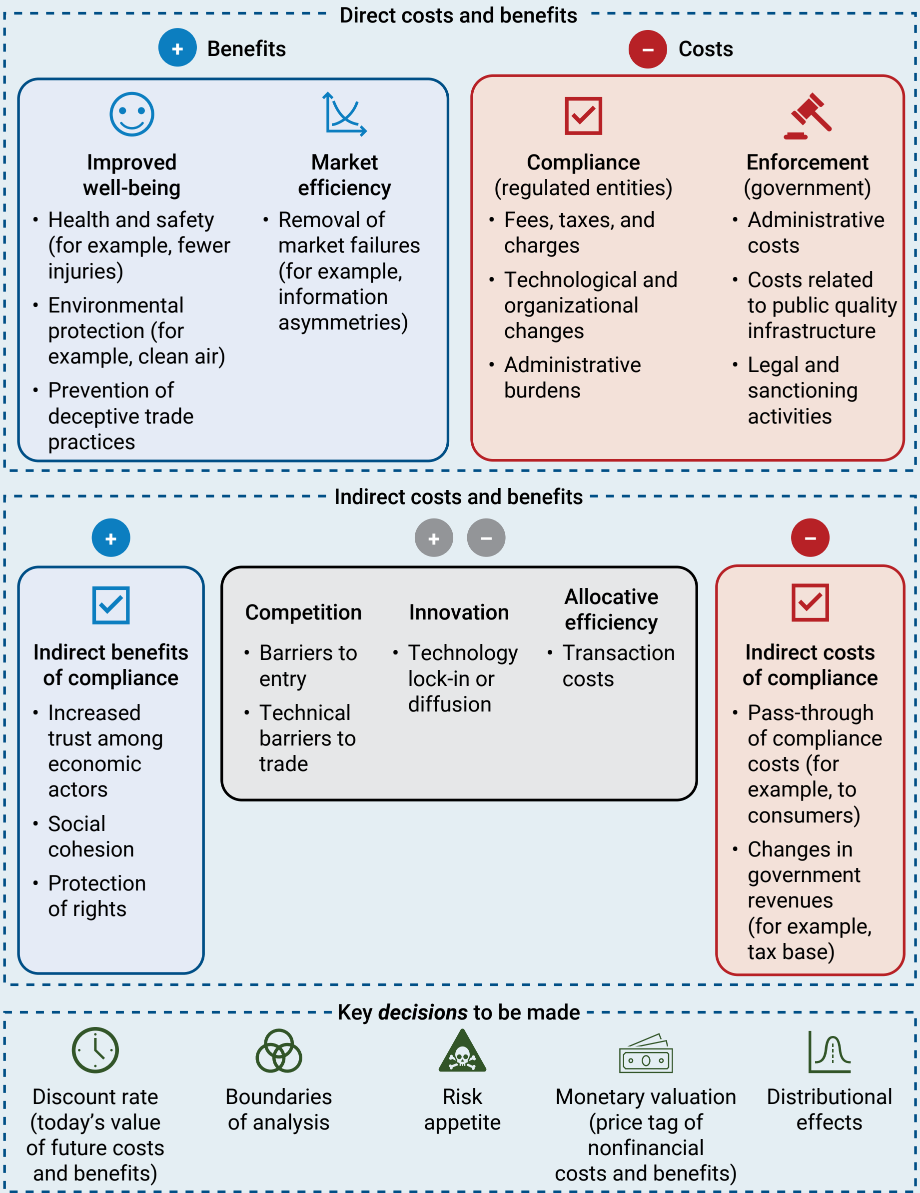
As this Report notes, data on standards are lacking, which makes the assignment of numerical values to costs and benefits difficult. Therefore, there is a demand to collect more data, for example, through monitoring and evaluation of the effectiveness of mandatory standards. Such after-the-fact evidence can provide important guidance for conducting before-the-fact cost-benefit analysis and improve policy making. This chapter therefore includes an appeal to collect more data on standards.

(Box continues next page)

Box 8.3 Conducting cost-benefit analyses to assess the regulatory impact of mandatory standards *(continued)*

The main challenge in assessing impact is knowing what would have happened without a particular standard, but comparing data before and after a standard is introduced, or between regulated and unregulated entities, can help approximate this counterfactual.

