DIGITAL POLICY FRAMEWORK FOR THE ARAB STATES

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Foreword by H.E. the Minister of Communications and Information Technology, State of Qatar

The Arab region is entering a formative stage in its digital development, where the rapid expansion of connectivity, the growing importance of data, and the increasing adoption of digital solutions are reshaping how services are delivered and how opportunities for innovation and economic growth emerge. In the State of Qatar, we are advancing the development of a knowledge-based digital society that places people at the centre of progress and ensures that technology supports national and developmental priorities.

Over the past decade, Qatar has invested deliberately in the foundations of a modern digital economy: advanced communications networks, trusted digital identity systems, secure and interoperable data platforms, and resilient infrastructure that enables efficient and high-quality public services. These efforts align closely with the approach presented in this Digital Policy Framework for the Arab States, which is built around three essential pillars: strengthening networks and digital infrastructure, developing the systems and policies needed for data, identity, and digital financial services, and enabling intelligent applications and emerging technologies that enhance productivity and improve service delivery.

However, the digital future of our region cannot be realized through national initiatives alone. Digital divides, service affordability, inclusion gaps, and the need for trusted cross-border data flows are challenges that call for coordinated policies and capable institutions across the Arab States. This Framework provides governments with a practical tool to assess digital maturity, identify structural gaps, and design policies that strengthen competitiveness and turn digital potential into measurable impact.

Today, the Arab region has a strategic opportunity to accelerate the developmental gains of digital transformation and reinforce the foundations of a sustainable, competitive, and future-ready regional digital economy.

I want to extend my appreciation to all partners, experts, and institutions whose contributions have shaped this report, reflecting our shared commitment to a more prosperous, inclusive, and sustainable digital future for the region.

H.E. Mr. Mohammed bin Ali Al Mannai
Minister of Communications and Information Technology
State of Qatar

Foreword by the Director of the Regional Bureau for Arab States, UNDP

The Arab States region stand at a pivotal moment in its digital transformation journey. Governments, businesses, and communities across the region are embracing new technologies that are reshaping economies, redefining governance, and opening opportunities for innovation and inclusion. Yet, the benefits remain uneven. Persistent digital divides, gaps in infrastructure, and differing levels of institutional readiness impose limitations on who can participate in the digital economy, and who benefits from it.Digital transformation is not only about adopting technology - it is about leveraging fast emerging technological tools to advance human development and build more inclusive, resilient, and equitable societies. When guided by clear policies and inclusive institutions, digital innovation can expand access to quality services, promote transparency and accountability, and empower people - particularly women, youth, and persons with disabilities - to participate fully in economic and civic life. Responsible digital transformation can also strengthen resilience to crises, foster regional integration, and accelerate progress toward the Sustainable Development Goals.

The **Digital Policy Framework for the Arab States** that is proposed here translates this vision into action. It offers governments a practical tool to assess digital maturity, identify policy and institutional gaps, and design tailored interventions to strengthen national digital ecosystems. Built around three interconnected pillars - networks and connectivity, data capture and aggregation, and intelligent systems and applications - the Framework outlines the foundations of a digital economy that empowers people, fosters innovation, and builds trust in systems that support daily life. Developed jointly by the United Nations Development Programme (UNDP) and Ooredoo Group, the Framework draws on the shared experience of governments, experts, and regional partners. It reinforces UNDP's Whole-of-Society Digital Transformation Framework and aligns with our priorities of advancing accountable governance, reducing inequality, empowering women and youth, and promoting economic transformation.

Recognizing the diversity of the Arab States as both a challenge and a source of strength, the Framework provides shared reference points for cooperation, mutual learning and regional integration. By working together, countries in the region can harness digital transformation to unlock economic opportunities, strengthen governance, and improve the quality of life for all. UNDP remains deeply committed to accompanying countries on this journey, ensuring that every digital advance contributes to more inclusive, resilient, and human-centered societies across the Arab States

Abdallah Al Dardari

United Nations Assistant Secretary-General,
Director of the Regional Bureau for Arab States, UNDP.

Foreword by the Group Chief Executive Officer, Ooredoo

We are living through a defining moment for the global economy and technology. The rapid digital progress we are witnessing offers a rare opportunity for governments to revitalise economies and create new pathways for growth. But it also risks leaving behind those who fail to adapt.

Artificial intelligence and other disruptive technologies are expected to add more than USD 16 trillion to the global economy by 2030, roughly equivalent to the current combined annual output of China and India.

Translating this economic potential into real social and human progress, however, requires intentional action. Whether this technological shift becomes an engine of inclusion or a source of inequality will depend on how governments respond, and how effectively they design and implement digital policy.

Today, digital transformation has the potential to significantly improve lives: expanding access to healthcare and education, fostering new skills, and creating opportunities on a broad scale. Yet technological innovation alone cannot achieve these outcomes. We need a coordinated policy and regulatory response that enables trusted, affordable, open, and equitable digital ecosystems.

The Digital Policy Framework for the Arab States, developed jointly by Ooredoo Group and the United Nations Development Programme (UNDP), provides policymakers across the Arab States with a practical toolkit for action to assess policy maturity, implement effective responses, and strengthen digital environments. The Framework draws on evidence, case studies, expert insights, and global best practices to highlight the policy levers that can accelerate national digital transformation.

Our shared ambition is to help governments turn digital potential into tangible, measurable progress, enabling them to realize the full benefits of the digital economy.

I hope policymakers find this report both practical and inspiring as they work to build an inclusive and sustainable digital future for our region.

Aziz Aluthman Fakhroo
Group Chief Executive Officer, Ooredoo

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The authors would also like to thank participants from the Groupe Speciale Mobile Association (GSMA), and Cullen International, for their contribution and input on the framework.

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- Matt Parry, Consultant, Frontier Economics

Their collective commitment will help advance digital development in the Arab Region.

The analysis and examples presented in this framework are intended solely to inform and illustrate possible policy options. They do not necessarily reflect the official positions of UNDP, Ooredoo Group, or any other contributors, nor do they constitute an endorsement of any particular policy, approach, or national practice.

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Glossary of Acronyms

A2A	Account-to-Account
AI	Artificial Intelligence
AILA	AI Landscape Assessment (UNDP)
AIPI	AI Policy Index
API	Application Programming Interface
CBDC	Central Bank Digital Currency
CRA	Communications Regulatory Authority
DPI	Digital Public Infrastructure
DRA	Digital Readiness Assessment (UNDP)
FTTH	Fibre to the Home
FTTP	Fibre to the Premises
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GSMA	Global System for Mobile Communications Association
ITU	International Telecommunication Union
KYC	Know Your Customer
NBN	National Broadband Network
OIDC	OpenID Connect
P2P	Person-to-Person
PKI	Public Key Infrastructure
PPP	Public-Private Partnership
PSD2	Payment Services Directive 2 (EU)
QR	Quick Response
RTGS	Real-Time Gross Settlement
SDGs	Sustainable Development Goals
SIM	Subscriber Identity Module
SLA	Service-Level Agreement
SSO	Single Sign-On
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TRA	Telecommunications Regulatory Authority
TRAI	Telecom Regulatory Authority of India
UN	United Nations
UNCDF	UN Capital Development Fund
UNCTAD	UN Conference on Trade and Development
UNDP	United Nations Development Programme
UPI	Unified Payments Interface
USAID	United States Agency for International Development
USF	Universal Service Fund
USO	Universal Service Obligation

USOF	Universal Service Obligation Fund (India)
USSD	Unstructured Supplementary Service Data
VAT	Value Added Tax
WEF	World Economic Forum
WHO	World Health Organization
WSIS	World Summit on the Information Society
ZAR	South African Rand
e-Gov	Electronic Government
eID	Electronic Identity
eIDAS	Electronic Identification, Authentication and Trust Services (EU)

1 Introduction

Digital policy touches many aspects of modern economies. Historically, policy was focused on connectivity infrastructure: ensuring consumers and businesses had affordable access to high quality voice and internet services. While this is still vital,

digital policy now encompasses broader aspects of connectivity in the internet value chain, so-called "Digital Public Infrastructure" (i.e. the public network and systems that support digital trust, Digital ID, data exchange, and digital payments) and how digital services are promoted and used. Indeed, the interconnected nature of the digital economy and off-line economy means that governments must, if they are to fully reap the benefits of digital transformation, develop a 'whole of government' approach to digital policy making.

Recognising the importance of providing an overarching Digital Policy Framework (DPF) that can guide policy makers in the Arab States region, the Ooredoo Group and the United Nations Development Programme (UNDP) have partnered to take forward a joint initiative to develop a comprehensive policy framework aimed at accelerating digital transformation across the region. By applying this framework, governments can better understand the maturity of their digital policies and economies, identify gaps, recognize opportunities for improvement and steps they take to drive greater digital transformation, to the ultimate benefit of both businesses and citizens.

This is critical because digital transformation is a key accelerator of broader economic development. Indeed, multiple studies have demonstrated a strong link between the digital sector growth and economic performance. For example, research published by the International Telecommunication Union (ITU) found that a 10% increase in fixed broadband penetration can increase Gross Domestic Product (GDP) by up to 1.5% in developing countries.[1] Similarly, a study by the World Bank concluded that countries with more developed digital ecosystems tend to grow faster, create more jobs, and provide better public services, with broadband investment often yielding higher returns than investment in many traditional infrastructure sectors.[2]

This framework builds on existing DPFs published by international organisations and institutions, which are referenced throughout the document (see Annex 1 for full list) . It also draws on examples of policies enacted by digitally mature and maturing economies, both in the region and beyond, to illustrate policy levers available to governments in lower- and middle-income Arab countries who are looking to accelerate digital transformation.[3] The focus on these countries reflects both their significant development potential and the need to ensure

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1 ITU (2012). *The Impact of Broadband on the Economy: Research to Date and Policy Issues*. International Telecommunication Union. Available at: The Impact of Broadband on the Economy: Research to Date and Policy Issues

2 World Bank (2016). *World Development Report 2016: Digital Dividends.* Washington, DC: World Bank. Available at: World Development Report 2016: Digital Dividends

3 These country examples are drawn from six diverse jurisdictions (3 GCC and 3 global: Saudi Arabia, Qatar, Oman, Singapore, the EU, and India) at different stages of development and varying characteristics.

that digital transformation supports inclusive growth and reduces existing inequalities. The framework also sets out indicators that governments may use to track their progress. Whilst it focuses on the Arab States region, it could equally be applied to other regions.

1.1 How to use this framework

This joint initiative is intended to support governments to identify and develop their own digital policy priorities and, doing so, accelerate their digital transformation. To do so, it introduces the **Digital Policy Framework** that serves as a practical tool to guide policymaking.

The framework recognises the links between different aspects of digital ecosystems and highlights key policy areas that governments should consider when shaping national digital strategies. It is designed to be flexible and broadly applicable to different jurisdictions, regardless of their level of development, while placing particular emphasis on lower- and middle-income countries in the Arab States region where digital transformation can drive inclusive and sustainable growth.

The framework also provides examples of policy levers that have been used to advance digital transformation in different contexts and at varying levels of development. These policy examples are drawn from other referenced DPFs, as well as case studies and are intended to illustrate the range of options available to policy makers. However, the framework does not prescribe or endorse any specific measures. . Effective policy making must be based on a deep understanding of national contexts – including local market dynamics, institutional capacities, and government priorities. Policy makers should therefore use these examples as reference points and adapt any interventions to their own circumstances and development objectives.

The relevance of different policy measures will also evolve over time, as a country's digital economy and broader economy, matures. The framework acknowledges this by identifying how the appropriate policy levers vary according to the degree of maturity of a country's digital economy. It does this by grouping policy levers into those most relevant for countries seeking to progress from a *basic to a moderate level of digital development*, and those for countries aiming to advance from a *moderate to an advanced level of digital development*. While foundational policies for countries at lower levels of digital development will remain relevant as they evolve into more digitally mature countries; certain policies which are relevant to countries at an advanced level of digital development may be less relevant to countries at an earlier stage of development. The framework also underscores the importance to balance growth in the digital economy with long term goals of digital equity, inclusion and resilience.

The framework identifies indicators to evaluate a country's level of digital development. Again, these indicators are intended as guides rather than requirements. . Levels of network coverage and penetration, for example, will vary for many reasons, often beyond a policy maker's control.

This means individual governments must assess the maturity of their digital framework and digital economy, and hence determine the policy responses most appropriate to their context. To do so effectively, they should engage with a broad range of stakeholders - including sector participants, businesses and consumers - to identify constraints, challenges, opportunities, and successes. Policy frameworks can be iteratively and gradually adapted as a country's digital development advances, while maintaining the predictability needed to sustain investor confidence. To support this balance, policy makers should follow clear processes before implementing or changing initiatives: for example, setting timeframes for policy measures and being clear when they may be reviewed, linked either to a given time horizon or to when certain outcome measures have been achieved.

2 The pillars of digital development

The Digital Policy Framework is structured around **three interrelated pillars** that together capture the essential components of an inclusive and sustainable digital economy:

- **Pillar 1: Networks and Connectivity** – the foundational infrastructure that enables access to digital services, including telecommunications networks and broader digital infrastructure.

- **Pillar 2: Data Capture and Aggregation** – the systems and policies that allow trusted, secure, and interoperable use of data, including digital identity, data sharing, and digital financial services.

- **Pillar 3: Intelligent Systems and Applications** – the advanced digital systems, applications, and enabling policies that unlock productivity and innovation across sectors.

These pillars reflect the interdependencies within digital ecosystems: progress in higher layers relies on robust foundations in the lower ones. Developing digital services and applications therefore relies on a hierarchy of infrastructure and systems. Policy development needs to reflect this hierarchy and the interdependencies across different aspects of the digital economy. For example, without a policy environment that supports investment in and usage of networks and connectivity, it is not possible for consumers, government and businesses to benefit from digital services. However, whilst necessary, access to this infrastructure alone is not sufficient to drive a truly digital economy.

Policies must also support the systems and infrastructure that enable data to be shared and aggregated securely, allowing greater value to be created from digital services. Finally, to drive widespread adoption of digital services, a set of horizontal and vertical policies are required to promote uptake and effective use of digital technologies. Focusing on this “top” layer (“pillar”) without addressing the fundamental elements will not generate the vibrant digital economies that governments often target.

In many lower- and middle-income Arab countries, persistent gaps in connectivity infrastructure, digital trust identification, data transfer and payments systems continue to constrain digital transformation. Without addressing/closing these gaps, it is not possible for economies to advance their adoption and incorporation of digital technologies.

The framework builds upon and amalgamates existing policy frameworks (see Annex 1 for details), recognises these different layers by identifying a layered[4] structure for digital policy.

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[4] Though the layered digital policy framework structure appears hierarchical/ pyramidal, to some extent, the relations between the components of the structure are more complex and not necessarily hierarchical or linear in nature.

To operationalize these pillars, each is divided into sub-pillars that highlight the specific policy areas and interventions necessary to advance digital transformation

Pillar 1: **Networks and Connectivity.** This base layer serves as the foundation for all digital services, encompassing the telecommunications regulatory environment that supports the deployment and usage of modern, high-speed fixed and mobile networks, as well as broader digital infrastructure.[5] A supportive policy environment in this domain is critical to ensure high-quality, affordable, and widespread access to connectivity. Recognising different elements within this, the framework divides this pillar into four sub-pillars.

- **Pillar 1.1**: The overall regulatory and policy framework governing the sector.
- **Pillar 1.2**: The roll out and usage of high-speed fixed networks and fixed network services.
- **Pillar 1.3**: The roll out and usage of high-speed mobile networks and mobile network services.
- **Pillar 1.4**: Investment in wider digital infrastructure, such as (but not limited to), international connectivity, (such as submarine cables and landing points), data centres, internet exchange points, and so on.

Pillar 2: **Data Capture and Aggregation**, focuses on the importance of establishing trusted and secure systems for managing data across emerging technologies through foundational Digital Public Infrastructure (DPI) building blocks. For instance, it includes policy frameworks which are essential to building user confidence and enabling interoperable digital ecosystems. Recognising different elements and the policy levers available across this pillar, the framework again divides this into multiple sub-pillars, specifically:

- **Pillar 2.1**: Promoting inclusive[6] digital identity and trust online. Digital IDs are foundational for accessing services, both public (such as social protection, healthcare, and education) and private (such as banking and telecommunications).
- **Pillar 2.2**: Promoting data sharing and interoperability across platforms to facilitate secure, real-time data sharing between government agencies and between public and private actors.
- **Pillar 2.3**: Promoting the use of digital financial services to allow for fast, low-cost and transparent financial transactions.

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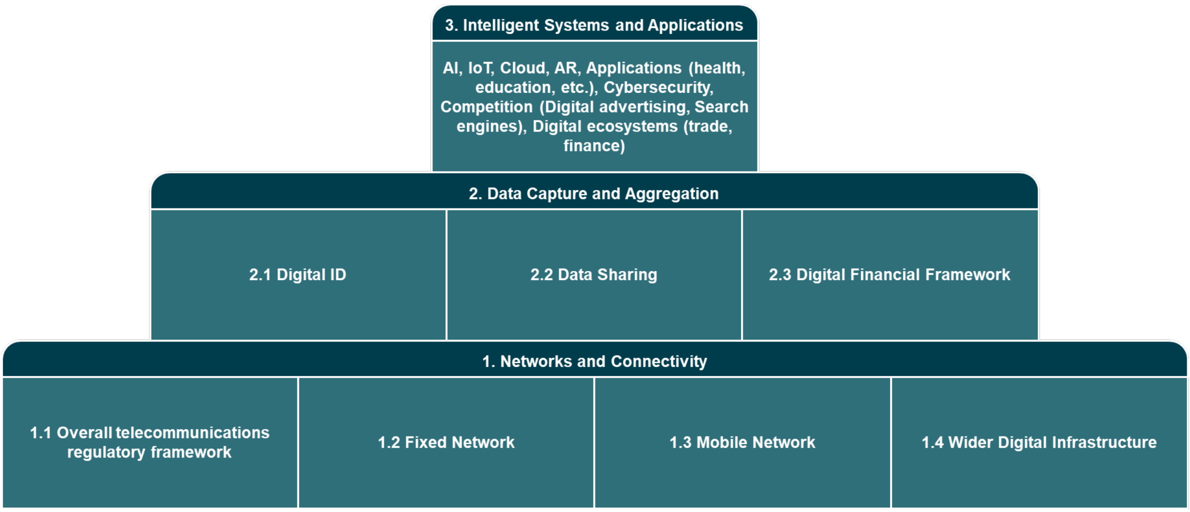
5 This framework is focused on the digital economy and digital policy making. Clearly, all the layers in this framework also rely on a strong foundational layer, for example related to property rights, the rule of law, high-quality and low-cost energy infrastructure, and so on. The foundational layer is beyond the scope of this framework.

6 Those who are unable to access digital IDs can be at a huge disadvantage when all essential systems become reliant on digital IDs. This often includes non-citizens and other marginalized groups that cannot readily prove their identity, especially in LMIACs

Pillar 3: **Intelligent Systems and Applications**, focuses on policies to support and unlock the full potential of next-generation digital technologies, including cybersecurity[7]. By enabling efficient digital service delivery and driving productivity, these systems underpin the economic and societal gains of the digital era.

These pillars are summarised below in Figure 1.

Figure 1 The pillars of comprehensive digital policy



A key aim of this framework is to support countries in achieving the UN Sustainable Development Goals (SDGs). Digital transformation is not only a driver of economic growth and innovation but also an enabler of broader development objectives such as quality education (SDG 4), gender equality (SDG 5), decent work and economic growth (SDG 8), industry, innovation and infrastructure (SDG 9), and reduced inequalities (SDG 10).

The framework is also aligned with the UNDP Inclusive Whole-of-Society Digital Transformation Framework. This serves as a comprehensive guide for countries striving to achieve inclusive digital transformation. It identifies key domains and areas where collaboration across society is essential to ensure that digital transformation is both inclusive and effective and is grounded in the principle that digital transformation must be thoughtfully designed and implemented with a focus on people and human rights.

The Digital Policy Framework for the Arab States is thus strategically aligned with other relevant global initiatives and frameworks, such as the Digital for Sustainable Development (D4SD) initiative[8], Digital Public Infrastructure (DPI) principles, and the Whole-of-Society

7 Though cybersecurity is shown as part of a separate pillar 3, it is important to note that this has been done from the aspect of grouping together various foundational and next-generation digital components that are cross-cutting in nature and serve as enablers for intelligent digital systems and applications.

8 The D4SD initiative serves as a regional engagement platform to drive sustainable, inclusive, and catalytic digital transformation across the Arab States.

Digital Transformation[9] approach. Accordingly, the pillars in this framework reflects these ambitions of these frameworks.

The policies are arranged around a three-pillar hierarchy[10]. The sub-pillars help translate these goals into actionable areas. For example, Pillar 1.1 supports SDG 9 through enabling regulation; 1.2 and 1.3 promote equitable access to connectivity (SDG 10); 1.4 supports cross-border integration and sustainable industry (SDGs 8 and 9); 2.1 fosters inclusion and identity for all (SDG 16); 2.2 strengthens government capability and transparency (SDG 16); and 2.3 supports financial inclusion and economic participation (SDGs 1 and 8). [11] By structuring policy recommendations around these interconnected layers, the framework offers practical guidance for countries seeking to embed digital development as a foundational component of their SDG strategies.

