SPOTLIGHT 5

Standards and Digital Public Infrastructures

Digital technologies have the potential to foster development in a wide range of areas, from boosting economic growth to enhancing public services.[1] The digital economy depends on digital public infrastructure, the digital systems and platforms (such as digital systems for identification and for payment and platforms for data exchange) that enable essential services to be delivered on a large scale.[2] Sector-specific digital platforms, like those in health care, education, and transportation, often support digital public infrastructure. Digital infrastructures create open channels on which both public and private actors can develop solutions, similar to the way physical infrastructure, such as roads and electricity, does. Standards act as the "rails" for the digital economy, especially in building digital public infrastructure, shaping who can participate, innovate, and benefit from the digital economy.

The *public* nature of digital *public* infrastructure does not mean that the government necessarily is, or should necessarily be, involved in the development and management of the infrastructure; many successful digital public infrastructures are entirely managed by private institutions. Rather, it refers to the fact that digital public infrastructure is inherently a public good, supporting both governance and market innovation. Such infrastructure also aims to fulfill critical objectives in the realm of public policy like enhancing competition, expanding access to services, and fostering inclusion. Accordingly, governments can take the lead in the adoption of digital public infrastructure, whether by convening stakeholders, mandating standards, or even directly building the infrastructure.

Open versus proprietary standards: The hourglass model of standardization

The model used to set standards for some notable digital public infrastructures, like India Stack, can be visualized as an hourglass.[3] In the middle is a slim set of common standards (a "thin waist") covering areas such as digital authentication of identification, payment protocols, and the protocols for software connecting computers and programs (that is, the application programming interface) and for data consent. At the bottom of the hourglass is a wide range of technologies. At the top is a wide range of applications. The core standards in the thin waist at the middle of the system interconnect with the base of technologies below and support the range of applications above.

There is a strong case for requiring openness of standards for digital public infrastructure, especially for the core layers (that is, the thin waist). Because public infrastructure serves the public interest, it should not be limited by restrictions on private intellectual property or technologies that dominate the market. Therefore, standards for such infrastructure should be open, meaning

generally accessible to all potential users without restrictions, rather than being controlled by a single company or consortium that may impose licensing fees or usage constraints. "Open standards policies" are based on the idea that core government systems, such as platforms for identification, payments, and data exchange, should not depend on proprietary software or require licensing fees for interoperability. However, enforcing a strict mandate that components of digital public infrastructure use only fully open standards can be difficult, especially because in some technology areas, the most advanced standards may involve patents. The emerging consensus is for governments to adopt a hybrid, principles-based approach: Use open standards whenever possible, especially for interfaces, but consider proprietary technology if it is in the public interest, ensuring that no proprietary element compromises the overall openness of the system.

Building on the hourglass model for digital public infrastructure, openness in the thin waist—the critical connectors and data definitions—ensures that the system can expand to additional users and remain competitive. Flexible options, including proprietary offerings, can be implemented above the waist (applications) and below it (infrastructure), provided they remain compatible with the open core. A balanced approach of this type recognizes that, at its core, public infrastructure should incorporate open standards by design, while also leveraging the best available technologies (open or proprietary) for providing services, as long as those technologies do not create silos.

There is also an argument for having a minimalistic set of core standards. Maintaining a small number of standards for an open core can foster more innovative services such as financial technology applications, e-commerce solutions, and digital health services without requiring separate agreements for each integration. Such a model can also allow for rapid scale-up. In India, for example, hundreds of banks and dozens of payment applications began interoperating on the country's digital public infrastructure within a few years of one another, without the government's needing to develop every application itself. The government also prevented a monopoly by ensuring no single vendor owned the standard for core digital public infrastructure, which kept barriers to entry low.

Another recurring feature of successful digital infrastructures is interoperability across platforms and providers. A key consideration at every level of digital public infrastructures should be how easy it would be to replace a component. Designing for replaceability hedges against both technological obsolescence and vendor opportunism. As a principle, it leads to modularity: the practice of building systems from modular components connected using standard interfaces (again in line with the hourglass model). In the area of payments, the clearest success stories are intentionally built around common rails for clearing and settlement (networks for instant payment with shared rules), with strong competition in consumer-facing products. In the area of data exchange, although arrangements are newer, the same philosophy is gaining traction. Countries are identifying key common standards—data formats, exchange protocols, security methods, and consent rules—that form the thin waist of the hourglass. When such standards are established at a national level, they enable a wide range of data-sharing uses.