Figure B8.3.1 Key components of a cost-benefit analysis for mandatory standards



Source: WDR 2025 team.

(Box continues next page)

Box 8.3 Conducting cost-benefit analyses to assess the regulatory impact of mandatory standards *(continued)*

Governments can use the administrative data they already collect, such as tax filings, procurement records, and inspection logs, to evaluate whether mandatory standards are delivering results. Strengthening the quality, accessibility, and linkage of these data sets enables real-time monitoring and evidence-based evaluation, helping governments measure not just compliance, but the real economic and social benefits of regulation.

Source: WDR 2025 team.

a. OECD (2014, 2015, 2020).
b. OECD (2015).
c. Weitzman (2011).
d. OECD (2015).

Require all sectoral regulators and other government bodies to use quality infrastructure consistently

Many regulatory authorities, including environmental protection agencies, labor inspection bodies, consumer protection agencies, and financial oversight agencies, establish and enforce mandatory standards. However, most of these authorities do not consistently apply principles related to quality infrastructure to improve regulatory design and enforcement. Instead of relying on existing standards and methods of conformity assessment, they create their own rules and new requirements governing testing and certification, which often do not align with good international practices. They also operate their own testing laboratories, often without accreditation. This results in inefficient use of limited public resources. For example, in some countries, companies complain that they are frequently visited by multiple government agencies conducting the same tests for water pollution, each using their own laboratory. This unnecessary duplication causes inefficiencies, especially when expensive laboratory equipment is in short supply.

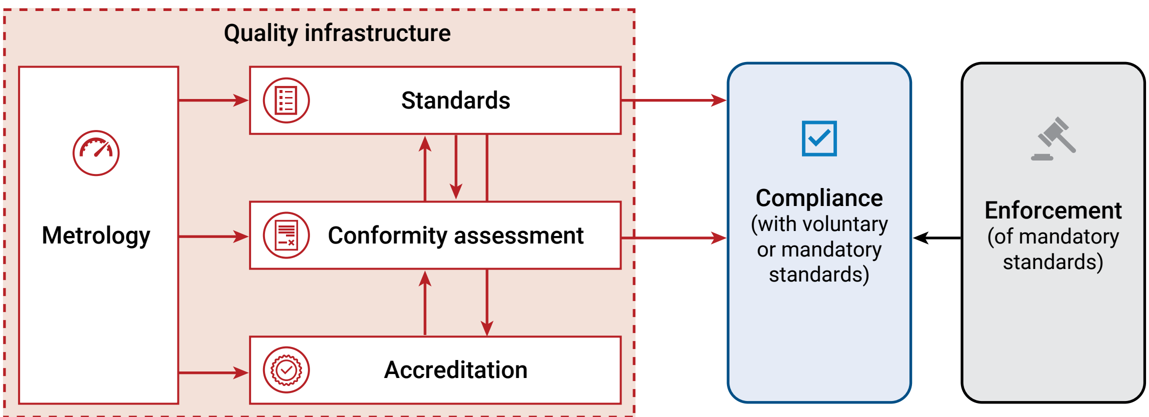
Developing a framework for technical regulation can establish the institutional, legal, and procedural structures needed for countries to oversee how mandatory standards (technical regulations) are created, implemented, and enforced. Such a framework might require regulatory authorities to base regulations on available international standards whenever possible, aligning with the WTO's Agreement on Technical Barriers to Trade. It also clarifies how standards are to be incorporated into legislation. Additionally, the framework should include a predefined menu of conformity assessment approaches for regulators to choose from, depending on the level of risk associated with noncompliance with a particular regulation or standard. The approaches may specify who assesses conformity (for example, a third party), how (for example, product testing or factory inspection), and when (for example, during product design or manufacturing process). For instance, an environmental protection agency might mandate third-party testing by accredited laboratories for high-risk industries to verify wastewater quality while using simpler procedures like self-declaration of conformity for lower-risk activities such as waste segregation (refer to chapter 3).