2.1 The remainder of this document

The framework addresses each sub-pillar in turn and provides guidance in four key areas:

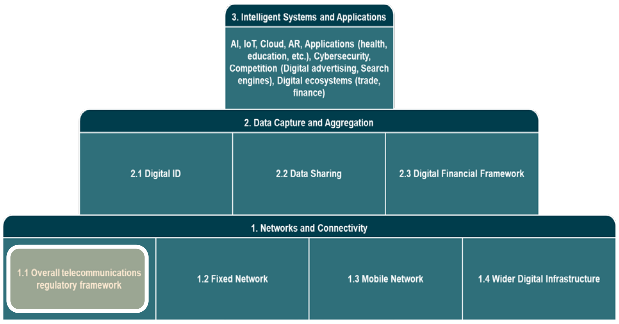
- **Role in Digital Transformation:** The role played by that sub-pillar in supporting digital transformation.
- **Indicators:** Metrics which can be used to assess a jurisdiction's development against various aspects of that sub-pillar. For example, Sub-Pillar 1.2 identifies indicators which can be used to assess availability of high-speed, fixed broadband infrastructure.
- **Digital Maturity Parameters:** Indicative parameters for determining a country's level of digital maturity against these indicators (i.e., identifying whether, against the selected indicators, a country is at a low, moderate or advanced level of development).
- **Policy Measures:** Examples of policy measures which might be appropriate for countries looking to move to the next level of digital maturity in that sub-pillar, the circumstances in which these can be appropriate, how policies are reflected in other DPFs and examples of similar policies which have been introduced elsewhere (with links to where more information on these policies is available). In this regard, it is important to note there are likely to be some overlaps between policies for each sub-pillar. For example, policies to enhance the overall telecommunications regulatory framework will also support fixed and mobile network connectivity.

[9] The Whole-of-Society framework serves as a practical tool for guiding national digital transformation efforts, offering a structured approach to identifying, organizing, and prioritizing digital initiatives. This framework ensures that these efforts are aligned with the SDGs and tailored to the specific development objectives of each country. For more details, refer to: https://www.undp.org/sites/g/files/zskgke326/files/2023-11/%5Bconcept%20note%5D%20digital%20transformation%20framework.pdf

[10] Pillar 1 focuses on providing inclusive and resilient digital infrastructure; Pillar 2 focuses on enabling secure and interoperable public services through foundational DPI building blocks; and Pillar 3 supports advanced systems that can power improvements in vertical sectors such as healthcare, education, and economic inclusion.

[11] The attainment of SDGs through the actions and interventions from the frameworks' sub-pillars will be similar in example to that of the UNDP's SDG Digital Acceleration Agenda, where we found that 70% of SDG targets directly or indirectly can be improved by the use of digital technologies.

3 Pillar 1.1: Overall Telecommunications Regulatory and Policy Framework



This sub-pillar and associated policies refer to the importance of jurisdictions having in place an overall telecommunications regulatory and policy framework that supports investment and sustainable competition in the sector, wherever that is feasible. It therefore encompasses various elements that collectively aim to create an enabling environment for investment, promote sustainable competition, and ensure the inclusive and sustainable growth of the telecommunications sector.[12]

3.1 Role of the telecommunications regulatory and policy framework

3.1.1 Telecommunication regulatory and policy framework in LMIACs

The telecommunications sector's overall regulatory and policy framework plays a foundational role in shaping digital development in low- and middle-income Arab countries (LMIACs). It defines the environment in which telecommunications markets operate, investment decisions are made, and digital services are delivered. A stable, transparent, and coordinated framework is essential to unlock the economic and social benefits of digital connectivity.

Critically, an effective framework requires coordination across government to ensure that telecommunications policy supports broader social development goals. Strategic planning, such as digital transformation strategies, provides direction for both public and private sector investment, while clarifying roles, targets and timelines. Similarly, decisions on taxation and fiscal policy need to reflect the importance of the telecommunications sector as an enabler of economic growth, whereby specific taxes or duties, such as levies on services or infrastructure, can raise costs and reduce affordability, especially where they go beyond recovering the costs of regulation and are used to contribute to a government's overall fiscal position.

Alongside these elements, a clear and independent regulatory structure can ensure that rules are applied consistently and in the public interest. Regulatory authorities that operate at arm's length from government and industry can make technically sound decisions, protect consumers and promote competition; whilst still having regard to government policy objectives. Their mandate often includes overseeing licensing, managing spectrum, designing, imposing and monitoring proportionate obligations to promote sustainable competition, enforcing quality of service standards, and resolving disputes. Where regulators

12 As set out in the preceding section, this excludes foundational-level policies that go beyond the digital sector.

are empowered, well-resourced, and transparent, they can support healthy market dynamics and drive investment. Independence and clarity of purpose help shield regulatory decisions from political or commercial pressure, ensuring that outcomes serve the broader public good.

Together, these elements form the foundation of an enabling environment for connectivity and digital participation, supporting infrastructure rollout and the development of digital services. As LMIACs seek to expand digital inclusion and competitiveness, ensuring their overall regulatory and policy framework is fit for purpose is, therefore, a critical step towards building a resilient and inclusive digital future.

3.1.2 The role of the telecommunications regulatory and policy framework in a nation's digital development

The role and priority given to the telecommunications regulatory and policy framework evolves as a country progresses through different stages of digital development. Indeed, it often mirrors the development of the connectivity infrastructure in other parts of pillar 1. In lower-income contexts, especially where sector reform to date has been limited, the immediate policy focus is often on expanding access to connectivity infrastructure. At this stage, simple, transparent rules and the establishment of a credible, independent regulator, with clear responsibility for licensing and ensuring the availability of sufficient spectrum, on reasonable terms and conditions, are key to enabling initial market entry and private investment in networks.

As countries' digital economies begin to mature, a more developed and coordinated policy environment becomes essential to support network expansion, promote competition, and safeguard consumer interests. For example, this could include enhancing the mandate and capacity of regulators, improving clarity on rights of way and infrastructure sharing, and aligning telecommunications policy with broader digital strategies. Effective fiscal policies also become increasingly important, with careful attention needed to avoid sector-specific taxes that could undermine affordability or deter investment.

In the most advanced and digitally mature economies, the role of the regulatory and policy framework continues to deepen, as regulators face the challenge of improving outcomes for end users whilst maintaining incentives which create growth in digital markets. For example, emphasis may shift toward ensuring high quality of service, advancing universal access, and fostering innovation and competition. This can include the introduction of forward-looking spectrum policies, targeted subsidies for rural or marginalised areas, and enhanced coordination across parts of government to embed digital priorities into education, health, and economic planning. Regulatory frameworks at this stage must also address emerging challenges such as cybersecurity, data governance, and convergence between telecommunications and digital services. As with digitally mature economies, the imperative for growing and less mature digital economies also requires them to address similar challenges around cybersecurity and data governance. These are foundational to setting up a strong communications sector and laying the groundwork for interoperable and inclusive digital frameworks and policies.

Across all stages, the strength and adaptability of the regulatory and policy framework play critical roles in shaping the pace, direction, and inclusiveness of digital development. A transparent, coherent and enabling environment helps to mobilise investment, promote efficient markets, and ensure that the benefits of connectivity reach all segments of society as a country's digital economy matures.

3.2 Telecommunications Regulatory and Policy Framework Development Indicators

Capturing, in a quantitative indicator, the "strength" of a country's regulatory and policy framework is challenging. This is because of the broad nature of this sub-pillar, together with the fact that country context plays a central role in shaping the telecommunications regulatory and policy framework. Nevertheless, the quality of the regulatory and policy framework is tracked through the score a country's national regulator is given on the ITU ICT Regulatory Tracker Index. This index combines four regulatory pillars (Regulatory Authority, Regulatory Mandate, Regulatory Regime, and Competition Framework), with a total of 50 individual indicators. Each country receives a score from 0 to 100, based on the cumulative performance across all 50 indicators.

In addition, it can also be useful for policy makers to track sector outcomes as a way of monitoring progress and digital maturity. For example, these could include the size of the digital economy (for example measured by the size or development of the Information and Communication Technology sector[13], and internet penetration). Whilst such indicators will be affected by policy measures across many of the pillars and sub-pillars covered in this framework, they can be useful to indicate the digital developmental context in which the regulatory and policy framework sits, and therefore how advanced this framework should be.

13 The OECD defines this sector as manufacture of computer, electronic and optical products; and information and communication (publishing and broadcasting industries, telecommunications and computer programming, and information service activities).

Table 1 Regulatory and Policy Framework Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Quality	ITU ICT Regulatory Tracker	Regulatory Tracker Score	<70	70-85	>85	ICT Regulatory Tracker 2024https://www.itu.int/pub/D-IND-ICT_MDD-2024-3/en
Context	ITU ICT Development Tracker Index	IDI Score	<70	70-85	>85	ICT Development Index 2024
Context	Size of digital economy	% of GDP accounted for by digital activity	<3%	3%-5%	>5%	National Data[14]
Context	Internet penetration rate	% of individuals using the internet	<65%	65-85%	>85%	World Bank Indicators

Source: Frontier Economics

14 This can be measured in a range of ways, with countries adopting varying measures. The OECD has a consistent measure of ICT value added (%GDP) [ICT value added | OECD]

3.3 Policy levers

A country's policy approach should depend on its existing level of digital development.

In countries at the beginning of their digital journey, policy makers should focus on establishing foundational elements of an enabling regulatory environment. This includes building an independent, well-resourced regulator, reviewing any tax and levy regimes that may act as barriers to investment, and setting out a coordinated digital strategy that clarifies roles, targets, and timelines.

As a country's digital sector begins to mature, the emphasis will shift toward more advanced policy frameworks. These frameworks should promote innovation and competition, whilst safeguarding consumer interests and ensuring effective coordination across government. This may include conducting regular market reviews to identify competition issues, developing forward-looking regulatory tools, and introducing flexible spectrum and licensing regimes.

Table 2 Regulatory and Policy Framework Policy Levers to Increase Digital Development

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Ensuring an appropriately resourced, independent regulatory authority is in place, with sufficient decision-making powers. ■ Ensuring that sector-specific taxation does not constitute a barrier to development. ■ Developing a National Digital Strategy, with clear roles, responsibilities and actions. ■ Ensuring the licensing framework is fit for purpose, with clear rights and obligations for all parties.
Shifting from moderate to advanced levels of development	■ Ensuring a regulatory focus on promoting sustainable competition alongside investment, with proportionate ex-ante regulation. ■ Ensuring that there are clear roles and clarity between different institutions, promoting regulatory transparency across the broader digital sector. ■ Implementing regulatory frameworks which promote innovation, while balancing risks.

Source: Frontier Economics

Table 2 illustrates typical policy levers which can be appropriate at each level of digital development, noting that notwithstanding this, policy makers should undertake detailed market studies before imposing new policies or obligations on providers.

3.3.1 Policies for countries shifting from low to moderate levels of digital development

Ensuring an appropriately resourced, independent regulatory authority is in place, with sufficient decision-making powers.

Regulators should be established as independent institutions, with clearly defined mandates, decision-making autonomy, and adequate resources. This includes not only legal and operational independence, but also financial independence. Where this is not yet the case, governments should introduce reforms to separate the regulatory authority from political or commercial influence. This independence helps to ensure technically sound decision-making, build investor confidence, and protect consumers. Industry-funded models (where costs are recovered through licence fees or levies from regulated entities, rather than government funding through taxation) can support greater continuity and impartiality.

An independent body also helps to avoid regulatory capture[15], reduces the risk of short-term political interference, and increases transparency and trust in public decision-making. This is particularly important in contexts where early private investment is needed to complement any public infrastructure funding.

A strong regulator will typically oversee, among other matters, licensing, spectrum management, competition enforcement, and consumer protection.

This policy is highlighted in the following DPFs:

- **Digital Regulation for Digital Transformation and Access for All (ITU, 2023):** Highlights that regulators should be both structurally and financially independent, with industry-funded models reducing risk of political interference and enhancing long-term planning.[16]
- **Framing Policies for the Digital Economy (NUS, 2018):** Emphasises the need for regulators to transition from static rule enforcement to proactive enablers of innovation and market development.[17]

This policy is observed in the following country examples:

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15 A situation where regulatory agencies disproportionately advance industry interests to the detriment of the wider public.

16 P. 5

17 P.15

- **Saudi Arabia's Communications, Space and Technology Commission (CST):** Operates as an independent, well-resourced regulator with a broad mandate over telecommunications and digital services.[18]

- **Singapore's Infocomm Media Development Authority (IMDA):** A consolidated regulator (which oversees multiple sectors, which were previously managed by two now-merged regulators) with a clear mandate, overseeing multiple sectors and empowered to manage licensing, spectrum allocation and cross-sector policy consistency.[19]

- **Oman's Telecommunications Regulatory Authority (TRA):** Operates under an industry-funded model, collecting fees from licensed entities, which supports both its operational independence and long-term financial sustainability. It has strong enforcement powers that enable it to issue binding decisions and manage spectrum allocations and assignments efficiently.[20]

Ensuring that sector-specific taxation does not constitute a barrier to development

Taxes or duties that go beyond the cost of regulation can raise barriers to investment, reduce affordability for consumers, and undermine digital inclusion. For example, taxes such as levies on handsets / devices, SIM cards, or infrastructure, can discourage network rollout, particularly in remote or low-income areas.[21] Such taxes are also often regressive, hitting lower-income populations hardest and reducing the affordability of internet access. In countries seeking to expand basic connectivity, reducing or eliminating these levies can be one of the most immediate steps to encourage adoption and accelerate network investment.

This policy lever is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Argues for promoting private investment by offering cost-reducing incentives, such as competitive tendering for partial tax exemptions.[22]

- **Digital Economy Kit (Oxford/ITU, 2020):** highlights that economic policy should focus on objectives like data flows and interoperability, rather than solely on tax revenue.[23]

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18 Implementing Regulations of the Telecommunications and Information Technology Law -.pdf

19 Who We Are | IMDA

20 Telecommunications Regulatory Authority

21 Spectrum fees can be considered as a type of levy, especially when they are used to support government revenue generation. Spectrum policy is explored separately in pillar 1.3.

22 P. 9

23 P. 33

This policy lever has been implemented in the following country examples:

- **Oman's 2025 royalty rate standardisation:** Oman's TRA has unified royalty rates across all telecommunications services, resulting in a reduction in mobile royalty rates from 12% to 10% of revenue,[24] although it still taxes the telecommunications disproportionately higher than other sectors, which ideally needs to be examined.

- **No Specific EU-wide telecommunications tax:** The EU encourages member states to avoid distortionary telecommunications taxes and aligns fiscal incentives with broader digital targets set in the Digital Decade 2030 programme. Substantial support is channelled through instruments such as the Connecting Europe Facility and the Recovery and Resilience Facility, with a focus on ensuring that taxation policies do not disincentivise private sector investment or restrict access to connectivity in underserved areas[25]

Developing a National Digital Strategy, with clear roles, responsibilities and actions

Countries at early stages of development should develop a clear national digital strategy which considers the overall strategy for developing the country's connectivity infrastructure, and systems and infrastructure to support digital trust, identity and payments. Such strategies help align efforts across government, clarify institutional mandates, and provide direction for public and private investment. A robust strategy includes measurable targets for connectivity, adoption, and service affordability, with defined review timelines and coordination between central and local agencies.

Modern digital strategies increasingly address digital inclusion, ensuring affordable and secure access for underserved groups, and prioritise the development of DPI such as Digital ID, e-payments, interoperable data systems, and the increasingly default nature of digital public service delivery. Such elements are essential to ensure broad and equitable access to digital services.

Strategic roadmaps should also cover enabling legislation and regulation, including data privacy and protection, cybersecurity, and infrastructure access. Without such planning, efforts risk being fragmented, duplicative, or misaligned with national priorities. A well-crafted strategy promotes policy coherence, attracts investment, and creates the foundation for inclusive, sustainable digital growth.

In this context, the UNDP Digital Transformation Framework and the Digital Readiness Assessment (DRA) tool serves as a practical tool for guiding national digital transformation efforts, offering a structured approach to identifying, organizing, and prioritising digital initiatives. These ensure that these efforts are aligned with the SDGs and tailored to the specific development objectives of each country. Its adaptability allows for customisation to meet the unique needs and priorities of different nations. Balancing trade-offs and addressing

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24 Oman's TRA Standardises Telecom Royalty Rate at 10% to Boost Operators' Earnings

25 Digital Decade - Policy programme | Shaping Europe's digital future

priorities, it keeps sustainable development and digital inclusion at the forefront of all digital initiatives. [26]

The overall national digital strategy will ensure that telecommunications sector policy (such as national broadband plans (pillar 1.2), or spectrum policy (pillar 1.3) are aligned and supportive of other aspects of digital policy (whether digital public infrastructure (pillar 2) or wider digital policies such as AI, cyber security policy, (pillar 3).

This policy is highlighted in the following DPFs:

- **Arab Digital Economy Vision (League of Arab States, 2020):** Provides a region-wide digital strategy framework, covering digital infrastructure, public services, and digital economy development, with recommended governance structures and performance indicators for national plans.[27]
- **DE4LAC Jamaica (World Bank, 2024):** Recommends a consolidated national strategy to reduce fragmentation across agencies and includes a roadmap for legal and institutional reform, DPI, and cross-sector coordination.[28]
- **Digital Economy Kit (Oxford/ITU, 2020):** Emphasises the importance of national strategies that include infrastructure, skills, and services, and recommends integrated planning for DPI and inclusion targets.[29]

This policy has been implemented in the following country examples:

- **Oman's National Program for the Digital Economy:** Launched in 2021 by the Ministry of Transport, Communications and Information Technology (MTCIT) with OMR170 million investment focused on upgrading digital infrastructure, digitalising 8% of key government sectors and accelerating 5G nationwide coverage.[30]
- **The Digital India Mission:** Launched in 2015, the program encompassed flagship initiatives, like the BharatNet Broadband Plan and Aadhaar, and is guided by a comprehensive roadmap for public service digitalisation and strengthened by pillars dedicated to digital literacy and workforce upskilling. It also references DPI (e.g. Aadhaar Digital ID, UPI payments, DigiLocker), and cross-ministry coordination. Implementation spans central and state governments with dedicated funding. [31]

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26 UNDP Digital Transformation Framework - https://www.undp.org/digital/transformations; Digital Readiness Assessment - https://www.undp.org/malawi/publications/digital-readiness-assessment-dra

27 P. 117

28 P. 22 and P. 57

29 P. 4

30 National Digital Economy Program

31 Initiatives - Digital India | Leading the transformation in India for ease of living and digital economy | MeitY, Government of India

- **Singapore's Smart Nation Strategy:** Integrates infrastructure, data, identity, and digital inclusion goals. It features centralised governance under the Smart Nation and Digital Government Office and links strategy to public sector digital services, cloud procurement, and national AI rollout. [32] [33]

Ensuring a fit for purpose licensing framework, with clear rights and obligations for all parties

Policy makers (including, in this context, national regulators) should ensure that licensing regimes provide a clear, transparent framework that sets out the rights and obligations of licensees. Such frameworks reduce uncertainty for investors, clarify regulatory expectations, and promote a level playing field. Where possible, licensing frameworks should be technology-neutral, allowing licensees to use the most efficient technologies to deliver services. These frameworks should have clear conditions for renewal or revocation, fee schedules, and compliance mechanisms. They will typically also be supported by secondary instruments such as regulations, or guidelines on specific topics, thus enabling an authority to ensure specific policy measures can be kept up to date as new challenges or issues arise over the duration of a licence.[34] By reducing ambiguity and administrative burden, clear licensing regimes help to facilitate market entry and long-term investment.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends that governments streamline licence approvals and review and update rights-of-way policies.[35]

- **Going Digital Integrated Policy Framework (OECD, 2020):** Encourages clear and efficient licensing policies to reduce administrative complexity and promote infrastructure rollout.[36]

This policy has been implemented in the following country examples:

- **Singapore:** The IMDA uses a single-licence framework with defined rights and obligations for Facilities-Based Operators (FBOs) and Service-Based Operators (SBOs).[37]

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32 Tech Stacks: The invisible tech backbone driving Singapore's Smart Nation success | Government Technology Agency (GovTech)

33 Building an accessible Smart Nation: Inclusive design in Singapore's digital services | Government Technology Agency (GovTech)

34 This is because it is typically more practical to update secondary instruments, rather than a licence document.

35 P. 56

36 P. 7

37 Full Competition in SG's Telecommunication Sector | IMDA

- **India:** Introduced a unified licensing regime, allowing operators to offer multiple types of telecommunications services, under its National Digital Communications Policy to simplify entry and support service neutrality.[38]

- **Qatar:** The Communications Regulatory Authority (CRA) has adopted a technology-neutral licensing framework, supported by detailed instruments including reference offers, compliance schedules and online submissions to streamline the licensing process.[39]

3.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Ensuring a regulatory focus on promoting sustainable competition alongside investment, with proportionate ex-ante regulation

Regulators should conduct regular reviews of market conditions to assess competition. These reviews should be based on clear, transparent guidelines and procedures published by the independent regulatory authority.

Where operators are found to hold significant market power (SMP), proportionate, asymmetric obligations may be introduced to ensure market outcomes are more consistent with those of a competitive environment and to prevent those SMP operators from leveraging market dominance to limit innovation or restrict access for new entrants. By ensuring remedies are proportionate, regulatory authorities ensure the least cost and least intrusive measures possible to remedy the identified market failure are identified. Typically, such remedies should be focused at the most upstream level of the value chain necessary to remedy the market failure – with remedies only imposed on retail markets where upstream remedies alone are not sufficient.