Digital public infrastructure has impact: The case of digital payments

Digital public infrastructure can have impacts in areas ranging widely, from health care to agriculture and from financial services to government payments.[4] Instant and interoperable digital payments often represent the most advanced level of digital public infrastructure in developing countries. Globally, 93 countries have active, real-time retail payment systems managed by operators

functioning in the public interest. The interoperability of these payment systems has become an unofficial standard. Examples of real-time payment schemes in developing countries that allow instant fund transfers include the UPI (Unified Payments Interface) in India, Pix in Brazil, SPEI (Sistema de Pagos Electrónicos Interbancarios) and CoDi (Cobro Digital) in Mexico, the Internet Banking Payment System in China, and Fonların Anlık Sıstemde Transferı (Instant and Continuous Transfer of Funds) in Türkiye. Recent growth in the number of real-time payment schemes means the number now surpasses what was available a decade ago, when the infrastructure required to support them was limited to a few advanced economies. In fact, many emerging markets have surpassed their more developed counterparts in the volume of transactions these systems process.

Lowering transaction costs related to digital payments can boost financial inclusion. Users of India's UPI, for example, are nearly three times more likely to save in formal accounts without reducing their informal savings.[5] In Brazil, adoption of Pix facilitates new banking relationships: a 1 percent increase in active Pix users results in a 0.25 percent rise in relationships with new banks and a 0.8 percent increase in first-time openings of bank accounts.[6] Interoperable payment systems also significantly influence competition and innovation in the payment sector and, more broadly, in the banking industry.[7]

The effects extend beyond financial outcomes. By lowering transaction costs and reducing information asymmetries, efficient methods for payment can improve outcomes in the real economy. For example, in India, households in districts with a higher share of banks participating in UPI experienced a 2 percent greater increase in business ownership and an 8 percent greater rise in income between 2018 and 2022, compared with households in districts with lower shares of banks participating in UPI.[8] Increased borrowing capacity mainly drove this growth in household income and entrepreneurial activity, indicating that histories of transactions through digital payment systems can serve as collateral for loans. Having open and interoperable data is crucial to unlocking this potential. Thanks to UPI, data on customers' financial transactions can be shared among providers of financial services, promoting competition and innovation and leading to an expansion of credit, primarily for underbanked and marginalized borrowers.[9]

Beyond technology standards: The need for complementary policies

Technology standards alone cannot ensure a thriving, competitive digital ecosystem; supportive policies are also required. If a government mandates an open standard for, say, mobile payments, it must also be prepared to monitor the market and prevent anticompetitive behavior. Policy makers need to oversee market concentration even after open standards have been adopted.[10] Therefore, competition policy, data governance (ensuring fair sharing of data), and consumer protection (preventing proprietary lock-in through application stores or devices) all come into play.[11] Effective exchange of data in digital public infrastructure requires both technical standards (such as common protocols, formats, and application programming interfaces for interoperability) and legal frameworks (such as those including policies on privacy, security, and data management). Achieving scalable nationwide exchange of data is difficult and requires addressing rising concerns regarding data privacy.

In addition, technology choices alone do not ensure success; institutional and policy frameworks are the foundation that makes digital public infrastructure effective for development. Emerging market and developing economies must carefully sequence legal and regulatory steps as they implement digital public infrastructure. Countries should be free to adopt approaches

that suit their specific contexts and should consider limitations in their capacities. Implementing digital public infrastructure requires coordination across multiple sectors (finance, telecommunications, social welfare, and so on), so having a clear institutional home or coordination body is essential. In lower-income countries, international partners may initially support such high-level coordination to build capacity, but it is crucial that local ownership be established (perhaps through a permanent e-government unit or information and communications technology ministry).

There is no one-size-fits-all blueprint for digital public infrastructure, but the hourglass logic presented in this spotlight can act as a guiding principle. Policy makers should first evaluate which elements of the infrastructure, if standardized, will generate the greatest network effects and public benefits. These likely belong in the thin waist of the hourglass and include things such as a national format for identification, a scheme for interoperability of payment systems, and a data-sharing consent system. Then, policy makers should identify areas in which diversity and competition are more valuable than uniformity. These areas are better at the edges and can include things like user-facing applications and sector-specific business processes. By making distinctions of the type discussed here, governments can avoid both extremes: chaos from failing to standardize essential elements and stifling uniformity by imposing too many standards in areas better suited for local innovation.

Notes

1. World Bank (2016).
2. Clark et al. (2025).
3. Sankritik and Shetty (2025).
4. For a comprehensive set of case studies, refer to Clark et al. (2025).
5. Greenlend and Toth (2023).
6. Sampaio and Ornelas (2024).
7. Refer to Bianchi and Garz (2024) for more details.
8. Dubey and Purnanandam (2023).
9. Alok et al. (2025). Refer to Özyilmaz (2024) for additional evidence and Plaitakis and Staschen (2020) for a more in-depth discussion on open banking and financial inclusion.
10. Kawale (2024).
11. Medine and Plaitakis (2023).

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