Predefined approaches for conformity assessment allow regulators to select appropriate compliance methods while ensuring those methods are harmonized across government agencies. This enables regulatory entities to share laboratory resources and use private testing, inspection, and certification bodies more strategically. In India, the central government issues Quality Control Orders to require that certain products meet Indian Standards, with conformity assessment conducted by the Bureau of Indian Standards.[10] Although ministries have the discretion to decide which products within their areas of responsibility to regulate and when to issue Quality Control Orders, the harmonized framework for issuing such orders promotes a more consistent approach to technical regulation across sectors.[11] The African Continental Technical Regulatory Framework, adopted in 2024, aimed at encouraging the use of regulatory frameworks in countries across the continent, reflects a positive trend in the direction of a more systematic approach to issuing technical regulations.[12] Meanwhile, sectoral regulators may resist frameworks for technical regulation because they are concerned about their autonomy, making strong leadership essential to mainstreaming principles related to quality infrastructure.

Use quality infrastructure to realize the full potential of standards

As chapter 3 advocates, low- and middle-income countries should invest in a well-functioning system of quality infrastructure, which comprises four core interrelated elements: metrology, conformity assessment (testing, inspection, and certification), accreditation, and standards themselves (refer to figure 8.3). But how can low- and middle-income countries build quality infrastructure effectively? As the discussion that follows indicates, they should sequence the development of quality infrastructure according to market demand and national priorities; develop capacity for compliance assessment through public-private partnership; and collaborate internationally to give stakeholders access to quality infrastructure services, which does not mean that all required capacities must be available domestically.

Figure 8.3 Compliance with standards depends on a quality infrastructure system that functions well



Source: WDR 2025 team.

Sequence the development of quality infrastructure according to market demand and country preferences

Effective implementation of voluntary standards and enforcement of mandatory standards depends on well-functioning quality infrastructure: a system of public and private institutions that includes the four core elements noted earlier and (for regulated areas) market surveillance (refer to chapter 3). Advancing quality infrastructure in a country requires a sequence of actions.

1. First, countries should establish core quality assurance functions: oversight of national standards; basic metrology; and testing, inspection, and certification services. The institutions providing these functions form the foundation for further elements of a country's quality infrastructure system. At this stage, services are typically publicly funded and operated, because of their nature as public goods and limited commercial viability. A key goal is to build capacity in the public sector for, among other things, international cooperation to establish the traceability of measurement standards and the adoption (or adaptation) of international standards.
2. Second, as domestic markets expand and trade integration progresses, quality infrastructure must develop to meet more complex demands, requiring the creation of an accreditation function to increase the credibility of conformity assessments for international trade. This also includes entering into mutual recognition agreements to strengthen the international validity of the results of conformity assessments.
3. Third, over time, responsibilities for testing, inspection, and certification should transition from the public to the private sector, with market demand and sector-specific needs driving investments in quality infrastructure to ensure the infrastructure developed is relevant and operates efficiently. Although governments can support the private sector through subsidies, these should be carefully tailored in response to market failures, not to particular business interests.

Develop capacity for compliance as a public-private partnership

For quality infrastructure to be effective, the specific roles of the government and the private sector must evolve over time. Initially, governments may need to provide testing and certification services because limited market demand prevents these services from being commercially viable. But over time, as private providers of quality assurance start to become available, governments should shift their focus to their regulatory and oversight functions. Public institutions, which may have become dependent on revenues from conformity assessment services or perceive these services as part of their regulatory mandate, may find the transition to regulation and oversight difficult. Some government bodies also consider it their responsibility to provide affordable testing, inspection, or certification services as a form of industrial policy, for example, to help small and medium enterprises expand their access to international markets. Offering demand-side incentives, like subsidizing firms' certification costs, however, is generally preferable to government provision of services.[13] Such a strategy increases demand and fosters a competitive market for private services in the area of conformity assessment, promoting long-term efficiency and sustainability.