Ex-ante tools are particularly important in fixed broadband markets where infrastructure-based competition is limited due to high fixed costs and natural monopoly characteristics. [40]

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends conducting market analysis to define SMP and impose cost-based wholesale access obligations.[41]

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38 NDCP 2018 - Press Release: Press Information Bureau

39 DLA Piper Telecommunications Laws of the World - Telecoms Regulatory and Legal Insight

40 This is considered again in sub-pillar 1.2.

41 P. 22

- **Going Digital Integrated Policy Framework (OECD, 2020):** Emphasises the role of regular market analysis in aligning regulatory interventions with changing market dynamics.[42]

This policy has been implemented in the following country examples:

The EU's Electronic Communications Code (EECC): Requires national authorities to undertake periodic market reviews and enables regulators to impose a range of remedies where competition is not effective.[43]

Singapore's IMDA: Conducts regular reviews of telecom and digital markets. It publishes a quarterly Quality of Service (QoS) report and imposes ex-ante obligations on designated DSPs (dominant service providers), including wholesale access obligations, price controls and an obligation for these providers to publish Reference Offers, setting out the terms and conditions on which they offer wholesale services[44] [45]

Ensuring clear roles and clarity between different institutions, promoting regulatory transparency across the broader digital sector

As digital markets become more complex, and the policy framework develops, it is important that institutional roles are clearly defined to avoid overlap, duplication, or regulatory gaps. This includes clarifying responsibilities between telecommunications regulators, spectrum authorities, and other public digital policy bodies, including, for example, on data protection, online safety or cybersecurity. Improved coordination ensures that policy decisions are consistent, transparent, and supportive of broader digital transformation goals. It also avoids conflicts between infrastructure goals, consumer protection policies, and innovation strategies. In advanced regulatory environments, institutional cooperation should be formalised through memoranda of understanding, joint taskforces, or integrated planning mechanisms.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends modernising the legal and institutional framework to focus on data services rather than legacy voice systems. It calls for clearer institutional roles between the Spectrum Management Authority (SMA), Office of Utilities Regulation (OUR), and Universal Service Fund (USF).[46]

42 P. 42

43 European Electronic Communications Code | EUR-Lex

44 Quality of Service Reports

45 IMDA Public Consultation on RIO Review

46 P. 22, P. 31, and P. 57

- **Going Digital Integrated Policy Framework (OECD, 2020):** Emphasises the value of cross-government coordination and clear accountability for digital development.[47]

- **Digital Regulation for Digital Transformation and Access for All (ITU, 2023):** Advocates for institutional clarity to improve investment outcomes.[48]

This policy has been implemented in the following country examples:

- **Oman's TRA**: Oversees regulation of telecommunications and manages coordination with other ICT policy arms, avoiding duplication and enabling coherent oversight.

- **Saudi Arabia's CST:** Oversees regulation and development of the digital and telecommunications sector, coordinating with MCIT and other regulatory authorities on sectoral development programmes so that they align with Vision 2030 and national digital transformation goals.[49]

Implementing regulatory frameworks which promote innovation, while balancing risks

Regulatory frameworks should evolve to address convergence between telecommunications and digital services, and to foster innovation. This may include:

- technology-neutral licensing and adaptive spectrum frameworks, to allow service providers to use the most efficient technologies;
- horizon scanning and engagement with industry, to ensure an appropriate level of regulation to enable and manage technological growth; and
- the use of regulatory sandboxes, to provide a space for innovation with controlled oversight.

These tools help regulators keep pace with rapid technological changes, such as new generations of mobile services, edge computing, and AI-enabled services, and allow for agile policymaking in the face of uncertainty.

This policy is highlighted in the following DPFs:

- **Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023):** Supports technology-neutral, flexible legal frameworks and forward-looking regulation that enables innovation.[50]

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47 P. 11

48 P. 5

49 Saudi Arabia - Information and Communications Technology

50 P. 10

- **Going Digital Integrated Policy Framework (OECD, 2020):** Promotes adaptive regulatory frameworks that keep pace with emerging technologies and prevent sector-specific rules from creating unnecessary barriers to innovation.[51]

- **Framing Policies for the Digital Economy (NUS, 2018):** Recommends regulatory capacity building to prepare for next-generation service convergence.[52]

This policy has been implemented in the following country examples:

- **India's Telecommunications Regulatory Authority of India (TRAI):** Pilots a technology-neutral licensing regime and is exploring sandbox approaches for 5G use cases.[53]

- **Saudi's CST Emerging Technology Regulatory Sandbox**: Backed by grants and includes schemes for cloud computing, IoT, and AI, allowing new technologies to be tested in a controlled environment.[54]

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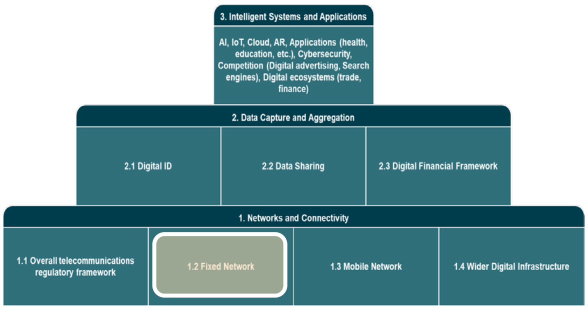
51 P. 45

52 P. 48

53 Cullen International

54 Communications, Space & Technology Regulatory Sandbox

4 Pillar 1.2 Fixed Connectivity Infrastructure



This sub-pillar and associated policies refer to the strategic development and encouragement of investment in fixed telecommunications infrastructure, particularly fibre-optic networks. It encompasses various elements that collectively aim to expand, enhance, and ensure equitable access to high-speed,[55] reliable broadband connectivity.

4.1 Role of Fixed Connectivity Infrastructure

4.1.1 Fixed connectivity infrastructure in LMIACs

Fixed connectivity infrastructure is a critical enabler of economic and social development for LMIACs. While mobile networks have rapidly expanded access to communication, fixed connectivity such as fibre broadband can complement such networks, offering reliable, high-capacity option to support digital participation at scale. High-speed fixed connectivity can support the stable and consistent internet services that are essential for both households and businesses to access and benefit from digital opportunities; with more advanced digital economies benefitting from almost universal availability of both high-speed fixed and mobile connectivity.

For households, high-speed fixed networks can support seamless access to education, healthcare, and digital financial services. Businesses, particularly small and medium sized enterprises, also benefit from high-speed fixed networks to improve efficiency, reach new markets, and adopt digital tools. For instance, applications like cloud computing, video conferencing, and digital payment systems often require the capacity and reliability that fixed networks provide. This infrastructure also supports broader digital transformation across sectors, helping LMIACs integrate more deeply into regional and global value chains.

Indeed, whilst fixed and mobile networks and services can often be complementary, fixed connectivity also supports other technologies, including mobile and wireless networks, by serving as essential backhaul infrastructure. This is explored further in sub pillar 1.4.

While the investment required for fixed infrastructure can be significant, its long-term benefits make it a foundational element of a resilient and inclusive digital ecosystem. It supports productivity, innovation, and long-term growth across the economy.

55 Where high-speed refers specifically to speeds exceeding those which xDSL infrastructure is able to deliver.

4.1.2 The role of fixed connectivity infrastructure in a nation's digital development

The role and priority given to fixed connectivity infrastructure varies significantly depending on a country's economic development. In low-income countries, early connectivity efforts often focus on mobile networks, which can be deployed rapidly and cost effectively to expand basic access. Mobile technologies offer an accessible entry point to digital services, helping to bridge the initial connectivity gap and build demand for digital inclusion.

As countries begin to transition from low to middle income status, attention[56] often switches to investment in high-speed fixed infrastructure to complement mobile networks and support advanced digital use cases. The initial focus for such connectivity typically centres on urban and high economic activity areas, where user density, income levels, and business demand can justify the investment and generate early returns. In these areas there may also be more existing copper and passive infrastructure which can be leveraged for the roll out of high-speed networks. This urban-first approach helps demonstrate the value of high-speed fixed networks and lays the groundwork for broader rollout.

Over time, as digital adoption deepens and the need for inclusive growth becomes more pressing, focus will further shift towards expanding high-speed connectivity to underserved communities. This includes investing in rural areas, low-income regions, and informal settlements, often through targeted public funding, policy incentives, and innovative delivery models. In more advanced middle income or emerging high-income contexts, the emphasis increasingly moves toward upgrading infrastructure quality, enhancing network resilience, and ensuring equitable access to high-speed, high-quality internet across all population segments through improved competition.

4.2 Fixed Connectivity Infrastructure Development Indicators

A set of practical indicators can be used to measure progress towards these objectives. These include the percentage of households covered by high-speed fixed broadband networks (coverage), and the percentage of households that subscribe (penetration). Performance can also be tracked through average download speeds, which reflect network quality. Lastly, the availability of speed test and coverage mapping data is important for evaluating the evidence base available to regulators and policy makers.

Country context plays a central role in interpreting a nation's digital advancement. Digitally less advanced countries typically experience lower fixed broadband coverage, especially in non-urban or rural areas, and often have limited access to high-capacity technologies such as FTTP. This may reflect a combination of geographic barriers, economic constraints, and

[56] It is also important to note that many LMICs are now 'mobile first'. In that kind of environment, there could be different priorities where countries could choose to pay attention first. In many more mature developing countries like Nigeria and India, most people have cell phone access but not fixed broadband access, which has proven sufficient for a lot of digital transformation efforts.

weaker regulatory or investment environments. In contrast, more digitally mature countries often achieve near-universal fixed coverage, including in rural regions. They may also have more competitive retail broadband markets and robust public data on infrastructure quality and coverage. When considering the development of fixed connectivity networks, it is important to consider the geography of a country: smaller jurisdictions with a more urban-based population will naturally be able to achieve roll-out faster.

Table 3 Fixed Connectivity Infrastructure Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Coverage	Fibre Broadband Coverage (small, urban state)	% of households covered by a fibre broadband network (+/-10% for city states/larger countries with significant rural populations)	<35%	35-70%	>70%	National Data + FTTH Council
Penetration	Fibre Broadband Penetration (small, urban state)	% of households who subscribe to a fibre broadband service (+/-10% for city states/larger countries with significant rural populations)	<25%	25-50%	>50%	FTTH Council
Performance	Speed	Average fixed Download Speeds (Mbps)	<60 Mbps	60–125 Mbps	>125 Mbps	Ookla Speedtest Global Index

Source: Frontier Economics

4.3 Policy levers

A country's policy approach should depend on its existing level of digital development.

In countries with basic levels of digital development, which are hoping to shift to moderate levels, policy makers should set targets for the expansion of fibre broadband networks in urban and semi-urban areas. To meet these targets, it can then be important to incentivise investment in fibre infrastructure by lowering roll-out costs and creating a stable regulatory environment, thus supporting the private sector to invest where it is feasible.

In countries with moderate levels of development, the focus should shift toward closing remaining coverage gaps and ensuring high-quality, competitive broadband access, whether through fibre or, if necessary, other technologies capable of delivering high-speed access at lower cost. This could include leveraging Universal Service Funding in uneconomic areas and promoting competitive wholesale markets through open-access frameworks to further drive improvements in affordability and customer service. We note that whilst Universal Service Funding is a policy lever for expanding coverage (for all stages of development), its effectiveness has been mixed in many markets. This has largely been due to a lack of transparency, ineffective distribution of funds and inappropriate governance of the schemes.

Table 4 Fixed Connectivity Policy Levers to Increase Digital Development

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ National broadband planning and digital strategy ■ Public investment and financial incentives ■ Passive infrastructure sharing ■ Reducing costs of network rollout ■ Regulatory frameworks to incentivise investment
Shifting from moderate to advanced levels of development	■ Extending coverage to uneconomic areas through USF ■ Promoting competition and active infrastructure sharing ■ Enforcing competition through market remedies, focused on access to bottleneck infrastructure.

Source: Frontier Economics

Table 4 illustrates which policy levers are appropriate at each level of digital development, although countries should ensure that all policies are updated and fit-for-purpose (e.g. increasing fixed connectivity targets) and undertake detailed market studies before imposing new policies or obligations on providers. The remainder of this section explores these policies in greater detail, providing examples of high-level direction from international frameworks and specific policies adopted by individual countries.

4.3.1 Policies for countries shifting from basic to moderate levels of digital development

National broadband planning and digital strategy

Governments and regulators should develop comprehensive national broadband plans with speed, technology, and coverage targets tailored to their digital transformation objectives. These plans typically include defined targets and benchmarks: for instance, specific coverage targets by a certain date. To ensure that these goals are met, plans often incorporate mechanisms for monitoring progress, with systems in place for evaluation and adjustments over time.

This policy lever is highlighted in the following DPF:

- **Arab Digital Economy Vision (League of Arab States, 2020) (1):** The report notes that "*This strategic objective aims to develop the framework for national broadband plans to set the requirements in terms of speed, technology, and coverage together with a detailed time plan to ensure that the goal of digital transformation in each Arab state based on its current status, is reached*. … *The main objectives are to increase broadband capacity and speed, increase broadband coverage to better connect remote areas and improve the resilience of existing broadband infrastructure*."[57]

This policy has been implemented in the following country examples:

- **The EU's Digital Decade Policy Programme 2030:** Sets targets for 'Secure and Sustainable Digital Infrastructures' including 100% gigabit connectivity.[58]
- **Oman's National Broadband Strategy**: Aims to bridge the urban-rural digital divide through targeted subsidies and public–private projects, with priority given to underserved areas to expand high-speed connectivity, wholesale broadband access and FTTH coverage.[59]

Public investment and financial incentives

Governments may need to have more direct influence on investment where there is not a strong enough case for the private sector to invest. This may include:

- Direct government investment.

57 P. 101 and P. 116.

58 Digital Decade - Policy programme | Shaping Europe's digital future

59 ITU Workshop 28.09 – National Broadband Strategy - Yahya Al Hajri.pdf

- Tax incentives relating to infrastructure investment.
- Favourable loans and low interest financing.
- Blended finance models (combining, public with private capital (more relevant in low-income countries).
- Co-investment through public-private partnerships (PPPs); and,
- Offering providers a time-limited period of exclusivity, for example through provisions to limit overbuild.

This policy is highlighted in the following DPFs:

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** "*Investment in basic infrastructure (electricity, broadband coverage, roads, buildings, water) is required, as well as investment in sector-specific infrastructure (high-speed internet in targeted areas, service hubs, and networks). Those investments in turn call for better coordination and collaboration among development partners, notably in the field, and for the potential use of public private partnerships (PPPs)"*[60]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia's Special Economic Zones (SEZ):** Offers tax relief for fibre infrastructure investment in SEZs. This includes: 5% corporate income tax rate for 20 years, instead of 20-25%; and tax exemptions on withholding tax, VAT and customs duty. These SEZs are economic areas of high importance which will require reliable high-speed connectivity – including manufacturing centres, ports and airports.[61]

- **Singapore's Next Generation Nationwide Broadband Network:** Provided up to S$750 million in government grants to support nationwide rollout of ultra-high-speed fibre networks and involved a PPP approach, leveraging private sector innovation to optimise infrastructure development.[62]

- **Qatar's PPP Law (Law No. 12 of 2020):** Establishes a clear legal framework for private sector participation in infrastructure, enabling co-investment and risk-sharing in strategic projects[63]

- **European Investment Bank (EIB):** Supports deployment of Very High-Capacity Networks (VHCNs) by offering operators favourable loans and investment guarantees.[64]

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60 P. 18

61 Special Economic Zones

62 10Gbps Nationwide Broadband Network (10G NBN) Grant | IMDA

63 Qatar: PPP Law Published | Addleshaw Goddard LLP

64 Germany: EIB boosts high-speed internet with €350 million InvestEU-backed loan

Passive infrastructure sharing

Regulators should consider mandating passive infrastructure sharing to lower deployment costs, especially in rural and semi-urban areas. Passive infrastructure sharing includes sharing of ducts, poles, and dark fibre, including infrastructure owned by non-telecommunications providers. Other areas include 'unused radio frequency' as an option for expanding access (for example, some LMICs have leveraged TV white space to close last mile connectivity gaps.)

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** "*Access to fixed infrastructure is less widespread and is particularly weak in rural and peri-urban areas... in this regard, infrastructure sharing may be a useful tool to strengthen the network in rural areas where it is often not profitable for the private sector to develop or upgrade the infrastructure.*"[65]

- **Going Digital Integrated Policy Framework (OECD, 2020):** "*Infrastructure-sharing provisions… should reduce costs for network and service providers while enabling the development of new and innovative services…*"[66]

This policy has been implemented in the following country examples:

- **Qatari Open Access Model:** Shared use of passive infrastructure, such as ducts and poles, with all licensed telecommunications providers granted wholesale, non-discriminatory access.[67]

- **Singapore's NetLink Trust**: Provides equal access to government-owned duct and fibre infrastructure.[68]

- **Passive Infrastructure Sharing in Oman:** Regulated by the TRA under Royal Decree 30/2002, it imposes site-sharing guidelines to minimise network duplication and deployment costs.[69]

Reducing costs of network rollout

Governments and regulators should reduce barriers which may prevent expansion of fibre connectivity. For example, governments may:

65 P. 51

66 P. 8

67 CRA Opens Access to Over 4,860 km of Government Telecom Infrastructure Across Qatar

68 NetLink Trust's ICO Agreements | IMDA

69 Decisions & Regulations - TRA

- simplify rights-of-way (RoW) access to reduce administrative bottlenecks that hinder infrastructure rollout and investment;
- align telecommunications works with other public road and utility infrastructure policies (so called 'Dig Once' policies); and
- fast-track permitting processes with predictable timelines and transparent procedures.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommend that the government should streamline the process for granting licences; assess and update policies on rights-of-way; and enhance measures to foster a more competitive market environment.[70]
- **Going Digital Integrated Policy Framework (OECD, 2020):** *"Simplifying license requirements, removing regulatory uncertainty and facilitating efficient access to rights of way can help to spur investment."*[71]

This policy lever has been implemented in the following country examples:

- **The EU's Gigabit Infrastructure Act:** Reduces rollout barriers by streamlining and digitising permit procedures, enforcing faster approval timelines, enabling infrastructure sharing (e.g. ducts, rooftops) and requiring coordination of civil works. NRAs are required to submit relevant information on permits and rights of way through a single information point, which helps standardise decision making.[72]
- **India's Centralised GatiShakti Sanchar Portal:** Facilitates digital Right of Way approvals for telecommunications infrastructure, with approximately 20% of applications processed within 15 days.[73]
- **Singapore's 9-step Earthworks Process**: Establishes a standardised procedure all contractors must follow, and coordinates excavation works so that telecommunications ducts, fibre, and other utilities can be installed at the same time as other infrastructure works.[74]

Regulatory frameworks to incentivise investment

Regulators should ensure that digital infrastructure development is underpinned by mature, pro-competition regulatory frameworks to promote investment and innovation. This may

70 P. 56

71 P. 7

72 [Regulation - EU - 2024/1309 - EN - EUR-Lex]

73 [PM GatiShakti - Digital India | Leading the transformation in India for ease of living and digital economy | MeitY, Government of India]

74 [Earthworks Requirements | IMDA]

include streamlining licensing requirements to promote market entry and implementing specific regulations such as in relation to in-building wiring regulations to support fibre connectivity.

This policy is highlighted in the following DPF:

- **Digital Regulation for Digital Transformation and Access for All (ITU, 2023):** "*Investment and development of infrastructure in the digital ecosystem are directly and positively influenced by the maturity of ICT regulatory frameworks and by competition in ICT markets*."[75]

This policy has been implemented in the following example:

- **The EU's Gigabit Infrastructure Act:** Enforces mandatory fibre-readiness for new/renovated buildings.[76]

4.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Extending coverage to uneconomic areas through USO / USF

Regulators could attempt to enable coverage to be extended into uneconomic areas by subsidising roll-out, conditional on providers meeting a universal service obligation, where it is not otherwise commercially viable to do so. Obligations may include 100% household coverage, minimum broadband speed benchmarks for institutions like schools, and price controls to ensure affordability. These obligations would need to be enforced, and the use of these funds would need to be monitored to prevent the hoarding or inefficient spending which can render Universal Service policy ineffective.

This policy is highlighted in the following DPF:

- **Digital Regulation for Digital Transformation and Access for All (ITU, 2023):** "Universality targets: 100% of households have Internet access … 20Mb/s Minimum download speed at every school".[77]

This policy lever has been implemented in the following country examples:

- **Competitive USO tenders in Oman:** The TRA awards 10-year subsidies to telecommunications operators through competitive bidding to deliver essential services in unserved areas.[78]

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75 P. 10

76 Regulation - EU - 2024/1309 - EN - EUR-Lex

77 P. 19

78 USO Strategy Report

- **Saudi Universal Service Fund (USF):** Funds rural connectivity with strict rollout and service obligations for operators, and caps tariffs at national average rates to ensure affordability.[79]

- **Digital Bharat Nidhi:** Indian Government fund that supports broadband rollout in rural and underserved areas through targeted subsidies for telecommunications infrastructure.[80]

Promoting competition and wholesale access

Regulators should promote competition and encourage market-wide active infrastructure sharing. Specific policies include:

- **Symmetric Access Obligations:** In some cases (where assets are non-replicable, for example for in building wiring) regulators can consider requiring all operators to provide cost-based, non-discriminatory access to essential wholesale infrastructure (e.g. ducts, poles, dark fibre). This levels the playing field, supports new entrants, and avoids infrastructure duplication, but should be reserved for assets where SMP regulation is insufficient.

- **Promote Open Access Models:** To support investments by infrastructure operators which enable multiple service providers to use the same infrastructure to enhance retail competition and improve consumer outcomes.

- **Market Reviews and Monitoring:** To assess competition levels, identify bottlenecks, and inform future regulatory action. These reviews establish the evidence base for determining SMP status and help regulators tackle barriers to entry. This is considered further in the following policy lever.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends introducing wholesale access obligations for fibre infrastructure, regardless of SMP designation, to support infrastructure competition and reduce market entry barriers. It also notes the importance of “symmetric regulation” to prevent dominance by incumbent operators and encourage investment by new players.[81]

- **Arab Digital Economy Vision (League of Arab States, 2020):** Emphasises the need for non-discriminatory open access to core telecommunications infrastructure to increase

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79 Details of Decision on Public Portal

80 Universal Service Obligation Fund (USOF)| National Portal of India

81 P. 22, P. 23, and P. 53

retail competition. It advocates for a regulatory framework that supports infrastructure sharing, particularly in markets with limited economic incentives for network duplication.[82]

- **Framing Policies for the Digital Economy (NUS, 2018):** The report describes the approach taken in Singapore to enable incentives for investment while promoting competition. "*Singapore [… separated] the underlying broadband network of dark fibre (NetCo) which received a state subsidy, from the wholesale business (OpCo), from the retail business which is a competitive market.*"[83]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia's Open Access Regulation and Neutral Host Model:** The CST licenses neutral host operators (such as ACES-NH) to deploy shared network infrastructure with standardised designs and regulated tariffs, ensuring fair and equal access.[84]
- **The EU's EECC:** Enables regulators to mandate symmetric access to essential infrastructure.[85]

Enforcing competition through market remedies, focused on access to bottleneck infrastructure.

Regulators may choose to take more specific and direct measures to ensure, where possible, market outcomes mimic those of a more competitive market, particularly when an operator is identified as having SMP.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends imposing a reference-offer obligation on SMP operators so smaller and new entrants can access cost-based wholesale services on open-access terms.[86]

This policy lever has been implemented in the following country examples:

- **Ex-ante remedies applied to DSPs identified by the Market Definition, Designation and Dominance (MDDD) report in Saudi Arabia:** Measures imposed include wholesale access obligations, transparency requirements, price controls and functional separation.[87]

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82 P.44

83 P.16

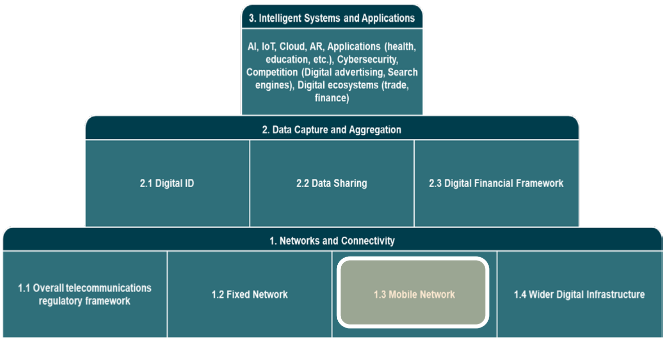
84 CITC Launching Open Access Agreements between Telecom Service Providers

85 European Electronic Communications Code | EUR-Lex Article 61 notes that "*NRAs may impose symmetric access obligations on providers of electronic communications networks where duplication of certain network elements or resources is economically inefficient or physically impracticable, and where such obligations are necessary to protect end-user interests or to promote competition*".

86 P.22

87 Public Consultations Details

5 Pillar 1.3 Mobile Connectivity Infrastructure



This sub-pillar and associated policies relate to investment in, and development of, mobile telecommunications infrastructure. It encompasses various elements that collectively grow the coverage, capabilities and access to meet demand for high-speed mobile connectivity.

5.1 Role of Mobile Connectivity Infrastructure

5.1.1 Mobile connectivity infrastructure in LMIACs

Mobile connectivity infrastructure is a vital enabler of economic and social development in LMIACs. It plays a critical role in rapidly expanding access to digital services, especially in rural and sparsely populated areas where deploying fixed infrastructure remains challenging and more costly. Mobile connectivity brings digital participation within reach for millions, often serving as the primary or only means of mass-market consumers accessing the internet. Indeed, continued improvements in technology and network densification, are enhancing network performance and capacity.

For consumers, mobile networks enable access to essential services. Mobile subscribers can access digital education, healthcare, and government services via their smartphone. As more services move online, mobile connectivity helps bridge the gap where fixed networks are unavailable or unaffordable.

Moreover, in some rural areas where access to the formal banking sector is limited, and in low-income countries where many individuals do not have bank accounts, mobile connectivity provides essential access to digital finance. This enables individuals to save, transfer, borrow and receive money securely in a way that they otherwise would not be able to.

Businesses, particularly small and medium sized enterprises, benefit from mobile connectivity in expanding market reach, enhancing productivity, and improving access digital tools. Services such as mobile payments, e-commerce, and digital communications allow businesses to operate more efficiently and participate in the broader digital economy. This infrastructure also supports economic inclusion by enabling entrepreneurship and "formalisation" of the economy (the process of transitioning from "informal economies" to economies where economic activity is integrated into regulation, tax or worker protection).

The long-term impact of mobile connectivity infrastructure in LMIACs is, therefore, significant. It enables productivity, financial and social inclusion, and broader participation in digital development. As part of a resilient and inclusive digital ecosystem, mobile networks are essential for ensuring that the benefits of digital transformation extend to all segments of society. In summary, mobile infrastructure can be an enabler of social development if combined with digital literacy and hygiene, cybersecurity, and inclusive and affordable access.

While all LMIACs now have mobile networks that offer good coverage of basic mobile data connectivity, there remain differences in the level of usage of mobile services and mobile data services between low-income and high-income countries. This includes access and usage differences along gender, urban/ rural, and age demographics which serve as big barriers to inclusive access. The high fixed cost of device ownership (relative to income) in low-income countries is a barrier for a proportion of the population. In many low-income countries APRUs are significantly lower than in higher income countries, meaning that the case for investment in network services and capacity is weaker. Low-income countries therefore have lower levels of data usage, and lower coverage of 5G and 4G, particularly in rural areas.

5.1.2 The role of mobile connectivity infrastructure in a nation's digital development

Investment in information technology and communications infrastructure has proven economic benefits, including increased productivity and employment. However, mobile connectivity plays a specific role in modern economies. In all countries, regardless of the level of digital development, it is mobile networks that consumers use to access financial, government and public services.

However, in many LMIACs at an early stage of digital development, fixed connectivity is limited in rural areas, and mobile networks are the only viable connectivity option. More generally, many LMIACs are "mobile first" countries, where the majority of the population only accesses connectivity services via mobile networks. Mobile networks therefore play particularly important role in the digital and economic development of many LMIACs for communication and access to government services and digital finance.

As countries evolve and they digitally mature, mobile networks become tools for value creation. Networks support the development and distribution of software, apps, services, and innovation across the value chain. Many vertical sectors (whether transport, retail, or entertainment) leverage mobile network and device capabilities to develop new value-added services.

At all levels of digital development policy should focus on ensuring appropriate incentives for investment; reducing costs of investment; and in low-income countries supporting consumers overcome affordability barriers for device ownership. In countries with higher levels of digital development, policy makers should maintain an emphasis on incentives for investment and cost reduction to support higher network capacity, capabilities and resilience with wider coverage of higher generation network infrastructure. More digitally mature countries should also consider policies that encourage and enable innovation using mobile technology.

5.2 Mobile Connectivity Infrastructure Development Indicators

A set of practical indicators can be used to measure progress towards these objectives. These include metrics which measure market outcomes and those which measure market inputs.

On the former, measures relating to both coverage and usage are relevant. Coverage indicators include the percentage of population covered by 4G or 5G networks and average download speeds (which can measure network performance). The level of digital maturity can be indicated by measures of mobile usage, such as the percentage of households with a smartphone (device penetration), device affordability indicators, as well as gender digital divide.

Market inputs can be tracked monitoring spectrum assignments, including the terms on which spectrum is assigned.

Country context plays a central role in interpreting these indicators. Digitally less advanced countries typically experience lower mobile broadband coverage, particularly in remote or sparsely populated areas, and often face limited availability of 5G. This may reflect a combination of geographic barriers, economic constraints, and underdeveloped spectrum policy or market structures. In contrast, more digitally mature countries tend to achieve near-universal mobile coverage, including in rural regions. In these cases, focus may shift to ensuring competitive markets are maintained and, for example, that transparent, timely data on network performance and coverage is available to consumers. However, even in very mature markets, the economics of mobile network deployment, particularly in low-density areas, mean that commercial incentives alone may be insufficient to support deployment in those areas.

Table 5 Mobile Connectivity Infrastructure Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Coverage	5G Coverage (Urban/Rural)	% of households covered by 5G	<30%	30 – 75%	>75%	GSMA Mobile Connectivity Index
Coverage	4G coverage (Urban/Rural)	% of households covered by 4G	<85%	85 - 95%	>95%	GSMA Mobile Connectivity Index
Coverage	Speed	Average download speeds	<60Mbps	60 – 100 Mbps	>100 Mbps	Ookla Speedtest Global Index
Usage (Accessibility)	Smartphone Ownership	% of population with smartphone access	<60%	60 -75%	>75%	GSMA Mobile Connectivity Index
Market inputs	Low-Band Frequency Spectrum	Total spectrum allocated under 1GHz (MHz)	<90 MHz	90-130 MHz	>130 MHz	Spectrum-Tracker + Cullen International
Market inputs	Mid-Band Frequency Spectrum	Total spectrum allocated between 1GHz and 8GHz (MHz)	<400 MHz	400-550 MHz	>550 MHz	Spectrum-Tracker + Cullen International

Source: Frontier Economics

Note: "Total spectrum allocated" refers to the volume of spectrum that is allocated for mobile use and cumulatively awarded to all mobile operators.

5.3 Policy levers

A country's policy approach should depend on its existing level of digital development. Table 6 below illustrates which policy levers are likely to be appropriate as countries' digital economies mature.

In countries with basic levels of digital development, regulators should prioritise affordable, efficient and sufficient spectrum (including making ample sub-1 GHz spectrum available for wide-area coverage and releasing mid/high bands for capacity). In order to lower the costs of rollout and incentivise investment, regulators should enable passive and active infrastructure sharing and streamline planning approvals (single-window processes, clear rights-of-way, time-bound decisions) to reduce delays and regulatory risk. To ensure affordability and strong connectivity for consumers, regulatory authorities should ensure they remove barriers affecting device affordability (including taxes affecting device costs) and enable an efficient market structure that sustains investment, allowing consolidation where it demonstrably improves incentives and service quality.

In countries with moderate levels of digital development, policy should enable roll out of 5G and introduce measures that boost adoption of future-proof networks. This includes identifying and releasing additional spectrum. Innovation should also be encouraged through focused pilots and testbeds for enterprise 5G/6G use cases.

Table 6 Mobile Connectivity Policy Levers to Increase Digital Development

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Affordable, efficient and sufficient spectrum allocation and assignment ■ Passive and active infrastructure sharing ■ Reducing costs of network rollout ■ Policies to mitigate device affordability ■ Enabling an efficient market structure
Shifting from moderate to advanced levels of development	■ Encouraging and enabling innovation

Source: Frontier Economics

5.3.1 Policies for countries shifting from basic to moderate levels of digital development

Affordable, efficient and sufficient spectrum allocation and assignment

Regulators should ensure that spectrum policy frameworks are designed to enable operators to efficiently meet demand. This includes identifying and making available sufficient sub-1GHz spectrum (e.g., 700 MHz, 800 MHz and 900 MHz) to enable wide-area coverage, particularly in rural and underserved areas; mid-band (1 GHz - 8 GHz) that provides city-wide coverage; and high band spectrum to provide capacity in high demand areas.

Spectrum pricing (e.g. administrative pricing or licence fees) should reflect long-term development and investment goals rather than short-term fiscal objectives.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Highlights the negative impact of high spectrum fees and proposes reform to encourage timely rollout of mobile broadband networks.[88]
- **Framing Policies for the Digital Economy (NUS, 2018):** Notes the importance of spectrum management and allocation.[89]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia's 2020 Spectrum Reforms:** The National Spectrum Strategy 2025 aimed to reduce the cost burden and stimulate investment by promoting efficient spectrum use through the allocation of new bands to mobile (such as 600MHz and 2600MHz), introduction of spectrum auctions and adoption of technology-neutral licensing.[90]
- **India's 2022 Spectrum Reforms:** India's Telecom Regulatory Authority of India (TRAI) reduced reserve prices for 5G spectrum by 35-40% compared to 2018 to encourage operator participation and improve auction outcomes, particularly after previous auctions faced high levels of unsold spectrum.[91]

Passive and active infrastructure sharing

Policy makers should enable passive and active infrastructure sharing (i.e., site / tower / antenna sharing, Multi-Operator Core Network (MOCN), Multi-Operator Radio Access Network (MORAN)) to reduce rollout costs. Infrastructure sharing helps operators avoid

88 P. 54

89 P. 28

90 CITC Public Consultation Document on National Spectrum Strategy 2025

91 India's 5G Spectrum Auction: A Look at the Bids and Commercial Roll-Outhttps://www.india-briefing.com/news/indias-5g-spectrum-auction-list-of-bidders-expected-commercial-roll-out-25328.html/

duplicative investment, minimises environmental disruption and speeds up deployment timelines.

This policy is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Encourages infrastructure sharing to share risk and spur innovation.[92]
- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Notes the benefits of cost-sharing in scarcely digitalised sectors.[93]
- **DE4LAC Jamaica (World Bank, 2024):** Recommends infrastructure sharing to improve rural coverage (in areas beyond population coverage to support rural agriculture, access to healthcare) and reduce deployment costs.[94]

This policy has been implemented in the following country examples:

- **Qatar's CRA:** Promotes co-location and passive infrastructure sharing of towers, ducts, sites, masts and power supply to mobile operators, which applies to all providers of passive civil infrastructure.[95]
- **The EU's Gigabit Infrastructure Act:** Introduces provisions to support passive infrastructure access for mobile operators. These include promotion of access to existing physical passive infrastructure (including symmetric access obligations for all fixed and mobile infrastructure providers), facilitating permitting procedures, and coordination with civil works.[96]
- **Saudi Arabia's CST**: Facilitates passive infrastructure sharing (through leasing licences to non-telecom entities, and right of access rules) which enables mobile operators such as STC, Mobily and Zain to reduce deployment costs.[97]

Reducing costs of network rollout

Governments should ensure there are no unnecessary barriers to mobile network deployment. For example, governments can develop "fast-track" processes for granting permits for new sites, coordinated access to public infrastructure and non-telecommunication infrastructure, and simplified rights-of-way, ensuring also consistency across different local authorities or regional governments. This is because barriers such as inconsistent local rules, long application timelines and lack of clarity on land access can significantly delay deployment.

[92] P. 8

[93] P. 16

[94] P. 43 and P. 52

[95] CRA's Civil Infrastructure Access Regulation Enacted to Enhance Delivery of Telecom Services in Qatar

[96] Regulation - EU - 2024/1309 - EN - EUR-Lex

[97] CST Published Documents

Streamlined processes and single-window clearances ("one stop shops" for approvals) can significantly accelerate 4G and 5G deployment in early-stage environments.

Governments should establish regulatory environments that encourage long-term private sector investment in mobile networks. This includes simplifying licensing processes and ensuring predictability in regulatory decisions.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends improving rights-of-way and other administrative processes to promote investment.[98]
- **Framing Policies for the Digital Economy (NUS, 2018):** Advocates for licensing reform to support innovation by simplifying regulatory processes, adopting technology-neutral frameworks.[99]

This policy lever has been implemented in the following country examples:

- **India's Telecommunications Act, 2023:** Introduced simplified Right of Way (RoW) rules which mandated effective Right of Way on public property, including agencies, local bodies, airports, highways etc., reduced delays in getting permission, and replaced previous statutes to embrace a single tech-neutral framework.[100]
- **India's TRAI:** Introduced a time-bound "deemed-approval" regime for "Experimental" and "Demonstration" licences. Fixed deadlines and automatic progression replaced open-ended reviews, reducing delays and uncertainty.[101]
- **Singapore's IMDA:** Implemented a streamlined "code of practice" for mobile infrastructure deployment in public spaces, which promotes co-location and reduced administrative barriers.[102]
- **Qatar's CRA Passive Civil Infrastructure Act (2015):** Streamlined rollout by replacing case-by-case approvals with class licensing and facilitated non-discriminatory access to existing ducts and towers to cut costs and avoid duplicate works.[103]

98 P. 58

99 P. 45

100 Press Release - Telecommunications Act 2023: Press Information Bureau

101 Press Release: Press Information Bureau

102 Code of Practice for COPIF | IMDA

103 Passive Civil Infrastructure Access Regulation

Policies to mitigate device affordability

Ensuring that entry-level smart devices are affordable is one of the most effective ways to boost adoption of mobile and digital services in LMIACs.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Suggests reviewing the tax policy on smart devices.[104] It provides policy options to target demand side barriers via device subsidisation and frameworks for digital inclusion targeted, for example, at women and rural areas.[105]

- **Digital Readiness Assessment North Macedonia (UNDP, 2024):** Highlights that lowering handset prices, especially entry-level device costs, is critical to boosting connectivity and closing the digital divide.[106]

This policy lever has been implemented in the following country examples:

- **Argentina: Reduction in handset import tariffs and taxes.** Argentina's government reduced import tariffs on mobile phones and reduced taxes on other electronic products.[107]

- **South Africa reduction of custom duties on lower valued handsets:** 1 April 2025, South Africa removed the 9% ad valorem excise duty (luxury/excise tax) on smartphones priced below ZAR 2,500.[108]

Enabling an efficient market structure

Policy makers need to ensure that mobile market structure is appropriate for supporting incentives to invest and innovate. Competition is always preferable to monopoly markets for promoting network investment (where an area economically supports more than one provider). However, excessive competition in mobile markets limits incentives to invest. Policy makers and competition authorities should seek to ensure that competition is enabled, but that consolidation can occur in markets where this is efficient.

This policy is highlighted in the following DPF:

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104 P. 57

105 P. 49

106 P. 20

107 Decree 333/2025 (published May 20, 2025, and effective May 21, 2025) reduces excise taxes on imported cell phones, televisions, and air conditioners from 19% to 9.5%, and eliminates excise taxes on products manufactured in Tierra del Fuego. https://www.cira.org.ar/es/servicios/normativas-servicios/decreto/decreto-333-2025/

108 https://www.reuters.com/technology/south-africa-remove-luxury-duty-lower-value-smartphones-2025-03-12/

- **Going Digital Integrated Policy Framework (OECD, 2020):** Highlights the necessity to address barriers to investment and improve competitive dynamics to spur private investment. The report notes that "*The degree of competition among infrastructure and service providers influences investment and pricing decisions and can drive up the overall quality and speed of broadband offers, including to underserved populations.*" [109]

This policy has been implemented in the following country example:

- **India's consolidation towards a more efficient market structure:** In 2009 there were 21 operators, and in 2016 the entry of disruptive 4G provider Jio led to sudden reduction in mobile data prices. Since then, there has been gradual consolidation in the market. A 2021 report for the Competition Commission of India[110] noted that three player markets were appropriate in mature markets.

5.3.2 Policies for countries shifting from moderate to advanced levels of digital development

In addition to policies to support investment, as countries evolve into more digitally mature markets policies should support, innovation, investment in new specialised services and in advanced technology standards.

Encouraging and enabling innovation

Governments should support innovation in 5G and other wireless technologies. It can designate areas to develop 5G pilot enterprise applications, such as ports, logistics hubs, and manufacturing clusters. These pilots can help demonstrate the value of 5G and encourage cross-sectoral partnerships. It can enable and encourage pilots, identify temporary spectrum for innovation pilots, and provide incentives for private-public collaboration. This also allows governments to gather evidence on the socioeconomic benefits of advanced connectivity, informing broader policy frameworks.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Proposes 5G pilots in ports and logistics centres to drive early adoption.[111]

This policy lever has been implemented in the following country examples:

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109 P. 6

110 "*The prevailing market structure validates the empirical finding expressed as the rule of three, which predicts that mature markets normally support three main competitors, others who survive, are limited to the fringes or a niche. The three major private sector operators, namely Jio, Airtel and Vodafone-Idea own almost 88.4 per cent of the market.* A Competition Commission of India (2021) MARKET STUDY ON THE TELECOM SECTOR IN INDIA, Key Findings and Observations: https://www.cci.gov.in/images/whatsnew/en/market-study-on-the-telecom-sector-in-india1652177923.pdf

111 P. 52

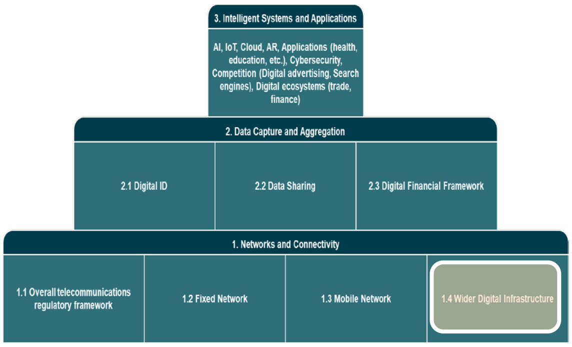
- **India's National 5G Testbed programme:** Enables sectoral pilots across agriculture, healthcare and logistics.[112]
- **India – Reform of Experimental & Demonstration Licences (2024).** India reformed the licensing of spectrum for experimental and demonstration licence, making the process faster and simpler. The purpose is to speed up innovation cycles (trials, pilots, experiments); and reduce uncertainty and regulatory risk for companies developing new technologies.
- **The EU's Connecting Europe Facility and National Recovery Plans:** Funds 5G corridors and smart city testbeds. [113]
- **Singapore's 5G Innovation Program** Grants cover up to 70% of project costs and encourage the deployment of 5G solutions.[114]

112 Press Release - 5G TESTBED: Press Information Bureau

113 Connecting Europe Facility - European Commission

114 Connecting Europe Facility - CEF Digital | Shaping Europe's digital future

6 Pillar 1.4 Wider Digital Infrastructure



This sub-pillar and associated policies refer to the physical digital infrastructure that underpins modern telecommunications beyond last-mile access. It encompasses critical components such as submarine cables and cable landing stations, national fibre backbones, internet exchange points (IXPs), and domestic data centres. These are essential connectivity infrastructure elements of the digital ecosystem.