Focus on the availability of quality infrastructure, not the location

State capacity is a major limiting factor in many low- and middle-income countries. Thus, these countries should leverage both international and domestic resources to raise their standards. Firms in these countries often send product samples abroad for testing, especially when international buyers require certification from recognized conformity assessment bodies. This method can be effective and commercially practical. However, it can pose challenges when testing is urgent, shipping logistics are difficult, or the exports being tested are perishable goods or bulk commodities traded on tight schedules. For many low- and middle-income countries and small economies, regional or bilateral cooperation provides a cost-effective alternative, especially for expensive and specialized services like accreditation and scientific metrology.[14]

Domestically, governments should strengthen and involve professional organizations—whether scientific and engineering societies or those in accounting, education, or medicine, as well as industry groups—in developing and updating standards. These professional organizations often operate their own codes of conduct or liability norms, motivating companies to manage risks even without strict government oversight. Moreover, insurance and tort law can be used instead of (or alongside) enforcement of mandatory safety standards through government inspectors. Improving education and infrastructure in universities can foster a deeper understanding of the importance of standards and quality infrastructure and help build a stronger domestic system of testing laboratories. Finally, governments should encourage civil society to act as quality watchdogs and encourage it to do so, as when, for example, consumer protection organizations offer independent testing and certification.

Leverage digital tools for better quality infrastructure

Low- and middle-income countries, in particular, can benefit from leveraging digital technologies to make quality infrastructure more accessible and cost-effective. Digital solutions can help these countries overcome geographic and capacity constraints, for example, by enabling remote audits or digital submission of results of conformity assessment. They also enhance traceability through use of tamper-resistant blockchain-based recordkeeping and interoperable data platforms that connect laboratories, accreditation bodies, and regulators. Publicly accessible databases can further strengthen trust by allowing users to verify the validity of certifications and identify accredited providers. Moreover, regulators can harness online information, such as consumer reviews or product data from e-commerce platforms, to detect emerging risks and target their enforcement activities more efficiently. Digital tools can also facilitate firms' adoption of standards by providing online guidance, training modules, and self-assessment tools to increase firms' compliance with international requirements. To realize these benefits, however, countries must invest in robust digital infrastructure, human capital, and governance frameworks that ensure data security, interoperability, and trust across national systems.

Recommendations for the global community

Develop international standards that better serve low- and middle-income countries

Support low- and middle-income countries in the process of developing international standards—or risk low uptake

Advanced economies should support a stronger role for low- and middle-income countries in the development of international standards, not only to make standards development more effective, but also to ensure there is greater uptake of standards globally. This is already a key principle in ISO's Good Standardization Practices.[15] And several initiatives have been launched to provide more support to low- and middle-income countries, including the ISO Committee on Developing Country Matters (DEVCO), which provides technical assistance and training to low- and middle-income countries.[16] The Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) Codex Trust Fund, which focuses on strengthening National Codex Committees, is a similar initiative. But progress on strengthening the involvement of low- and middle-income countries remains slow, and participation among countries at different income levels is still structurally imbalanced.

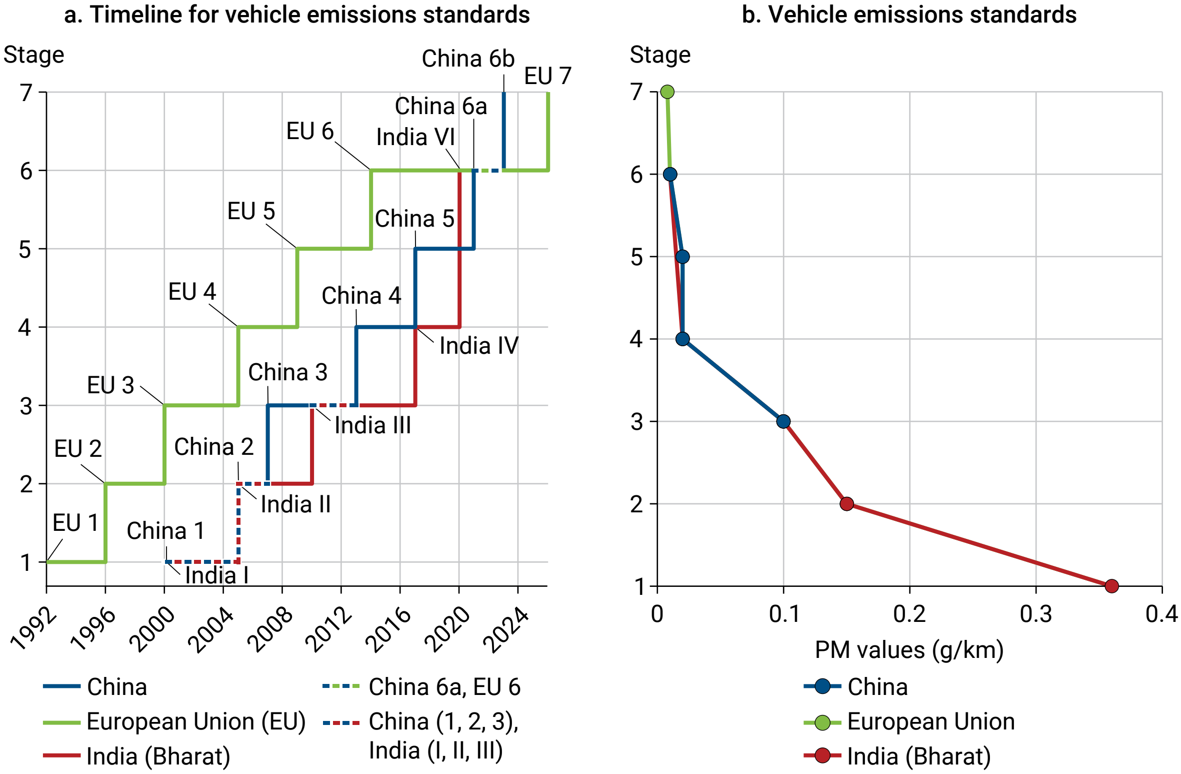
There are no easy solutions. A requirement stipulating that low- and middle-income countries should lead a defined number of technical committees runs up against the need for expertise in deep technical matters and the comparative lack of such expertise in these countries. Setting up a fund that financially supports the development and implementation of international standards in low- and middle-income countries runs into the perennial challenge of scarce financial resources. A more promising approach is to give DEVCO the mandate to systematically review and comment on draft international standards from the perspective of low- and middle-income countries, focusing on feasibility, implementation capacity, socioeconomic impacts, and alignment with development goals, especially if its role is confined to flagging barriers, suggesting adjustments, and promoting pathways for phased adoption as needed. But the approach also runs into a growing challenge from the fact that many standards in emerging technologies are being developed in other (private) forums. Twinning programs that link national standards bodies from high-income countries with those in low- and middle-income countries can build capacity in the latter group to participate meaningfully in the work of technical committees.

In addition to strengthening low- and middle-income countries' participation in international standard setting, there is a parallel need to build and enhance their quality infrastructure systems. As this Report emphasizes, well-functioning quality infrastructure is essential for the effective implementation of standards and for achieving a wide range of policy objectives, from consumer protection and industrial upgrading to environmental sustainability and trade facilitation. Yet many low- and middle-income countries face persistent constraints in the areas of technical expertise, institutional capacity, and financing. Establishing national metrology institutes, gaining international recognition for national accreditation bodies, and fostering a dynamic network of conformity assessment services all require sustained investment and coordination. Although several development partners already provide targeted assistance for these types of activities, greater and more coherent support is needed to help low- and middle-income countries fully leverage standards and quality infrastructure as enablers of sustainable development and competitiveness.

Promote tiered standards to match different capacities

The selective use of *tiered standards* can help low- and middle-income countries implement international standards. Tiered standards either apply different levels of stringency to the same standard (refer to figure 8.4) or follow a more modular approach that allows for gradual adoption of several standards that build on one another, with the international standard typically being the highest of these standards. As standards for vehicle emissions indicate (refer to figure 8.4), even the EU took a tiered approach, one that China and India subsequently followed. Using a tiered approach for adapting standards has many benefits, including that standards at all tiers share the same underlying terms and definitions as the corresponding international standard, which eases conformity assessment. Moreover, an organization that complies with a standard at a higher tier automatically

Figure 8.4 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.

complies with those at lower tiers, increasing the likelihood of mutual recognition of the results of conformity assessment. However, it is important to limit the number of tiers—ideally, already built into the international standard—to ensure that such a tiered approach itself does not contribute to fragmentation. In principle, it may be better for countries to use tiered standards as guidance and not make them certifiable standards.