6.1 Role of Wider Digital Infrastructure

6.1.1 Wider digital infrastructure in LMIACs

In many LMIACs, the wider digital infrastructure ecosystem remains underdeveloped. While mobile and fixed access networks provide connectivity to end-users, without the complementary investments in core transport and hosting infrastructure, the connectivity services can be constrained by high latency, poor reliability, or limited scalability.

For instance, limited participation in submarine cable systems or reliance on a single landing station can result in bottlenecks and vulnerability to outages. The absence of neutral and well-governed IXPs means local internet traffic may be routed internationally, adding cost and with lower quality of service. Similarly, where there is insufficient data centre capacity, or no local presence of cloud providers and content delivery networks (CDNs), most content must be served from offshore locations. This negatively impacts user experience (lowering quality and adding costs for businesses that use cloud technology) and undermines domestic service innovation.

In these contexts, government plays a vital enabling role. This includes clarifying institutional mandates for IXP and backbone development, coordinating regional integration efforts (on cross-border connectivity and harmonised policy), and creating investment conditions that allow domestic and international actors to participate in infrastructure development.

6.1.2 The role of wider digital infrastructure in digital development

At early stages of digital development, the focus is often on gaining access to international bandwidth. This may be achieved through government participation in submarine cable consortia or support for competitive open access landing stations. Simultaneously, efforts should begin to establish basic domestic routing capability through a national IXP and to connect major cities with high-capacity national fibre backbone infrastructure.

As a country's digital development progresses, emphasis shifts toward diversifying international links, building redundancy and resilience into national transport networks, and encouraging the deployment of neutral, high-traffic IXPs. Domestic hosting of content becomes increasingly important, as it enables the development of national digital platforms and reduces dependency on international transit.

In more mature digital economies, policies can attract large-scale data centres and cloud infrastructure, enabling investment in edge nodes closer to users, and integrating into regional fibre corridors. At this stage, wider infrastructure becomes a competitive differentiator and is closely tied to economic diversification strategies, industrial policy, and national data sovereignty.

6.2 Wider Digital Infrastructure Development Indicators

A set of practical indicators can be used to measure progress toward the development of wider digital infrastructure. These indicators span international connectivity, domestic routing, and hosting capacity. They reflect both the availability and quality of the infrastructure that underpins a country's ability to transport, exchange, and store digital data efficiently and securely. These indicators can also act as early signals of digital maturity, with higher-capacity infrastructure supporting lower latency, better content delivery, and more resilient network performance.

As with other pillars, these indicators should not be viewed in isolation. Instead, they should be considered together to build a picture of a jurisdiction's wider infrastructure readiness. For example, a country with access to multiple submarine cable systems may still experience high costs or low speeds if domestic traffic is inefficiently routed or if most content is hosted offshore. Conversely, a country with strong data centre capacity but weak international links may face constraints in global service reach and interconnection.

Country context is important in interpreting these indicators. In less digitally advanced countries, international capacity may be limited to a single submarine cable or landing station, domestic traffic may be routed offshore, and very little content may be hosted locally. In more advanced jurisdictions, the combination of multiple landing stations, high-capacity IXPs, and Tier III/IV data centres allows for efficient domestic exchange, greater resilience, and improved support for local platforms and services.

Submarine cable connectivity varies significantly by geography. While coastal countries can host landing stations and participate directly in cable consortia, landlocked countries must rely on cross-border terrestrial fibre links to access international capacity. Accordingly, all indicators should be interpreted considering a country's geographic location, regional integration, and infrastructure dependencies. Submarine cables may also vary in capacity, so a country should consider how the capacity of their cables compare with average international submarine cable capacity.

Table 7 Wider Digital Infrastructure Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
International Capacity	Submarine Cable Connectivity	# of active submarine cables per 10 million people	<1	1-4	>4	Submarine Cable Map - Telegeography
Domestic Routing	Internet Exchange Points (IXP)	# of functioning IXPs per 10 million people	<1	1-4	>4	IXP Tracker - ISOC
Hosting Capacity	Data Centre Capacity	Total installed capacity (MW) per 10 million people	<5 MW	5 – 50 MW	>50 MW	National data + Arizton Global Report 2023-2028

Source: Frontier Economics

6.3 Policy levers

A country's policy approach should depend on its existing level of digital development.

In countries with basic levels of development, policy priorities should focus on establishing foundational elements of the digital core. This includes enabling international connectivity through participation in submarine cable consortia or landing stations, building a domestic routing ecosystem by establishing an internet exchange point (IXP), and extending a national fibre backbone to connect urban hubs and government institutions. Public investment and coordination across agencies may be necessary, especially where commercial incentives are weak, or market failures persist.

As countries advance in their digital journey, the emphasis should shift toward improving the capacity, quality, and efficiency of this infrastructure. This includes promoting domestic data hosting through higher tier data centres (tier III or tier IV if there is market demand), enabling the presence of cloud and edge providers, and investing in regional and cross-border links to improve redundancy and reduce latency. At this stage, policy frameworks must become more sophisticated, incorporating sustainability standards, cybersecurity protections, and long-term planning around land use, energy provision, and the environmental impact of data infrastructure.

Table 8 Wider Digital Infrastructure Policy Levers to Increase Digital Development

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Facilitating investment in submarine cables and landing stations ■ Establishing and strengthening Internet Exchange Points (IXPs) ■ Extending national fibre backbone infrastructure
Shifting from moderate to advanced levels of development	■ Promoting local hosting and data centre development ■ Enabling investment in cloud and edge infrastructure

Source: Frontier Economics

Table 8 illustrates which policy levers are likely to be appropriate as countries' digital economies mature. The remainder of this section explores these policies in greater detail, providing examples of high-level direction from international frameworks and specific policies adopted by individual countries.

6.3.1 Policies for countries shifting from basic to moderate levels of digital development

Facilitating investment in international connectivity such as submarine cables and landing stations

Governments should take proactive steps to improve international capacity through encouraging operators to participate in submarine cable consortia, reducing barriers to landing station construction, and ensuring that new infrastructure is governed under open-access principles. These investments reduce the cost of international bandwidth and improve resilience to outages. Policy can support private investment by streamlining permitting, coordinating across government agencies, or offering co-investment models for smaller markets.

This policy is highlighted in the following DPFs:

- **Arab Digital Economy Vision (League of Arab States, 2020):** Identifies submarine cable provision as a key resilience objective.[115]
- **DE4LAC Jamaica (World Bank, 2024):** Proposes implementing cost-based open access to submarine cables.[116]
- **Framing Policies for the Digital Economy (NUS, 2018):** Recommended to adopt market-based, flexible, and transparent approaches to the management of international submarine cables, supporting innovation, efficient use, and reduced barriers to deployment.[117]

This policy has been implemented in the following country examples:

- **India:** Enabled private-led cable consortia with open licensing at gateway locations.[118]
- **EU's Connecting Europe Facility (CEF Digital):** Co-finances cross-border cable infrastructure.[119]

Establishing and strengthening Internet Exchange Points (IXPs)

Neutral, well-governed IXPs allow domestic internet traffic to be exchanged locally, reducing the need for costly international transit and improving performance. In markets with limited private incentive to build IXPs, governments may support their creation through convening

[115] P. 116

[116] P. 31

[117] P. 34

[118] India - Submarine Networks

[119] Connecting Europe Facility - CEF Digital | Shaping Europe's digital future

stakeholders, offering startup funding, or housing IXPs in neutral locations (e.g. universities or government facilities). Legal frameworks may be required to ensure fair and open participation by ISPs and content networks.

This policy lever is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Highlights IXPs as critical for routing efficiency and network security.[120]
- **Arab Digital Economy Vision (League of Arab States, 2020):** Recommends establishing national IXPs in every country to reduce reliance on international exchange points.[121]
- **Framing Policies for the Digital Economy (NUS, 2018):** Identifies supporting IXPs development to attract major content providers.[122]

This policy lever has been implemented in the following country examples:

- **Qatar:** IXPs supported through neutral co-location policies and open peering frameworks.[123]

Extending national fibre backbone infrastructure

A strong national fibre backbone is essential to link cities, rural areas, and institutional users to core infrastructure. Governments can support backbone expansion by facilitating rights of way, reducing regulatory fragmentation across jurisdictions, and coordinating deployments with other infrastructure rollouts (e.g. roads, energy grids). Public-private partnerships and universal service mechanisms may be needed where the commercial investment case is weak. Satellite connectivity can also play a complementary role, providing backhaul in hard-to-reach areas.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Suggests exploring the establishment of a Public-Private Partnership (PPP) to develop an open-access backbone network.[124]
- **Going Digital Integrated Policy Framework (OECD, 2020):** Suggests expanding rural backhaul and backbone infrastructure through public-private models.[125]

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[120] P. 7

[121] P. 114

[122] P. 26

[123] Minister of Transport and Communications Launches Qatar Internet Exchange Point

[124] P. 57

[125] P. 9

This policy lever has been implemented in the following country examples:

- **Saudi Arabia:** Backbone buildout supported by a SR3.5bn agreement between the Integrated Telecom Company (ITC) and MCIT to deploy high-speed fibre across urban areas, government office, and 640,000 residential units[126]
- **India's National Broadband Mission 2.0 (2025-2030)**: Aims to build a robust national fibre backbone by connecting 270,000 villages and supporting 100 Mbps fixed broadband nationwide by 2030.[127]
- **Oman's Afaq Initiative:** Will provide fixed internet services to villages and rural communities.[128]

6.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Promoting local hosting and data centre development

Encouraging the development of neutral, high-quality data centres enables local content hosting, enterprise cloud adoption, and platform innovation. Governments can support this by offering fiscal incentives, facilitating access to land and power, and streamlining permitting processes.

Governments should ensure that they have plans to ensure datacentres can access power (i.e. there is sufficient power generation capacity or international interconnection to import power) and that distribution grids are sufficient to support growing demand for datacentres.

Policy should also ensure that facilities meet recognised international standards (for example that datacentres which offer higher levels of resilience and redundancy are available where there is sufficient demand).

This policy lever is highlighted in the following DPFs:

- **Framing Policies for the Digital Economy (NUS, 2018):** Recommends fostering data centre growth through land access policies and sustainability measures. [129]

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126 ITC inks agreement for fiber optic initiative in Saudi Arabia - SAMENA Daily News

127 NBM 2-0 Vision Document_Final_RoW-compressed.pdf

128 Initiative Details

129 P. 27

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Highlights the importance of building data centres to keep up with advanced economies and increase foreign direct investment.[130]

This policy lever has been implemented in the following country examples:

- **Singapore's Data Centre – Call for Applications:** Launched by the Economic Development Board (EDB) and IMDA, this programme allocates new data centre capacity to operators via a competitive selection process[131] and ensures sustainable growth aligned with climate commitments in the Digital Connectivity Blueprint (DCB).[132]
- **Oman's ITHCA Group:** Encourages growth in data centres by co-investing in digital infrastructure and by backing technology startups via the Jasoor Fund.[133]
- **Digital India Mission:** Initiatives like the Open Government Data Platform and UMANG (Unified Mobile Application for New-age Governance) increase demand for scalable domestic data centre hosting by centralising government datasets and digital services.[134]
- **Saudi Arabia**: Under the Regional Headquarters Program, data centre companies that establish regional HQs in KSA can benefit from 30-year exemptions from corporate income tax[135] and through the 2021 Data Centre Strategy Plan, they aim to attract $18bn in investment by 2030.[136]

Enabling cloud and edge infrastructure

Governments can promote Cloud First policies (which encourage government to adopt cloud services as the default for data storage and processing instead of on-premises data, usually through leveraging third-party datacentres). As applications become more data-intensive and latency-sensitive, governments should facilitate the development of domestic cloud and edge computing nodes. Policies may include procurement mandates favouring local cloud providers, guidelines for edge zone designation, or the inclusion of edge infrastructure in national broadband plans. These tools help enable services like AI, IoT, and smart logistics.

This policy lever is highlighted in the following DPFs:

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130 P. 15

131 https://www.imda.gov.sg/resources/press-releases-factsheets-and-speeches/press-releases/2023/four-data-centre-proposals-selected-as-part-of-pilot-data-centre-call-for-application

132 Digital Connectivity Blueprint (DCB) | IMDA

133 About ITHCA – ITHCA

134 Press Release: Digital India Mission Initiatives - Press Information Bureau

135 Saudi Arabia offers 30-year tax holiday under Regional Headquarters program | EY - Global

136 Saudi Arabia launches $18bn data center strategy plan | Arab News

- **DE4LAC Jamaica (World Bank, 2024):** Recommended the establishment of a strategic vision and incentives to attract investment in cloud hosting capacity, ensuring the necessary international connectivity to support long-term research and innovation.[137]

This policy lever has been implemented in the following country examples:

- **Singapore's Pioneer Certificate Incentive**: Offers 5-15 years of partial or full corporate tax relief for companies investing in advanced digital infrastructure, including cloud platforms, edge computing capabilities and sustainable data centre technologies.[138]

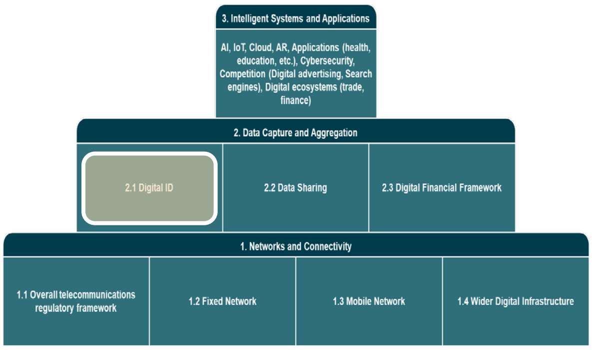
- **Qatar's CRA Cloud Policy Framework:** Aims to encourage foreign and domestic investment in cloud services and promote cloud solutions for digital infrastructure.[139]

137 P. 56

138 Singapore PC&DEI Tax Incentive 2025

139 Cloud Policy Framework

7 Pillar 2.1 Digital ID



This sub-pillar and associated policies refer to the development and governance of secure, inclusive, and interoperable Digital ID systems. It encompasses various elements that collectively aim to expand coverage and adoption of Digital ID across all population groups, strengthen interoperability between public and private sector services, embed robust trust and privacy safeguards through legal and institutional frameworks, and enable the effective use of Digital ID for a wide range of services.

7.1 The role of Digital ID

7.1.1 Digital ID in LMIACs

Digital Identity plays a foundational role in enabling inclusive participation in the digital economy and access to essential services. A robust Digital ID system helps bridge structural gaps in identity coverage, particularly in regions where large portions of the population lack official documentation. By offering a secure, inclusive, and accessible means of identification, Digital ID can ensure that everyone is able to exercise their rights and access the services to which they are entitled, as well as ensure people's rights to privacy, usage, and security safeguards.

Digital ID systems in LMIACs also support broader digital public infrastructure (DPI) agendas. For example, these systems can facilitate seamless integration across public and private services, such as government databases, banking, SIM card registration, and tiered-KYC (i.e. Know your customer systems with different levels of identity verification dependent on risk) and e-KYC (electronic know your customer) processes. This reduces duplication, lowers administrative costs, and increases the efficiency of service delivery. For LMIACs, where public resources are often constrained, such efficiencies are critical for maximising impact and accelerating development outcomes.

Another critical role of Digital ID in LMIACs is in fostering trust, security, and accountability within digital ecosystems. In contexts where regulatory environments may be uneven or underdeveloped, Digital ID systems, when backed by strong legal frameworks, help build citizen confidence in digital services. Privacy protections, grievance redress mechanisms, and independent oversight structures safeguard individuals from misuse of their personal data and reduce risks of exclusion or discrimination.

Finally, Digital ID systems can act as catalysts for innovation and economic growth. By providing a reliable method of identity verification, they enable the development of new digital services and business models, from mobile banking and e-commerce to health-tech and education platforms. There are different archetype models for providing reliable identity verification ranging from centralised Digital ID systems (such as Aadhaar system in India) to decentralised and federated models in other countries. Irrespective of the archetype model, Digital ID systems should ensure safeguarding of sensitive personal data and building trust in government services. In LMIACs, where informal economies dominate and barriers to participation are high, Digital ID can unlock new pathways for entrepreneurship, financial inclusion, and cross-border trade. When implemented effectively, this pillar supports the transition toward more resilient, inclusive, and digitally empowered societies, with safeguards and inclusion at the core.

7.1.2 The role of Digital ID in a nation's digital development

The role and priority given to Digital ID evolves with a country's stage of development, but in sequencing it follows Pillar 1, networks and connectivity. In LMIACs and countries at an earlier stage of digital development the immediate imperative is to expand affordable access, typically via mobile, so that people can reliably reach any future digital service. During this phase, governments should still lay the groundwork for Digital ID, defining governance, privacy and security safeguards, enrolment models, and interoperability standards, so that when coverage reaches critical mass, rollout can proceed quickly and inclusively.

Once broad access is in place, Digital ID becomes the foundation for scale. It underpins Digital Public Infrastructure in Pillar 2, most notably Pillar 2.3 digital finance through Electronic Know Your Customer ("e-KYC"), tiered or simplified KYC, payments, and benefits delivery, and enables Pillar 3 intelligent systems and applications such as e-health (patient identity and records linkage) and e-education (learner credentials and secure access). By providing trusted authentication, consent, and eligibility, Digital ID allows services to interoperate, reduce fraud and duplication, and reach everyone. Developing Digital ID policies ensures those higher-value services can launch smoothly rather than stalling for lack of a robust identity foundation.

7.2 Digital ID Development Indicators

Metrics for Digital ID systems are primarily based on national-level data and coverage statistics, as countries often maintain the most detailed information on population registration and system performance. The key objectives for Digital ID systems focus on coverage of the population, interoperability between the public and private sectors, and uptake by users.[140]

[140] While there are some external sources such as the World Bank's ID4D database and the UN E-Government Development Index, many digital policy framework (DPF) assessments do not provide direct indicators for Digital ID systems, limiting the comparability across contexts and making national data the main reference point.

Table 9 Digital ID Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Coverage	Global Digital Identity Index	Coverage of Digital ID system (ID Ownership, Digital ID Verification, Online Digital Identity)	<55	55-75	>75	Digital Identity Index Home - The Global Digital Identity Index & World Bank ID4D data

Source: Frontier Economics

7.3 Policy levers

A country's policy approach should depend on its existing level of digital development.

In countries with basic levels of digital development, which are aiming to progress toward moderate levels, policy makers should focus on building inclusive and secure foundational Digital ID systems. This involves ensuring universal enrolment while safeguarding against the exclusion of vulnerable groups, putting in place governance and legal frameworks to guarantee trust and privacy, and establishing unique identifiers that enable citizens to reliably access essential public services. Attention should also be given to ensuring that Digital ID systems can be used to expand access to finance, healthcare, and social benefits, helping to bring marginalised populations into the digital economy.

In countries with moderate levels of development, the emphasis should shift toward enhancing interoperability, integration, and service delivery. This includes deploying secure Single Sign-On systems, expanding the use of national e-IDs to streamline access across a wide range of government and private services, and fostering interoperability across institutions and sectors. Policy makers should aim to embed Digital ID as a core part of digital public infrastructure, ensuring it supports seamless service delivery, drives efficiency gains, and enables citizens to participate fully in the digital economy.

Table 10 outlines example policy levers that can help countries progress through different stages of digital development.

Table 10 Policy levers

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Foundational Digital ID systems with legal and governance safeguards ■ Promoting inclusion and access to services through ID ■ Unique identifiers to establish a basic digital framework
Shifting from moderate to advanced levels of development	■ Federated Single Sign-On and secure interoperability ■ Streamlining access to complex services via national e-IDs ■ Integration across public and private sectors

Source: Frontier Economics

The discussion that follows examines these policies in more detail, highlighting both strategic guidance from international best practices and concrete initiatives undertaken by national governments.

7.3.1 Policies for countries shifting from basic to moderate levels of digital development

Foundational Digital ID systems with legal and governance safeguards

Foundational Digital ID systems give citizens secure credentials that enable them to access services across sectors. To be trusted, the systems must rest on clear legal protections, transparent governance, and safeguards against misuse[141]. Embedding these rules early ensures that Digital IDs are seen as reliable public goods, providing a stable base for wider digital adoption.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends helping individuals to obtain their Digital ID to promote inclusivity.[142]
- **Framing Policies for the Digital Economy (NUS, 2018):** Highlights Aadhaar in India, a biometric Digital Identity scheme, which provides verification and legal safeguards, enabling authentication without intermediaries.[143]
- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Highlights Kenya's Huduma Namba[144] and Togo's Unique Identification Number (NIU) to show how biometric-based systems establish universal digital ID coverage.[145]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia: Absher Platform & Nafath SSO.** Provides over 28 million Digital IDs, backed by legal integration with the Ministry of Interior and governed by national data-protection frameworks. Absher and Nafath act as trusted, state-managed identity services, with clear accountability and legal backing.[146] [147]
- **Singapore: Singpass.** A universal Digital ID used by over 97% of eligible citizens, underpinned by Singapore's Personal Data Protection Act (PDPA). Governance

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141 UNDP Digital Legal ID Governance Framework: https://www.governance4id.org/

142 P. 146, P. 79, and P. 23

143 P. 30

144 Important to note that due to legal challenges, the Huduma initiative has been replaced with Maisha Namba, which is also facing an uphill battle in courts due to lack of appropriate safeguards and widespread exclusion. These challenges are notable to emphasize the critical importance of introducing digital IDs with proper safeguards.

145 P. 21

146 Absher's Development Timeline - Saudipedia

147 Nafath App - Observatory of Public Sector Innovation

safeguards promote trust while enabling secure use across both public and private services.[148] [149]

- **European Union: eIDAS 2.0 & EUDI Wallet.** Mandates that all Member States offer a Digital Identity Wallet that is interoperable across the EU, with strict user-control and data-minimisation principles, which requires that personal data be adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed. Legal safeguards (e.g., selective data sharing, GDPR alignment) form the backbone of the system.[150]

Promoting inclusion and access to services through ID

Inclusivity is vital to the success of Digital ID. Many people, particularly in low-income or rural settings, lack official IDs and are excluded from essential services. Policies that ease registration, support mobile or community-based enrolment, and address accessibility challenges can therefore bring more citizens into the system. In turn, this can make digital services more valuable and sustainable.

This policy lever is highlighted in the following DPFs:

- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Highlights how by leveraging Digital ID, healthcare and welfare services can more effectively reach and serve vulnerable populations.[151] It also notes that in India, Digital ID and payment systems enabled faster benefit transfers to marginalised populations.[152]

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Points to examples such as the integration of Togo's NIU integration system with the banking system which improved financial access.[153]

This policy lever has been implemented in the following country examples:

- **India: Aadhaar.** Provides unique Digital IDs to over 1.3 billion residents, with special efforts to include rural and low-income populations. It is linked to financial inclusion schemes (e.g., direct benefit transfers, PM Jan Dhan Yojana), ensuring previously undocumented citizens can access services.[154]

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148 All Government Agencies to Accept Singpass Digital IC from 1 November 2021 | Ministry of Digital Development and Information

149 Singpass | Government Technology Agency (GovTech)

150 Regulation - EU - 2024/1183 - EN - EUR-Lex

151 P. 7

152 P. 24

153 P. 21

154 95.5 percent of the population is under Aadhaar coverage as of March 2024; SDG India Index 2023-24 released - Nagaland Tribune

- **Singapore: MyInfo Service.** Enhances inclusivity by reducing paperwork and streamlining onboarding across government and private services. Ensures that even individuals with limited digital literacy can securely consent to and share their personal data.[155]

Unique identifiers to establish a basic digital framework

Unique identifiers, such as national ID numbers, form the backbone of digital ecosystems. They ensure consistency across databases, reduce duplication, and allow governments to build accurate population registries. This foundation improves service delivery in areas like health and education and sets the stage for more advanced interoperability, especially when paired with digitally stored biometric data (such as fingerprint, facial image, iris or retina scan, or voice pattern) to bind records to real people, such as integrated digital platforms, in later stages of development.

This policy lever is highlighted in the following DPFs:

- **Digital Readiness Assessment North Macedonia (UNDP, 2024):** Highlights the introduction of a Unique Electronic Number for Citizens (UENC) to streamline interactions with digital public services, alongside legal frameworks for e-documents and trust services.[156]

This policy lever has been implemented in the following country examples:

- **Oman: Civil Number & Smart e-ID Card.** Each citizen receives a unique civil number embedded in a smart ID card, functioning across government and financial services. Backed by a national Public Key Infrastructure (PKI), it supports e-signatures, e-payments, and trusted digital transactions.[157]

- **Qatar: Digital Identity (QDI) App.** The QDI App provides a unique Digital ID with biometric login and electronic documents (e-ID, driver's license). It is reinforced by Qatar's 2022 data protection law, ensuring legal recognition of e-signatures and trust services.[158]

- **EU: European Digital Identity Wallet (EUDI).** Under eIDAS 2.0, the EU is rolling out a wallet with unique electronic identifiers, enabling secure cross-border services (e.g. tax, healthcare). GDPR and trust service regulations ensure legal safeguards.[159]

155 Myinfo | Singapore Government Developer Portal

156 P. 15

157 Oman's eID card - The Sultanate's national ID program

158 Qatar Launches Revolutionary Digital Identity App to Enhance Government Services

159 EU Digital Identity Wallet Home - EU Digital Identity Wallet

7.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Federated Single Sign-On and secure interoperability

Federated SSO enables citizens to access multiple government and private platforms with one secure login, reducing complexity while strengthening cyber resilience. At more advanced stages, interoperability allows data to move safely across agencies, enabling "once-only" service delivery and more personalised digital experiences. This shift is critical to seamless digital government.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024)**: Recommends governments should leverage Digital ID to implement SSO across G2C[160], G2B[161], and G2G[162] services, enabling secure access through a single identity.
- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023)**: Highlights how Palestinian Mizan integrates ID systems with other institutions for seamless interoperability in e-services.[163]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia: Nafath (Unified National Access).** The Nafath platform enables citizens and residents to log into multiple government and private services using a single, secure Absher-based identity. Built on international standards, it strengthens security and streamlines access across sectors.[164]
- **Singapore: Singpass Federation Services.** Singpass supports federated SSO through OpenID Connect (OIDC), allowing both government and private apps to integrate with it. This fosters frictionless access to diverse platforms while maintaining high security.[165]
- **Oman: Omanuna.** Omanuna is Oman's national e-Government portal, providing secure single sign-on (SSO) access to public services, with identity verification powered by the Smart National ID card for government, civil, and law enforcement services.[166]

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160 Government to Citizen

161 Government to Business

162 Government to Government

163 P. 44

164 Nafath App

165 Overview of Singpass | Singpass Developer Docs

166 Omanuna Oman

Streamlining access to complex services via national e-IDs

As digital systems mature, national e-IDs evolve beyond basic authentication into enablers of high-value services such as healthcare, taxation, and property management. By embedding tools like qualified e-signatures, biometrics, and consent-driven data sharing, e-IDs reduce paperwork and in-person verification. This transformation lowers transaction costs and makes complex interactions fully digital, boosting both efficiency and trust.

This policy is highlighted in the following DPFs:

- **Framing Policies for the Digital Economy (NUS, 2018)**: Highlights that Estonia's e-ID enables access to 99% of state services online (tax filing, medical records, bill payments). This saves citizens' time and costs by eliminating paperwork and physical travel.[167]
- **Digital Readiness Assessment North Macedonia (UNDP, 2024)**: North Macedonia's eIDAS-compliant National Digital Identity Platform facilitates secure access to e-government platforms.[168]

This policy has been implemented in the following country examples:

- **Singapore: Singpass.** Singpass acts as a gateway to over 2,000 services across more than 700 agencies and businesses. It enables streamlined access to complex services like healthcare, taxation, and official documentation, enhancing convenience and efficiency.[169]
- **India: Aadhaar in the Digital Public Infrastructure (DPI).** Aadhaar facilitates access to 1,200+ digital government services such as vaccination records. It allows citizens to conduct banking transactions using only their Aadhaar number and biometrics at micro-ATMSs and enables citizens to receive Direct Benefit Transfer (DBT).[170] [171]
- **Qatar: Hukoomi.** Hukoomi is Qatar's e-Government Portal, which provides access to over 1,400 services, in areas such as health, education and business.[172]

Integration across public and private Sectors

The hallmark of advanced digital economies is the use of a single trusted identity across public and private services. When banks, utilities, healthcare, and education adopt the same digital credentials as government, citizens enjoy a unified and consistent journey. For businesses,

167 P. 30

168 P. 15

169 Singpass Factsheet

170 Aadhaar Enabled Payment System (AePS) – Aadhaar Pay | NPCI

171 Aadhaar Usage - Unique Identification Authority of India | Government of India

172 Online, Paper Form and Information Services on Hukoomi

integration lowers compliance costs and spurs innovation, while for governments, it drives higher uptake and confidence in digital services.

This policy is highlighted in the following DPFs**:**

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Highlights that Togo's NIU Platform / system is accepted by banks, demonstrating integration between ID and financial services.[173]
- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Identifies MIZAN's interoperability which improves data-sharing across institutions, enhancing efficiency and service delivery.[174]

This policy lever has been implemented in the following country examples:

- **India: Aadhaar Authentication Amendment 2025:** With the 2025 amendments, private entities across sectors, such as e-commerce, healthcare, travel, and telecommunications, can now use Aadhaar authentication for customer verification under a regulated framework. This expands Digital ID's reach beyond government services. [175]
- **European Union: eIDAS Framework.** Under eIDAS, public and private organisations, like banks, insurance firms, healthcare providers, and online retailers, can rely on cross-border eID and trust services including e-signatures and trusted authentication as legally recognised means of verification. Additionally, eIDAS 2.0 extends use across both public and private services to bolster interoperability and trust.[176]
- **Singapore: Singpass Bridging Public and Private Services**. Singpass serves as the trusted Digital ID for thousands of government and private platforms, spanning finance, healthcare, utilities, and more, ensuring secure access, with the Verify API enabling businesses to authenticate users seamlessly.[177]
- **Qatar: Tawtheeq.** Tawtheeq, which is Qatar's national authentication system, provides access to both public and private services, with 650+ transactional services supported using National ID card for authentication.[178]

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173 P. 19

174 The State of Palestine's MIZAN is a digital case management system that improves access to justice. The system performs end-to-end case management, including managing judges' calendars and paperwork flows to facilitate payments and allow complainants to track their cases. This service is available to multiple government departments. P.44

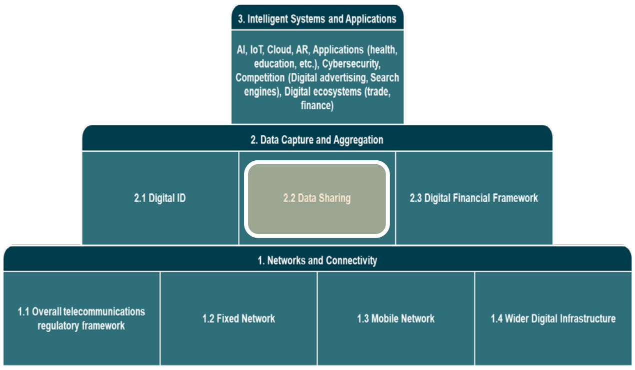
175 Aadhaar Authentication Amendment 2025: Key Highlights

176 eIDAS - electronic identification and trust services | Shaping Europe's digital future

177 Verify API | Singpass Developer Docs

178 Tawtheeq National Authentication Service for Secure E-Government Access

8 Pillar 2.2 Data Sharing



This sub-pillar and associated policies refer to the frameworks, infrastructure, and governance mechanisms that enable secure and trusted data exchange across government and third parties. It includes the release of open data for innovation, the use of standardised platforms and protocols, and the design of centralised or federated exchange architectures. It also encompasses whole-of-government governance frameworks and establishes coordinating authorities to ensure accountability, interoperability, and effective cross-agency collaboration.

8.1 The role of Data Sharing

8.1.1 Data Sharing in LMIACs

Effective data sharing is a critical enabler of digital transformation and public sector efficiency in LMIACs. By establishing secure and interoperable frameworks, governments can reduce duplication of effort across agencies, improve service delivery, and create more transparent systems that foster trust. For example, open data initiatives can unlock valuable information for the private sector, enabling innovation in areas such as financial services, agriculture, and health. In contexts where resources are limited, the ability to share and reuse data efficiently becomes particularly important for maximising impact. However, it is worth acknowledging the tension at a policy level between open data systems and the need for data sovereignty (of for e.g., indigenous communities), or for sensitive data (health) and for culturally rich data (local languages, etc.). Often impacted groups and communities may want to exert some level of ownership over their data to avoid extractive or surveillance issues. Hence, legal frameworks in different country contexts must support a balance between openness and closedness, depending on data use.

Data sharing also plays a central role in building cross-agency collaboration and supporting whole-of-government approaches to problem-solving. In LMIACs, where service delivery challenges often cut across sectors, such as linking health, education, and social protection, interoperable data exchange systems allow for more coordinated and efficient responses. Whether through centralised or federated architectures, these systems can help governments optimise scarce infrastructure, strengthen evidence-based policymaking, and reduce the risks of data silos. Ultimately, robust data sharing frameworks not only enable better governance and accountability, helping reduce fraud across the public sector, but also provide the foundation for inclusive economic growth and digital innovation in LMIACs, proving to be a key mechanism for the development of Pillar 3.

8.1.2 The role of Data Sharing in a nation's digital development

In the development trajectory of a country, data sharing becomes most impactful once the foundational layers of digital infrastructure are in place. Data sharing adds to the value of the underlying infrastructure by enabling applications that directly advance development outcomes. For example, in health systems, trusted, secure, and interoperable data exchange can support digital patient records, disease surveillance, and more coordinated responses to public health crises. In education, data can flow between ministries and schools to monitor attendance, performance, and resource allocation. Similarly, in social protection, integrated data platforms can ensure that benefits reach the right people efficiently and transparently.

8.2 Data Sharing Development Indicators

Measuring the development of data sharing systems involves assessing both the availability of data and the institutional capacity to manage secure, interoperable exchanges. The indicators below capture progress across three critical domains: open data, institutional data exchange, and metadata standardisation.[179] These indicators provide insight into how far a country has moved toward enabling seamless, secure data use across government and between the public and private sectors. In this context, it is noteworthy that data quality is as important (if not more) as availability and capacity. While there may not be strong indicators to measure data quality this aspect of data sharing is nonetheless important.

Context matters when interpreting these indicators. In basic development environments, open data portals may be limited in scope or poorly maintained, and formal data exchange may be rare or ad hoc. In more advanced settings, governments actively manage automated, standards-based data flows across ministries and sectors, often with legal mandates and central coordination. At the highest level of maturity, metadata registries and enterprise architectures are fully institutionalised, enabling secure, scalable and transparent data flows that power digital services and support innovation.

[179] Metadata standardisation refers to the process of defining and adopting common structures, formats, and vocabularies for describing data, so that datasets from different sources can be consistently understood, integrated, and reused.

Table 11 Data Sharing Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Open Data and Interoperability	Openness of Public Sector Data	Assesses data accessibility via open formats, metadata, bulk/API options and licensing	<50	50-70	>70	Open Data Inventory: Global Index of Open Data
Open Data and Interoperability	Coverage of Public Sector Data	Assesses availability of key indicators with temporal and geographic disaggregation across government entities	<50	50-65	>65	Open Data Inventory: Global Index of Open Data
Metadata & Standards	National Metadata Standards in Use	Existence and adoption of API and metadata standards across public institutions	None or inconsistent	Partial adoption	Fully adopted across key agencies	National data: Architecture guidelines

Source: Frontier Economics

8.3 Policy levers

A country's policy approach should depend on its existing level of digital development.

In countries moving from basic to moderate digital development, policy makers should prioritise government-wide interoperability and the enterprise architectures that make it possible. This means adopting open technical standards, standardised APIs, and shared metadata protocols so core registries, such as health, identity, and social protection, can exchange data securely and reliably. Alongside the technical layer, governments should operationalise national data-exchange platforms with clear governance, accountability for data controls, permissioned data collection, data quality, sustainable funding, and robust policies for secure data flows. Open-data portals should be automated and kept current, publishing machine-readable datasets under consistent quality rules to spur transparency and innovation.

For countries progressing from moderate to advanced stages, the focus should shift to whole-of-economy interoperability and people-centric data sharing. Frameworks ought to enable trusted, consent-based exchange between public registries and private providers so services, finance, health, social protection and beyond, can be linked without duplication while preserving user control. At the same time, open-data governance should be updated to clarify ownership and stewardship, recognise platform dynamics and network effects, and strengthen cross-government coordination. With these foundations in place, governments can actively leverage open data for targeted, evidence-driven policy, directing resources to priority needs, improving accountability, and delivering more inclusive outcomes.

Table 12 Policy levers

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Government-wide interoperability frameworks and enterprise architectures ■ National data exchange platforms ■ Robust open data management systems ■ Updating open data governance frameworks
Shifting from moderate to advanced levels of development	■ Targeting public / private sector and registry interoperability ■ Leveraging open data for targeted policy

Source: Frontier Economics

Table 12 sets out this high-level trajectory for data and interoperability. The following section provides a detailed exposition of these objectives, informed by international practice and illustrated through selected national initiatives.

8.3.1 Policies for countries shifting from basic to moderate levels of digital development

Government-wide interoperability frameworks and enterprise architectures

Countries at early stages of digital development should prioritise building national enterprise architectures and secure interoperability frameworks. These should include standardised APIs[180], metadata protocols[181], and national guidelines to facilitate interoperability across ministries and agencies.

Governments should encourage adoption of open technical standards and protocols that ensure system-level interoperability across registries such as health, identity, and social protection.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends establishing a government-wide interoperability framework and national enterprise architecture supported by standardised APIs and data governance policies to ensure interoperability and secure data exchange across government systems.[182]
- **Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023):** Highlights Indonesia's One Data Policy as a model for standardising metadata and API protocols.[183]
- **Digital Readiness Assessment North Macedonia (UNDP, 2024):** References North Macedonia's interoperability framework as aligned with EU standards.[184]
- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Recommends promoting open digital standards and protocols to facilitate interoperability between digital systems and registries.[185]

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180 An API (Application Programming Interface) is a set of rules, protocols, and tools that allow different software applications to communicate with each other

181 A metadata protocol is a formal set of rules and standards that governs how metadata is structured, exchanged, and interpreted between systems.

182 P. 23 and pp. 64-66

183 P. 50

184 P. 15

185 P. 7

This policy lever has been implemented in the following country examples:

- **EU: Interoperable Europe Act**. Mandates cooperation structures, interoperability assessments and a portal for reusable solutions; aligns with and evolves the European Interoperability Framework (EIF).[186]

- **Oman: Oman eGovernment Architecture Framework (OeGAF).** Serves as a guide to the development, deployment and operations of Information Systems of Omani Government entities.[187]

National data exchange platforms

Policy makers should operationalise data exchange platforms (i.e. national, interoperable infrastructures for secure, permissioned data sharing across institutions, such as Estonia's X-Road and Finland's Suomi.fi Data Exchange Layer), with sustainable funding, dedicated governance structures, and clear protocols for secure data flows. Such platforms act as the backbone of data sharing.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Calls for operationalising data exchange platforms.[188]

- **Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023):** Highlights Malaysia's central data exchange program.[189]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia**: **Government Service/ Secure Network & Bus (GSB/GSN)**. Secure inter-agency data exchange connecting >200 entities and billions of transactions.[190]

- **Qatar: Government Data Exchange (GDX).** Streamlines end-to-end e-services via secure data flows.[191]

- **Singapore's APEX data platform**: Enables access to over 2,400 APIs from more than 30 agencies access government data.[192]

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186 Interoperable Europe Act enters into force | Interoperable Europe Portal

187 Oman eGovernment Architecture Framework (OeGaF)

188 P. 23 and P. 64

189 P. 28

190 SDAIA | About Government Service Bus

191 Government Data Exchange System (GDX) for Secure & Efficient e-Services

192 Apex Factsheet

- **Oman: Government Integration Platform (GIP)**. Enables real-time data exchange among government services on a live service.[193]

Robust open data management systems

Open data portals should be kept automatically updated, with data released in machine-readable formats and governed by consistent quality standards. Open data frameworks increase transparency, accountability, and innovation opportunities.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Highlights the importance of regular and automatic updating of the data portals.[194]

This policy lever has been implemented in the following country examples:

- **India: Open Government Data Portal.** Provides centralised access to datasets, with implementation guidelines requiring machine-readable, periodically updated datasets.[195]

- **Qatar: State of Qatar Open Data.** Contains an official Open Data Policy specifying open formats, update duties, and a compliance checklist.[196]

- **Saudi Arabia: Saudi Open Data Portal under NDMO/SDAIA policy regime.** This includes sectoral open-data rules (e.g. health), which set tailored requirements on privacy, security, and reuse to reflect each sector's specific sensitivities and legal context.[197]

Updating open data governance frameworks

Strong governance is essential for open data to deliver public value. Updating frameworks means clarifying ownership and stewardship and adapting to platform-based models. This requires updated consent protocols for varied data usage, as well as mechanisms to mitigate against and respond to data and privacy breaches. It also requires whole-of-government coordination to avoid silos and ensure consistency. Modernised governance balances innovation with safeguards, so open data initiatives strengthen trust, accountability, and the broader data economy.