There are several examples of tiered standards. For example, ISO 50005 gives organizations guidance on establishing a phased approach for implementing an energy management system that targets, in particular, small and medium enterprises. The development of such standards could be promoted to ease compliance. Rwanda offers another good example. Through its Zamukana Ubuziranenge (“Grow with Standards”) program, the Rwanda Standards Board introduced a Standards Implementation Maturity Model that helps micro, small, and medium enterprises assess their current practices, receive targeted technical assistance, and progressively comply with international norms. Since its launch in 2017, the program has reached more than 1,000 micro, small, and medium enterprises, many of them women- and youth-led, improving product quality, enabling certification, and supporting entry into regional and global markets.[17]

Ensure that well-intended standards do not become barriers to development

Deepen international regulatory cooperation

The issues people care about shift over time. As incomes rise, consumers look beyond price to safety, ethics, and environmental impact. For years many firms have ignored the environmental costs of production processes, requiring the public to foot the bill for things such as pollution cleanup and management of waste, but with clearer evidence of long-term risks, a consensus is emerging that it is cheaper to prevent harm now than to pay for it later. Progress of this kind leads to a steady increase in both mandatory and voluntary standards, as policy makers try to find ways to make firms reduce the environmental harms they cause or at least bear the costs of mitigating them. Even if countries have no protectionist intent in enacting such standards, the expansion of regulated areas and the increasing complexity of technologies and commercial relationships can still disrupt trade.

The EU's Regulation on Deforestation-free Products illustrates this point. Designed to reduce the impact of the production of major commodities on forest loss, it requires detailed traceability and proof of deforestation-free production. Yet this well-intentioned regulation has considerable impact on even remote farmers in Brazil, Ethiopia, and Indonesia. As discussed, to avoid having domestic regulations affect international trade is why the WTO has formed agreements such as that on technical barriers to trade and has established measures to promote transparency such as requirements that member countries inform other WTO members about and provide drafts of upcoming technical regulations. In 2021, the Organisation for Economic Co-operation and Development (OECD) formulated Best Practice Principles on International Regulatory Co-operation, urging policy makers to draw on international standards, justify deviations from them, assess cross-border impacts of regulations they put in place, engage international partners early, recognize foreign procedures for compliance, and pursue mutual recognition.[18] Initiatives such as the ones undertaken by ISO and the WTO, as well as the forums provided by these organizations and others like them, remain essential, but more is needed to ensure that standards and regulations in other countries do not affect low- and middle-income countries negatively.

First, although the stringency of mandatory standards can be left to domestic regulators, the global community should increase efforts to establish shared terminologies, measurement standards, and compliance approaches. Many deviations from international standards are unintentional and can be traced to the complexity of modern life. International coordination can add another layer of complexity and costs for policy makers. International standards are therefore essential, especially as a means for agreeing on common terminology and basic principles. For example, a major benefit of Codex Alimentarius was to provide shared definitions such as basic frameworks for food hygiene and methods for testing for salmonella contamination and not just the quantitative specification of Maximum Residue Levels. In many areas, there is a major gap in agreeing on international definitions. For example, many terms in the field of environmental sustainability are not clearly defined. Initiatives such as the proposed Codex Planetarius, which aims to introduce sustainability standards for globally traded food and commodities, could increase regulatory coherence.[19]

Second, building trust between countries is crucial as the basis for their recognizing one another's compliance mechanisms. For this, low- and middle-income countries need more support for establishing trustworthy and internationally integrated quality infrastructure systems that enable mutual recognition of the results of testing, inspection, and certification (refer to chapters 3 and 4). Whereas donor support for quality infrastructure systems in low- and middle-income countries often focuses on the competitiveness of these countries' exports, strengthening the role of quality infrastructure in regulations is also essential to prevent future nontariff barriers from being enacted and reducing existing ones.

Third, in emerging regulatory areas like AI and gene editing, international cooperation on regulatory sandboxes is important. Regulatory sandboxes typically allow regulatory requirements to be relaxed temporarily in a controlled environment (involving things such as increased government oversight) to enable learning regarding policies, particularly in the area of emerging technologies.[20] Shared standards on how to design, implement, and evaluate regulatory sandboxes can help align standards and regulations across countries.

Tidy up the spaghetti bowl of standards

This Report shows that although the recent increase in voluntary standards and certification schemes can complement public regulation, the resulting spaghetti bowl of overlapping schemes can create confusion, undermine credibility, and increase compliance costs, particularly for firms in low- and middle-income countries. Many schemes in areas like food safety and sustainability operate outside formal quality infrastructure systems: They often employ standards that have not been developed by recognized bodies, and certification of compliance with these standards may not rely on accredited conformity assessment, limiting trust and international recognition.