This policy lever is highlighted in the following DPFs:

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193 Ministry of Transport, Communications and Information Technology

194 P. 23 and P. 64

195 Home | Open Government Data (OGD) Platform India

196 Homepage — State of Qatar Open Data

197 Open Data Portal

- **Digital Economy Kit (Oxford/ITU, 2020):** This DPF notes that good data governance standards imply clear data ownership with clear standards for collecting, processing and storage of data.[198]

- **Going Digital Integrated Policy Framework (OECD, 2020):** Highlights the need to improve cross agency coordination through whole-of-government approaches.[199]

This policy has been implemented in the following country examples:

- **Oman: Open Government Data Policy (2020).** Sets a minimum standard and a coherent approach for publishing Open Data.[200]

- **EU: Open Data Directive and HVD Implementing Regulation.** Clarifies stewardship, mandates open formats, and defines high-value categories.[201]

8.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Targeting public / private sector and registry interoperability

This policy focuses on building systems that allow seamless data exchange across public registries and private actors. This ensures that datasets, such as e-health, identity, and social protection registries[202], can connect without duplication, while also enabling responsible use by businesses to drive innovation. A people-centric approach, meaning prioritising right-based and inclusive digital transformation, safeguards trust and ensures that frameworks are equitable, transparent, and designed around social needs rather than technical convenience. In this way, interoperability becomes the backbone of digital public infrastructure, linking sectors for inclusive outcomes.

This policy lever is highlighted in the following DPFs:

- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Highlights the importance of people centric data sharing frameworks to apply to multiple registries (e-health, ID, social protection).[203]

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198 P. 32

199 P. 11

200 Open Data

201 Implementing regulation - 2023/138 - EN - EUR-Lex

202 Digital databases that collect and store socio-economic and demographic data on households and individuals to identify and select eligible recipients for social programs, such as cash transfers or food assistance.

203 P. 7

- **Framing Policies for the Digital Economy (NUS, 2018):** Recommends facilitating the sharing of public datasets with commercial organisations.[204]

This policy lever has been implemented in the following country examples:

- **Singapore: SGFinDex.** Links banks, insurers and government datasets via Singpass.[205]
- **India: DEPA consent-based data sharing (RBI Account Aggregators) and ABDM health data exchange.** Both emphasise user control and sandboxed, secure integrations.[206]

Leveraging open data for targeted policy

Open data enables governments to design more precise and inclusive policies by highlighting where needs and opportunities lie. By using data infrastructure to guide social investment, resources can be allocated more effectively, and interventions tailored to vulnerable groups. This strengthens efficiency and equity, turning open data into a key tool for evidence-based policymaking.

This policy is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Recommends using data infrastructure to drive targeted social investment. *"The Integrated Data infrastructure (IDI) gathers… de-identified data… to better understand the economic and social outcomes… and develop more sophisticated methods of targeting public services."*[207]

This policy has been implemented in the following country examples:

- **India: Aspirational Districts Programme.** Uses publicly available indicators via the Champions of Change dashboard to drive results-oriented fund allocation, while the National Data Sharing and Accessibility Policy (NDSAP) enables this by requiring government data to be open, machine-readable, and mergeable.[208] [209]
- **Singapore: Virtual Singapore.** Uses open data to build a 3D digital twin of the city, enabling precise urban planning and simulations. This allows the government to target resources effectively, for example by prioritising interventions in modelled flood-prone or heat-affected neighbourhoods, making policies more effective and inclusive.[210]

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204 P. 21

205 SGFinDex

206 Press Release: Press Information Bureau

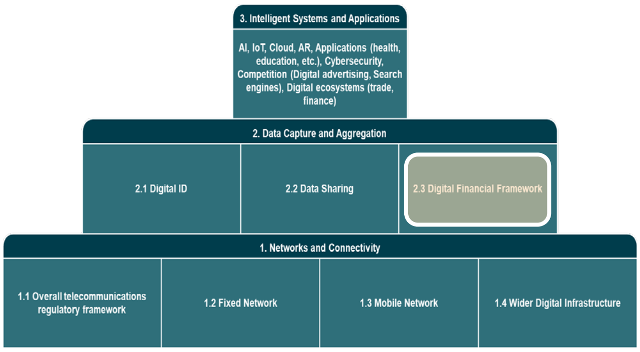
207 P. 30

208 National Data Sharing and Accessibility Policy | National Portal of India

209 NITI AAYOG, India | Aspirational Districts Programme / Aspirational Blocks Programme

210 5 things to know about Virtual Singapore | Government Technology Agency (GovTech)

9 Pillar 2.3 Digital Financial Frameworks



This sub-pillar and associated policies refer to the regulatory and infrastructural frameworks that enable inclusive digital payments and fast payment systems. It includes clear licensing for payment processors, e-money/digital wallets, mobile money, BNPL[211], and agent banking; adoption and accessibility measures, aimed at addressing underserved groups, and rural/mobile access; and interoperability with Digital ID and data layers via open APIs, simplified/ tiered KYC, and real-time e-KYC. It also encompasses trust and safety safeguards, cybersecurity, consumer protection, transaction integrity, fraud reporting and rapid dispute resolution, and market rules and coordinating authorities. These ensure a level playing field for PSPs (Payment Service Providers) and FinTechs, and a reliable, always-on service for end-users.

9.1 The role of Digital Financial Frameworks

9.1.1 Digital Financial Frameworks in LMIACs

Digital financial frameworks in LMIACs are central to expanding financial inclusion. By combining interoperable instant-payment rails[212], dense agent networks, remote onboarding, and proportionate, risk-based identity verification, these frameworks lower long-standing barriers to finance / banking faced by rural communities and other underserved groups. Basic-phone access (e.g., USSD or offline-capable options) and tiered account functionality further reduce distance, documentation, and cost constraints, enabling individuals to make and receive payments, and begin building usable financial histories.

Ensuring safe and reliable usage is critical. Robust frameworks embed security-by-design, strong customer authentication, transaction signing, end-to-end encryption, and real-time fraud monitoring, alongside operational resilience standards for uptime and recovery. Clear consumer-protection rules on pricing transparency, liability allocation, dispute resolution, and data protection (consent, purpose limitation, and minimisation) strengthen trust, reduce the incidence of scams, and provide predictable recourse for customers who encounter problems.

These systems deliver measurable economic benefits. Lower costs and faster transfers reduce cash-handling and travel time while enabling instant or same-day person-to-person, merchant, and bill payments, even for very small amounts. Transparency and trust in public

211 Buy Now, Pay Later

212 Instant-payment rails are the underlying payment infrastructures or networks that allow money to move in real-time (or near real-time) between banks, FinTechs, and other financial institutions.

spending improve as digital instant-payment rails allow for easier tracking of government-to-person transfers and subsidies, providing traceable accountability. Micro, small, and medium-sized enterprises benefit from greater formalisation: they can accept digital sales (QR codes and mobile payments), digitise supplier payments, and leverage transaction data to access working-capital credit, tightening value chains and supporting local growth.

9.1.2 The role of Digital Financial Frameworks in a nation's digital development

The role and priority given to digital financial frameworks varies with a country's development. In early stages, the focus typically falls on establishing a clear legal basis for fast payments and e-money, proportionate licensing and risk-based supervision, baseline consumer-protection and redress, interoperability and open technical standards, transparent pricing, and basic operational resilience and security. This set of priorities supports an effective rollout and inclusion by reducing uncertainty for providers while keeping entry requirements workable for lower risk use cases.

As countries progress, attention shifts to extending reach and improving performance. Policy efforts often centre on deepening interoperability across providers, expanding merchant acceptance and public-sector use, strengthening competition safeguards to avoid lock-in, enhancing resilience and cybersecurity expectations, and clarifying roles and liability across the payment chain. Implementation may prioritise urban centres where uptake is fastest, while laying the groundwork for nationwide coverage.

This sub-pillar relies on the earlier sub-pillars. Pillar 2.1 (Digital ID) enables streamlined remote onboarding, tiered and/ or simplified KYC approaches, e-KYC, and tiered access controls that lower friction while maintaining integrity; Pillar 2.2 (Data Sharing) establishes consent management, standardised interfaces, and governance that allow secure, predictable information flows among participants. Alongside other enablers, such as connectivity, financial literacy, agent networks, and public-sector adoption, these inputs create the conditions for scale. With this foundation, the sub-pillar can then broaden what is feasible in Pillar 3 (Intelligent Systems and Applications), opening space for innovation to develop the digital financial ecosystem.

9.2 Digital Financial Frameworks Development Indicators

Digital financial inclusion relies on both the reach of financial accounts and the presence of robust frameworks for secure, inclusive digital payments. Indicators for this pillar measure access to formal financial services, usage of digital payments, and the supporting regulatory and technological environment. Together, these indicators reflect the depth and inclusivity of a country's digital financial ecosystem.

In countries at early stages of development, bank account ownership may remain low and digital transaction usage minimal due to limited trust, access, or infrastructure. In more advanced contexts, mobile money, e-wallets, and real-time payment platforms become mainstream, supported by strong legal frameworks and active government usage. At the most advanced stage, digital financial infrastructure is interoperable, affordable, and used widely across private and public sectors, including for social protection and tax systems.

Table 13 Digital Financial Frameworks Development Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
Access	Account Ownership	% of adults with an account at a financial institution or mobile money provider	<50%	50–80%	>80%	World Bank Global Findex database
Usage	Digital Payment Adoption	% of adults who have made / received a digital payment (in the last 12 months)	<50%	50-70%	>70%	World Bank Global Findex database
Infrastructure	Real-Time Payments System Presence	Existence of an operational national real-time payment system	None	Partial or developing	Operational and widely adopted	World Bank: Global Payment Systems Survey
Governance	Financial Inclusion Strategy	Existence of a national strategy to promote digital financial inclusion	None	Exists but limited in scope	Comprehensive and implemented	National data: Financial strategies

Source: Frontier Economics

9.3 Policy levers

A country's policy approach should depend on its digital development.

In countries moving from basic to moderate digital development, the priority is to create the conditions for safe competition and widespread use of digital payments. That means ensuring multiple providers can offer services, supporting innovation and pushing interoperability between systems. At the same time, policy should aim to widen access, particularly to traditionally marginalised populations, making everyday transactions affordable and easy to understand, while giving legal certainty to digital transactions. Finally, governments should establish reliable payment infrastructure for social transfers so benefits reach people directly and transparently, regardless of their provider.

For countries progressing from moderate to advanced stages, the focus shifts to a whole-economy, always-on financial ecosystem. Objectives may centre on promoting trusted, consent-based data sharing between public and private actors to unlock better services and competition; ubiquitous, instant payments that work seamlessly across platforms and forms of money; and data mobility that allows individuals and firms to use their own information to access finance on optimal terms. Policy makers should also enable cross-border interoperability to support digital trade, and strengthen supervisory capacity so oversight keeps pace with innovation, resilience requirements, and consumer protection.

Table 14 Policy levers

Digital Development Targets	Policy Levers
Shifting from basic to moderate levels of development	■ Ensuring a legal framework is in place, including proportionate licensing for non-bank providers ■ Regulatory sandboxes to support payments innovation ■ Retail payments interoperability & merchant acceptance ■ Promoting inclusive access through access to basic accounts, affordability and improved financial literacy ■ Foundational G2P payment platforms (open by design) ■ Building supervisory capacity and modern oversight for digital finance
Shifting from moderate to advanced levels of development	■ Open banking and open finance for data-sharing relating to payments & financial data ■ Real-time retail payment rails and Central Bank Digital Currency (CBDC) interoperability ■ Leveraging data intermediaries for faster credit

Digital Development Targets	Policy Levers
	■ Promoting cross-border interoperability and trusted data flows

Source: Frontier Economics

The next section describes these levers in more detail, combining insights from international practice with concrete examples from national programs.

9.3.1 Policies for countries shifting from basic to moderate levels of digital development

Ensuring a legal framework is in place, including proportionate licensing for non-bank providers

Governments should enact or update payment services legislation and issue tiered, proportionate licences for non-bank payment institutions (e-money issuers, remitters, payment aggregators) in line with UNCITRAL models. This should seek to lower entry barriers to providing these services whilst safeguarding users and ensuring they have the confidence to engage. For example, it could clarify the requirements for parties wishing to become providers and distinguish core prudential regulatory requirements from conduct/operational requirements.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Calls for establishing a regulatory framework for electronic retail payment services under the Bank of Jamaica Act (BOJA) and Payment Clearing and Settlement Act (PCSA); it notes that onerous licensing processes for certain service suppliers (i.e. "sub-agents of remittance service providers") as a barrier to entry.[213]
- **Digital Readiness Assessment North Macedonia (UNDP, 2024):** Notes passage of a modern Law on Payment Services and Payment Systems (aligned with EU directives).[214]
- **Arab Digital Economy Vision (League of Arab States, 2020):** Recommends regulating e-payments and introducing FinTech laws.[215]
- **Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023):** Recommends United Nations Commission on International Trade Law (UNCITRAL) based Electronic Transaction Acts.[216]

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213 P. 93 and P. 96

214 P. 15

215 P. 147

216 P. 11

This policy lever has been implemented in the following country examples:

- **Oman: National Payment Systems Law.** This introduced executive regulations and licensing of PSPs, supporting non-bank entry under CBO oversight.[217]

- **Singapore**: **MAS's Payment Services Act (2019).** Uses tiered, activity-based licensing (i.e., with different licensing requirements for different activities) with proportionate obligations.[218]

Regulatory sandboxes to support payments innovation

Policy makers could look to create (or refresh) a payments/FinTech sandbox with clear eligibility, timelines, supervisory "no-action" parameters, and post-trial pathways. Access to the sandbox could include banks as well as deposit-taking institutions (DTIs), credit unions, remittance firms, and domestic FinTechs (including those partnering with DTIs). For example, sandboxes could be used to test mobile wallets, e-commerce payment solutions, prepaid/branded cards, and CBDC wallets.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Urges amending sandbox guidelines to promote competition/innovation; highlights priority areas such as digital wallets ahead of JAM-DEX Jamaica's central bank's digital currency.[219]

- **Framing Policies for the Digital Economy (NUS,2018):** Highlights Malaysia and Singapore regulatory sandboxes.[220]

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Cites Rwanda's FinTech hub/sandbox to adapt regulation as innovations emerge.[221]

This policy has been implemented in the following country examples:

- **India: The Reserve Bank of India's (RBI) Regulatory Sandbox (2019).** The RBI offers regulatory sandboxes to support the development and testing of new and innovative fintech products. It enables qualifying providers to test new products and services in a potentially relaxed regulatory environment. There are a number of themed "cohorts" (types of services) that focus on specific areas such as retail payments, where only

217 Central Bank of Oman - Payment System Evolution

218 MAS expands scope of regulated payment services, amends ongoing compliance requirements, and introduces user protection requirements for DPT service providers under Payment Services Act 2019: Allen & Gledhill

219 P. 94

220 P. 47

221 P. 19 and P. 21

innovations related to digital wallets, payment gateways or similar solutions are admitted.[222]

- **Saudi Arabia: SAMA Regulatory Sandbox.** Admits non-banks/FinTech's to test payment innovations under defined parameters.[223]

Retail payments interoperability and merchant acceptance

Adopt a single national QR code standard that works for cards, bank-to-bank transfers (A2A), and mobile wallets. Require both acquirers (the companies that sign up merchants and process their payments) and digital wallet providers to implement this standard, pass certification, and publish their acceptance rules and fees, (i.e., what it costs a merchant to take payments and under what conditions such as settlement times, refunds, any surcharges).

At the same time, governments should facilitate a “national retail switch” (i.e. the shared payments hub that connects banks, wallets, and acquirers), that supports the national QR specification, uses common message formats and open APIs, and offers a single, unified certification process. This will reduce duplicated systems, lower costs and allows merchants to accept payments from any customer.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024)**: Recommends national QR standards to foster interoperability and overcome cost/convenience hurdles.[224]
- **Framing Policies for the Digital Economy (NUS, 2018):** Urges policy makers to reduce barriers to cashless transactions via interoperable payment systems (e.g., NPCV).[225]
- **Digital Economy Kit (Oxford/ITU, 2020)**: Emphasises ensuring digital payment systems are widely accessible.[226]

This policy lever has been implemented in the following country examples:

- **India**: **UPI and Bharat QR.** This delivers interoperable QR acceptance across issuers/acquirers and wallet apps, lowering merchant costs and boosting acceptance.[227]

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222 Reserve Bank of India

223 Regulatory Sandbox Framework

224 P. 26 and P. 34

225 P. 39

226 P. 79

227 Bharat QR & UPI are transforming digital payments for SMEs

- **Qatar: QCB's Qatar Mobile Payment (QMP).** Issued unified QR specifications for retail, transit and P2P; national platform supports instant wallet payments.[228]

- **Singapore**: **SGQR.** National, interoperable QR standard; acquirers/wallets must support it, and government has driven nationwide merchant rollout.[229]

Promoting inclusive access through access to basic accounts, affordability and improved financial literacy

Incentivise low-fee transaction accounts and simplified Customer Due Diligence tiers to expand access; publish affordability benchmarks for domestic transfers; fund targeted financial literacy for high-impact groups (e-merchants, remittance recipients); and run periodic diagnostics of demand-side capabilities and provider infrastructure gaps to adjust policy.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024):** Recommends adding e-merchants and remittance recipients to BOJ financial literacy programs.[230]

- **Digital Economy Kit (Oxford/ITU, 2020)**: Calls to improve access to accounts/affordable services and to assess supply- and demand-side constraints to take-up.[231]

This policy lever has been implemented in the following country examples:

- **India**: **Pradhan Mantri Jan Dhan Yojana (PMJDY).** Sets a zero Merchant Discount Rate (MDR) for RuPay debit cards and BHIM-UPI transactions. MDR is the fee that merchants usually pay banks and payment providers for processing digital payments, so removing it makes small-ticket digital payments more affordable and encourages wider adoption among small businesses and low-income users.[232]

Creation of foundational G2P (Government to Person) payments platforms (open by design)

Create a national, open G2P platform with robust ID/authentication and standardised APIs so government can make direct, traceable benefits payments to any regulated account/wallet. This could include verification requirements to reduce payments that do not reach the intended beneficiary and should be vendor-neutral so multiple PSPs can participate.

This policy lever is highlighted in the following DPFs:

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228 Qatar Mobile Payment (QMP)

229 Annex A: Singapore Quick Response Code

230 P. 96

231 P. 28

232 Incentive scheme for low-value BHIM-UPI transactions boosted digital payments: Govt - The Statesman

- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Advocates "open" G2P systems to reduce leakages and speed transfers.[233]

- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Highlights mobile payment platforms and government cash transfers (e.g., Tosika Fameno; M-Pesa rails).[234]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia**: **Citizen's Account Program.** This is a Nationwide G2P cash-transfer scheme, delivering direct monthly benefits to eligible low- and middle-income households through a unified online system, anchored on traceable payments and standardised processes to reduce leakages.[235]

- **Singapore**: **GovWallet.** This lets agencies disburse benefits digitally, with unbanked consumers able to withdraw cash at AXS kiosks (AXS is the largest payment solutions provider in Singapore).[236]

Building supervisory capacity and modern oversight for digital finance

Policy makers could consider whether to build specialist supervisory capacity to support their activities. These could be in technical skills and understanding of e-payments, e-money, crypto/CBDC interfaces; the adoption risk-based and outcome-focused supervision; and deployment of Regtech/SupTech[237] to monitor APIs, scheme compliance, operational resilience, and market conduct. Policy makers should ensure frameworks do not default to bank only models that block specialised providers.

This policy is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Urges building regulatory/supervisory capacity to promote safe, beneficial digitalisation. The report warns that sector-based (bank-centric) rules can block payments entrants.[238]

This policy has been implemented in the following country examples:

- **India: DAKSH**. An end-to-end SupTech platform to strengthen risk-based, outcome-focused supervision.[239]

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233 P. 24

234 P. 21

235 Citizen's Account - Saudipedia

236 GovWallet - Features & Roadmap | Singapore Government Developer Portal

237 Regulatory and Supervisory Technology used to manage, monitor, and enforce regulatory compliance.

238 P. 45

239 Press Releases - Reserve Bank of India

- **Singapore: MAS Electronic Payment System (MEPS+).** Is the country's real-time gross settlement system for high-value SGD interbank transactions, using secure SWIFT messaging (a global standard for sending financial transaction instructions safely between banks) and automated gridlock detection (a mechanism that spots and resolves stuck payment queues by offsetting transactions) to ensure timely, risk-mitigated settlements.[240]

9.3.2 Policies for countries shifting from moderate to advanced levels of digital development

Open banking and open finance for data-sharing relating to payments & financial data

Open banking and open finance frameworks are regulatory and technological frameworks that let consumers and businesses securely share their banking and financial data with authorised third parties (via APIs). Promoting open banking, open finance, and data sharing can support innovation, competition, financial inclusion. To this end, policy makers could consider first completing a gap analysis of existing data-sharing initiatives, API adoption, legal bases, and supporting infrastructure (credit bureaus, retail payment guidance). Where gaps exist, they could introduce an open-banking framework that mandates standardised, secure APIs, with common technical specifications and strong customer authentication, so licensed third-party providers (TPPs), with explicit user consent, can access account information and initiate account-to-account payments ("pay by bank"). The framework should set interoperability requirements across banks/PSPs, certification and supervision of TPPs, clear liability and SLA rules, and implementation timelines.

This policy is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024)**: Recommends finalising an open banking framework and amending the PCSA[241]; it specifies the need for a gap analysis spanning legal, API, and infrastructure contexts.[242]

This policy lever has been implemented in the following country examples:

- **EU: Payment Services Directive 2** (**PSD2)** enabled open banking. It required banks to open access to customer accounts for licensed TPPs via APIs. Payment Services Directive 3 (PSD3) will strengthen consumer protection, fraud prevention, and improve open banking functionality.

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240 Singapore Fast Payments

241 Payment Clearing and Settlement Act

242 P. 93 and P. 96

- **Saudi Arabia: SAMA Open Banking Framework**. Set out AISP/PISP rules and go-live timelines in 2023.[243]

Real-time retail payment rails and Central Bank Digital Currency (CBDC) interoperability

Policy makers can consider mandating instant retail payment availability to all licensed PSPs via common access models; publish open scheme rules and fee caps for low-value transfers; and operationalise CBDC. This enables users to move value across all licensed wallets and bank accounts seamlessly, under central bank oversight.

This policy lever is highlighted in the following DPFs:

- **DE4LAC Jamaica (World Bank, 2024)**: Recommends accelerating JAM-DEX interoperability across wallet providers under BOJ oversight.[244]
- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Cites PIX (Brazil's central bank-operated instant payment rail) as an open, real-time, low-cost system enabling universal access.[245]
- **A Conceptual Policy Framework for Leveraging Digitalisation in SSA (IMF, 2024):** Notes the importance of mobile payments and national digital currencies (e-Naira, e-Ariary) for strengthening inclusion and transparency.[246]

This policy lever has been implemented in the following country examples:

- **EU**: **Instant Payments Regulation.** Requires PSPs that offer credit transfers in euro to send/receive instant payments, with staged compliance from 2025.[247]
- **India: Digital Payment Intelligence Platform (DPIP)**. RBI-led initiative that uses real-time data sharing and advanced analytics to detect and prevent digital payment fraud across India's financial ecosystem.[248]
- **Oman: Real-Time Gross Settlement System (RTGS)**. Is a high-value electronic funds transfer platform that settles transactions individually and immediately on a gross basis. Since June 2023, it operates continuously, even outside standard banking hours.[249]

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243 SAMA Issues the Open Banking Framework

244 P. 26 and P. 34

245 P. 27

246 P. 19 and P. 21

247 Instant Payments Regulation

248 Digital Payment Intelligence Platform: RBI Launches AI Platform to Combat Digital Payment Frauds, ETBFSI

249 Real Time Gross Settlement System | CMA

Leveraging data intermediaries for faster credit

There are a number of interventions that can open access and reduce barriers for borrowers and MSMEs. Policy makers should consider deploying open protocols and consent based data intermediaries (licensed, neutral utilities that relay a borrower's data from holders to lenders only with the borrower's explicit, granular, time-bound consent, with easy revocation and full audit trails) to reduce friction in the credit lifecycle. In practice, this enables low-cost, low-friction loan origination through borrower-authorised data pulls, and fast, traceable disbursal with real-time confirmation.

This policy lever is highlighted in the following DPFs:

- **The Human and Economic Impact of Digital Public Infrastructure (UNDP, 2023):** Highlights Open Credit Enablement Network APIs and account-aggregator-style flows that enable user-controlled data sharing across lenders and aggregators.[250]

This policy lever has been implemented in the following country examples:

- **Saudi Arabia: Mada.** Connects all ATMs and POS terminals to a central switch, is mandated across banks, and is interoperable with global schemes via unified API integration, enabling comprehensive and seamless transactions at home and abroad.[251]
- **Singapore: SGFinDex.** Enable consumer-consented data sharing from government/banks to financial institutions, streamlining loan origination and underwriting.[252]

Promoting cross-border interoperability and trusted data flows

Policy makers could consider the need to work with international partners to enable interoperability between regimes (payments, data protection, cybersecurity) and to support trusted cross-border data flows that underpin digital trade and cross-border financial services.

This policy lever is highlighted in the following DPFs:

- **Going Digital Integrated Policy Framework (OECD, 2020):** Recommends promoting interoperability and cross-border data flows to support digital trade/financial services.[253]

This policy lever has been implemented in the following country examples:

- **EU: EU-US Data Privacy Framework.** Re-established a lawful basis for transatlantic data flows via an EU adequacy decision (which is a ruling by the European Commission that a

250 P. 27

251 Mada

252 SGFinDex

253 P. 43

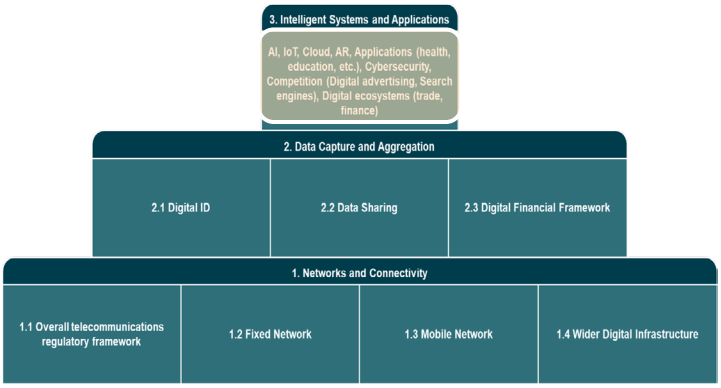
country ensures data protection equivalent to GDPR standards, allowing personal data to flow freely without additional safeguards).[254]

- **GCC/Arab region: Buna.** Banks in Saudi Arabia and Oman have joined Buna, the Arab Monetary Fund's cross-border multi-currency payment platform.[255]

254 Adequacy decision for safe EU-US data flows

255 Buna | Arab Monetary Fund

10 Pillar 3 Intelligent Systems and Applications



The third pillar focuses on the regulatory and policy environment that supports the use of digital applications and services that rely on digital public infrastructure (DPI). The broad range of possible applications and systems means it is not possible to explore the full range of policy levers that can be used to support every possible system or application. Nevertheless, the possible policy levers set out here illustrates the breadth of opportunities for governments to enable innovation, ensure fair competition, and build trust in digital ecosystems. These include:

- **Policies for emerging technologies** that can be used across many different sectors, such as AI, IoT, cloud services, and augmented reality. In this category, we focus, for illustrative purposes, on AI.
- **Horizontally applied policies** such as data protection and privacy, cybersecurity, rules to promote competition in digital markets, and digital initiatives to foster cross broader trade and finance ecosystems. This category is illustrated with policies around data protection.
- **Vertical sectoral applications** such as in e-health, e-agriculture, e-education, smart cities, and industry 4.0. E-education, e-agriculture and e-health are used to illustrate the breadth of policy interventions.

10.1 The role of Intelligent Systems and Applications

10.1.1 The role of Intelligent Systems and Applications in a nation’s digital development

Technological progress means that the way we produce, distribute and consume goods and services continues to evolve. Such progress brings economic productivity, lowering prices, increasing prosperity and driving consumer demand. Government policy can play a role in introducing and embedding new technologies across the economy, to maximise their potential and ensure that their use does not cause harm. However, while emerging and newer digital technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), cloud services, augmented reality, and advanced digital applications hold great promise, they rely on strong digital physical infrastructure (such as broadband networks, data centres) and the digital public infrastructure. Without pillars 1 and 2, efforts to introduce advanced technologies risk being ineffective, unsustainable, or unproductive.

Once the foundational pillars 1 and 2 are in place, countries can begin to effectively leverage advanced technologies to modernise public sector operations and drive efficiencies across key sectors. For example, AI and IoT can improve urban management in smart cities, while cloud services enable more scalable, secure, and cost-effective digital service delivery. In health, education, and payment systems, these technologies can enhance service accessibility and quality, while stronger competition in digital markets and robust cybersecurity measures can foster innovation in business models, service delivery and user protection.

Importantly, these applications may also have a transformative role in promoting inclusion and advancing Sustainable Development Goals (SDGs). AI-driven education platforms can help bridge learning gaps in underserved regions; health applications can extend medical advice to remote communities; and digital payment systems can expand access to financial services for unbanked populations. Similarly, trade and finance ecosystems powered by digital tools can bring small businesses into global value chains, while smart and sustainable urban planning can reduce inequalities in service provision.

However, the transformative role of AI is still very much in the 'promised' stage for LMIACs. Any large-scale benefits attributed to AI are 'potential' and not realised. At the same time, it is noteworthy that AI can in some circumstances reduce inclusion and widen online and offline divides (and thereby slow down progress on the SDGs). Through careful design and governance, fostering digital inclusion and aligning with goals such as universal health, quality education, and access to finance, AI technologies can become powerful enablers of inclusive and sustainable development.

10.2 Intelligent Systems and Applications Development Indicators

There are a range of indicators that can be used to track progress, depending on the specific policy areas under consideration. Some indicators are narrowly focused on specific policy areas, such as those measuring cybersecurity resilience, platform penetration, or data literacy. Others capture broader outcomes of digitalisation, such as the Economic Digital Access Index (EDAI) or the Global Innovation Index, which reflect the combined impact of multiple policies working together.

Table 15 Intelligent Systems and Applications Development Illustrative Indicators

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
AI	IMF AI Preparedness Index	Measures how ready a country is to adopt AI across infrastructure, skills, innovation, and regulation.	<0.4	0.4-0.6	>0.6	AI Preparedness Index (AIPI) - AI Preparedness Index
Data Protection and Cyber-security	Global Cybersecurity Index (GCI)	ITU index of cybersecurity performance across countries	<65	65-95	>95	ITU Global Cybersecurity Index
e-Education	DigComp 2.0 Proficiency Levels and Skill Benchmarks	Measure of digital/data literacy based on DigComp 2.0 framework	Low proficiency (DigComp Levels 1-2)	Intermediate proficiency (DigComp Levels 3-5)	High proficiency (DigComp Levels 6-8)	EU DigComp 2.0 Framework
e-Health	WHO Global Digital Health Monitor	Tracks countries' progress in adopting and implementing national digital health policies,	Phase 1-2	Phase 3-4	Phase 5	Global Digital Health Monitor

Pillar Objective	Indicator	Description	Basic Development	Moderate Development	Advanced Development	Source
		systems, and services.				
e-Agriculture	Agricultural research spending	Share of agricultural GDP invested in research and development.	0.5%	0.5-1%	>1%	National Data,

Source: Frontier Economics

10.3 Policy levers

Digital transformation requires a mix of broad, technology-focused, and sector-specific interventions. To structure these, policies can be classified both by their scope (horizontal, tech-specific, or vertical) and by their purpose (for example, whether they seek to enable adoption or promote digital and economic advancement).

- **Policies which enable adoption** are foundational measures that create trust, build capacity, and remove barriers, ensuring that digital technologies can be widely embraced by businesses, governments, and citizens.
- **Policies which promote digital and economic advancement** include measures which foster new products and services, support market expansion, and encourage the development of specialised capabilities (i.e. centres of excellence, or export comparative advantages) within the country.

10.3.1 Policies to enable adoption

Policy makers could consider a range of policies to drive adoption. These include but are not limited to, those set out below.

Table 16 Policy Levers

Policy Area	Policy	DPF example	Country example
AI	Development of a National strategy to encourage the use of AI.	Digital Readiness Assessment North Macedonia (UNDP, 2024)[256] UNDP AI Landscape Assessment (AILA)	Saudi Arabia: National Strategy for Data and Artificial Intelligence (NSDAI)[257]
Data Protection	Implement privacy-by-design principles and require mandatory data breach notification to promote trust and consumer protection.	Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023)[258]	India: DPDP Act 2023[259]

256 P. 17

257 SDAIA | National Strategy for Data & AI

258 pp. 23-24

259 The Impact of India's New Digital Personal Data Protection Rules | Privacy World

Policy Area	Policy	DPF example	Country example
Education	Expand and target digital transformation programs in the education sector	DE4LAC Jamaica (World Bank, 2024)[260]	Saudi Arabia: "Madrasati" national e-learning platform, embedded in Vision 2030[261]
Health	Provide hands-on training and clear communication to ease clinician adoption of Electronic Health Records (EHRs) and other e-health tools Foster a culture of innovation in healthcare to embed and sustain new digital technologies.	Arab Digital Economy Vision (League of Arab States, 2020)[262]	Singapore: MOH Telemedicine e-Training Programme.[263]
Agriculture	Provide grants and tax incentives to attract investments and support farmers and agri-startups in adopting precision agriculture.	Arab Digital Economy Vision (League of Arab States, 2020)[264]	India: Digital Agriculture Mission[265]

Source: Frontier Economics

AI

AI adoption-oriented policies focus on establishing comprehensive national strategies to guide the responsible use of AI[266] before deployment is scaled up. This can include leveraging AI

260 P. 119 and P. 128

261 Ministry of Education | In a new global achievement, "Madrasati" wins the grand prize at the World Summit on the Information Society (WSIS) Forum 2025

262 pp. 65-69

263 The Telemedicine services | Ministry of Health

264 pp. 79-84

265 Press Release: Press Information Bureau

266 Global Index on Responsible AI

tools to increase the efficiency with which government services are delivered and the accessibility of such services. For example, North Macedonia has launched an AI-powered digital assistant, ADA, to provide citizens with easier access to information and government services, as well as attracting investment.

Following adoption-oriented policies, governments typically start with a baseline **AI landscape assessment** to take stock of capabilities, governance gaps, data and skills, and priority public sector use cases before scaling deployments. UNDP's Artificial Intelligence Landscape Assessment (AILA)[267] is the established approach for this step, offering a structured assessment of national readiness across government as an enabler, government as a user, and ethical AI, and it complements UNDP's Digital Readiness Assessments with AI-specific governance and implementation guidance. Recent applications in Vietnam[268] and Montenegro[269] show how AILA anchors AI policy choices in evidence and links directly to roadmaps for responsible adoption, aligned to sustainable development priorities.

Data Protection

Policies in this area may focus on creating trust. These include implementing privacy-by-design principles, requiring mandatory breach notification when consumer data is compromised, and refining consent frameworks to reduce "consent fatigue". More advanced jurisdictions also clarify liability by distinguishing responsibilities between hosts, platforms, and service providers, ensure platforms adopt appropriate processes to take down inappropriate content. These steps provide the legal certainty and consumer protection needed for digital services to be embraced widely.

E-education

Policies to enhance adoption in this area may prioritise the foundations for digital learning by equipping teachers with ICT competencies, reforming curricula to embed technology, and ensuring equitable access to devices and internet to bridge any digital divide. They can also include expanding and targeting digital transformation programmes in the education sector, while giving schools autonomy to choose ICT tools suited to their needs and translating national ICT strategies into clear, practical guidelines. These measures create the necessary environment for effective uptake and sustained use of digital education.

E-Health

Governments should ensure that e-health technologies are introduced with adequate training and cultural integration. To overcome inertia, policies should provide hands-on training and highlight the value of technology to patients.

[267] AILA overview: https://www.undp.org/digital/aila

[268] Vietnam AILA Assessment - undp.org/sites/g/files/zskgke326/files/2025-04/undp_aila_eng_report_2025_final.pdf

[269] Montenegro AILA Assessment - https://www.undp.org/sites/g/files/zskgke326/files/2025-05/eng_undp-aila_montenegro.pdf

E-Agriculture

Policies to enhance adoption of precision agriculture typically emphasise reducing barriers and supporting farmers to embrace digital tools. They could include grants and tax incentives to encourage investment, training programs and centres to build farmers' digital skills, together with partnerships with global leaders to adapt solutions to local conditions. These measures create the conditions for faster, broader uptake of precision farming practices.

10.3.2 Policies to promote digital and economic advancement

Policy makers could consider a range of policies to promote digital and economic advancement. These include but are not limited to, those set out below.

Table 17 Policy Levers

Policy Area	Policy	DPF example	Country Example
AI	Develop AI Authorities and risk-based safeguards against harm.	Limited coverage in DPFs	Singapore's National AI strategy 2.0[270]
Data Protection	Modernise consent frameworks and introduce harm-based thresholds for breach notifications	Enhancing Policy and Regulatory Approaches to Strengthen Digital, Platform and Data Economies (ADB, 2023)[271]	Saudi Arabia: Data Breach Notification Guidance (PDPL)[272]
Education	Establish national E-Campus and Virtual Campus programmes to expand access to higher education through large-scale, cross-institution digital platforms.	Arab Digital Economy Vision (League of Arab States, 2020)[273]	Qatar: National e-Learning Strategy[274]

270 National AI Strategy | Smart Nation Singapore

271 pp. 23-24

272 Guide to the Saudi PDP law HANDBOOK

273 pp. 69-73

274 E-learning | Ministry of Education & Higher Education

Policy Area	Policy	DPF example	Country Example
Health	Adopt interoperable "Once Only" systems for seamless patient data sharing. Scale up EHR to enable faster, more accurate, and timely care.	Arab Digital Economy Vision (League of Arab States, 2020) [275]	Saudi Arabia's Unified Health File: Digital health platform via the Sehaty app launched by the National e-Health Strategy. [276]
Agriculture	Develop and deploy advanced robotic and AI-powered solutions (e.g., for automated crop evaluation and harvesting) to enhance efficiency and reduce labour intensity in agriculture.	Arab Digital Economy Vision (League of Arab States, 2020)[277]	EU: NextGenerationEU Support for precision Agriculture[278]

Source: Frontier Economics

AI

Policies that promote digital advancement in AI design more comprehensive frameworks for the use of AI which could include risk-based safeguards against harm; the development of strong AI authorities for oversight; incentives to attract infrastructure investment and AI providers; training in AI related skills (e.g. prompt design, AI tool training), and development AI centres of excellence, which are central hubs that set standards, provide shared tooling and expertise, and accelerate safe, high-impact AI use cases (e.g., AI Singapore). Together, these measures can build trust and enable more advanced AI applications to deliver economic and social benefits.

Data protection

Data protection policies can enable innovation, by modernising consent frameworks, embedding privacy-by-design culture into systems development, and introducing harm-based

[275] pp. 64-69

[276] Unified Health File - An Overview of the Unified Health File

[277] pp. 79-84

[278] Support for Precision Agriculture and 4.0 Technologies - European Commission

thresholds for breach notifications. Policy can ensure data protection rules will support cross-border trade while still protecting rights. This requires robust supply chain management and mature, risk-based policies on data sovereignty that go beyond strict rules, ensuring governance is both pragmatic and adaptive.

E-Education

Policies in e-education can encourage personalised, AI-driven learning platforms and real-time data analytics. For example, by connecting historical and real-time student data, governments can seek to deliver adaptive education, for example education platforms can adjust pace real time depending on the student's engagement and attainment. In addition, governments can establish national E-Campus and Virtual Campus programs to expand higher education access through large-scale, cross-institution digital platforms.

E-Health

Beyond adoption, broader digital advancement policies can emphasise interoperable data-sharing systems, support for health startups, and the scaling of key technologies such as Electronic Health Records, telehealth, m-health, e-learning, and big data analytics. These initiatives enable faster diagnosis, remote monitoring, better decision-making, and greater efficiency, while robust legal frameworks ensure data security, patient trust, and sustainable growth of e-health ecosystems.

E-Agriculture

Policies to promote digital advancement in agriculture can focus on the development and deployment of advanced robotic and AI-powered solutions (e.g., for automated crop evaluation and harvesting), supported by innovation hubs and EU-style research programs to promote the use of technology.

Annex A : Digital Policy Frameworks

The following table lists the Digital Policy Frameworks assessed to inform this Amalgamated Digital Policy Framework. These were ranked on four criteria: relevance to emerging digital markets in lower- and middle-income Arab countries; scope, favouring comprehensive, in-depth coverage of both Pillar 1 (Network & Connectivity) and Pillar 2 (Data Capture & Aggregation); policy detail, prioritising specific, actionable measures mapped to pillars and sub-pillars; and measurability, requiring clear, monitorable targets and guidance for tracking progress.

Table 18 Top 10 Digital Policy Frameworks Assessed

Rank	DPF Title	Author(s)	Year
1	Digital Economy for Latin America and the Caribbean (DE4LAC) – Country Diagnostic: Jamaica	World Bank	2024
2	Digital Economy Kit	Oxford/ITU	2020
3	Framing Policies for the Digital Economy	NUS	2018
4	A Conceptual Policy Framework for Leveraging Digitalisation in Sub-Saharan Africa	IMF	2024
5	Enhancing Policy and Regulatory Approaches to Strengthen Digital Platform, and Data Economies	ADB	2023
6	Digital Readiness Assessment – North Macedonia	UNDP	2024
7	Going Digital Integrated Policy Framework	OECD	2020
8	Digital Regulation for Digital Transformation and Access for All	ITU	2023
9	The Human and Economic Impact of Digital Public Infrastructure	UNDP	2023
10	Arab Digital Economy Vision	League of Arab States	2020

Source: Frontier economics

In addition to the ten DPFs studied in depth, the project involved a higher-level review for a further 18 DPFs.

Table 19 Other DPFs considered

Framework	Author	Year
UNDP Inclusive Whole-of-Society Digital Transformation Framework	UNDP	2023
Digital Economy for Latin America and the Caribbean: El Salvador	World Bank	2022
Digital Economy for Latin America and the Caribbean: Colombia	World Bank	2023
Digital Economy for Latin America and the Caribbean: Ecuador	World Bank	2024
Think differently. Think archetype. Your digital economy model.	Arthur D Little	2020
Going Digital Measurement Roadmap	OECD	2022
Digital Economy Report	UNCTAD	2024
Digital Ecosystem Framework	USAID	2022
Measuring Digital Economies & Regulatory Environment for Financial Innovation	UNCDF	2023
Digital Transition Framework	WEF	2023
Digitalisation in Europe 2022-2023	EIB	2023
Internet Value Chain	GSMA	2022
Digital Readiness Assessment: Moldova	UNDP	2021
Digital Readiness Assessment: Trinidad and Tobago	UNDP	2022
Digital Readiness Assessment: Suriname	UNDP	2022
Digital Readiness Assessment: Guatemala	UNDP	2023
Digital Readiness Assessment: Ecuador	UNDP	2023

Framework	Author	Year
Digital Readiness Assessment: Malawi	UNDP	2024
Digitalisation and the Africa We Want	GSMA	2024

Source: Frontier Economics

Note: Diagnostics and Digital Readiness assessment all offer similar coverage but to preserve variety only one of each category was selected