The requirements imposed by these schemes are driven more by what consumers and policy makers in high-income countries demand and less by the development needs of lower-income countries, so bargaining power is heavily loaded in favor of the former. Initiatives like the Global Food Safety Initiative, the credibility principles of the ISEAL Alliance, and Better Work attempt to benchmark private schemes against good practices and reduce duplication.[21] Still, stronger multilateral collaboration is needed to increase the credibility and interoperability of voluntary schemes. An initiative of the United Nations Industrial Development Organization (UNIDO) to establish a global mechanism for benchmarking of voluntary certification schemes marks a promising first step, but its impact as yet is unclear.[22]

Credible voluntary standards for sustainability can play an important complementary role in helping low- and middle-income countries achieve policy objectives, particularly those countries where public compliance and enforcement capacity are limited. Many such standards include requirements that mirror national laws, such as adhering to minimum wage provisions or respecting core labor rights, and depend on trained third-party auditors to verify compliance. In doing so, they expand the reach of public oversight and help bridge implementation gaps in instances in which governments face resource or institutional constraints. Ensuring the credibility of these standards is crucial, as they are increasingly used to support emerging regulatory frameworks (refer to chapter 4). For example, the EU's Regulation on Deforestation-free Products recognizes voluntary certification schemes as risk mitigation tools that companies may use to demonstrate they have exercised due diligence in preventing deforestation and ensuring legal compliance with the requirements of the regulation. However, these certifications do not replace firms' legal obligations or guarantee that they are compliant.

Amass more data and evidence

As this Report shows, standards are crucial for development and warrant further research. International organizations and academic institutions can do much in collecting more data and evidence on standards and quality infrastructure. For example, firm-level surveys could collect more information on the uptake of standards across different industries and firm types, enabling a better understanding of how the uptake of standards affects firm productivity and market access. Similarly, more data on quality infrastructure institutions could be collected to identify what models for quality infrastructure work well under what circumstances. Further research should also leverage existing administrative data to evaluate the impact of standards, both before and after implementation. Governments already have rich data sources, but these data sources are not often systematically used as sources of knowledge.[23] Tapping into administrative data could help inform better decisions on how best to use standards as a regulatory tool.

Tackle global challenges

Set and comply with standards now—or face crises later

Mandatory standards are particularly useful when the costs of prevention are lower than the costs of correction, once compliance and enforcement are considered (refer again to box 8.2). Today, the global community faces a rising wave of systemic risks that could have catastrophic or irreversible long-term costs (or both). These include climate change and biodiversity loss as well as the unchecked spread of transformative technologies like AI, gene editing, and social media.

At the root of these harms lies innovation that outpaces governance, with costs that are shifted onto society and nature. For example, the chemicals industry has identified about 15,000 different types of per- and polyfluoroalkyl substances (PFAS), innovative chemicals that are ubiquitous in applications for water and stain resistance and nonstick capabilities (such as those involved in food packaging, cookware, and industrial processes). Because PFAS do not naturally break down, they are often referred to as "forever chemicals." Once PFAS are in the environment, they are immensely expensive to clean up: They have been found on top of Mount Everest, in the bloodstreams of wildlife, and in drinking water across many countries. With growing awareness of the health risks associated with exposure to PFAS, such as cancer and other diseases, regulators are engaging in a game of Whac-A-Mole trying to regulate them. For example, in 2024 the US Environmental Protection Agency (EPA) set mandatory standards limiting the use of 6 PFAS (of the total 15,000) in drinking water.[24] The race between technology and managing its risks can be expressed in a simple statement: Whereas technology tells us what *can* be done, standards say what *should* be done.

The risks described here interact with and compound one another, which is why experts often refer to the current state of the world as a "polycrisis."[25] For example, although AI is expected to boost efficiency in economies, under the current incentive structure it will also boost the "efficient" extraction of natural resources like fossil fuels and accelerate unsustainable use of land and water. The data centers required for AI will require immense volumes of water and energy, straining natural ecosystems and impeding the transition to renewable energy sources. The International Energy Agency (IEA) estimates that AI will drive the electricity demand of data centers to about 945 terawatt-hours annually by 2030: roughly equivalent to the yearly power consumption of Japan.[26] Meanwhile, the deeper societal impacts of the widespread use of AI, including not only the job losses, but also the cognitive decline across population groups, are only slowly being understood.[27]

In the past, many technological risks were confined to specific geographic areas or sectors. Today's risks are global, systemic, and fast moving. Geopolitical competition creates a game of chicken in which governments fear that slowing down will mean losing advantage, even though speeding up may lead everyone to catastrophe. At the same time, the distribution of costs and benefits is highly tilted: Whereas the gains are largely private and concentrated among a few large technology conglomerates, society bears the risks. Winner-takes-most dynamics reinforce this imbalance, allowing dominant firms to consolidate influence over markets and governance. For example, big technology firms are heavily influencing the development of standards for AI, as a recent report on development of such standards in Europe illustrates.[28]

This warning is intended as a wake-up call to the global community. For transformative technologies such as AI, which carry risks that are poorly understood and evolving faster than regulatory systems can adapt, it is sensible to follow the *precautionary principle*: If serious harm is possible, take preventive measures even if there is not yet full scientific evidence that confirms these risks. For example, if there appears to be a risk that social media use is as addictive for children as gambling or drugs and presents serious risks to their mental health, it makes sense to put in place safety standards to prevent such harm, even as society awaits additional research confirming the risks. Similarly, AI systems used in sensitive areas such as hiring, education, or medical diagnostics should be subject to mandatory testing and certification to ensure transparency, fairness, and accountability before being rolled out to entire populations like large-scale social experiments. In short, it is sensible to implement standards before harm becomes irreversible.

Notes

1. Refer also to OECD (2021b).
2. Park and Gachukia (2021).
3. ISO (2021b).
4. Refer also to OECD (2025a).
5. Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the Harmonisation of the Laws of the Member States Relating to Electromagnetic Compatibility (Recast), Annex I, Section 1, item (a), European Union, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02014L0030-20180911.
6. For further explanation on this, refer to, for example, BMWi (2021).
7. BMWi (2021).
8. ISO (2023).
9. The content of a standard is often protected by copyright, and reproduction without proper authorization is prohibited.
10. The central government assumes this role in areas in which no sector-specific regulatory body has been established.
11. Kaul (2025).
12. Budoo (2025).
13. Kellermann (2019).
14. Miesner (2009).
15. ISO (2019).
16. ISO (2021a).
17. Refer to https://www.rsb.gov.rw/services/about-zamukana-ubuziranenge-zu-program/description-zu.
18. OECD (2021a).
19. Refer to Codex Planetarius: To Reduce the Environmental Impacts of Food Production (portal), Markets Institute, World Wildlife Fund, https://codexplanetarius.org/.
20. OECD (2025b).
21. In food safety, the industry-driven Global Food Safety Initiative established a benchmarking system to enable recognition of similar certification schemes as equivalent (Havinga and Verbruggen 2023; Henson 2025). The ISEAL Alliance was formed to facilitate collaboration on credible practices for voluntary sustainability systems, creating values defined in the ISEAL Credibility Principles and implementable definitions in the ISEAL Code. Refer to ISEAL Alliance (dashboard), https://isealalliance.org/. For labor standards, Better Work, a collaboration between the International Finance Corporation (IFC) and the International Labour Organization (ILO), reduces repeat audits of labor conditions in the apparel and garment industry by offering shared assessments that brands can use.
22. Refer to QI4SD: Quality Infrastructure for Sustainable Development Index—About (web

page), Knowledge Hub, United Nations Industrial Development Organization, https://hub.unido.org/qi4sd/about.

23. Legovini and Jones (2020); Rogger and Schuster (2023).
24. In the EU, five national authorities (those for Denmark, Germany, the Netherlands, Norway, and Sweden) submitted a proposal to the European Chemicals Agency (ECHA) to restrict the use of about 10,000 PFAS under a group approach (not one by one).
25. Lawrence et al. (2024, 2) define "polycrisis" as "the causal entanglement of crises in multiple global systems in ways that significantly degrade humanity's prospects."
26. IEA (2025).
27. Kosmyna et al. (2025).
28. CEO (2025).

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