

The DPI Approach

A PLAYBOOK



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Foreword

Every journey towards implementing **digital public infrastructure (DPI)** is unique. For countries at the start of their journey, wrestling with the questions arising from nascent technology and standards can be daunting. Where to start?

This playbook is **designed as a practical resource** for countries to use as they begin to think about building rights-based and inclusive DPI and at all subsequent stages. It provides perspectives from multiple points along the route and waypoints to chart progression. It shares **experiences from thought leaders** in DPI and offers a hands-on compilation of **'plays', techniques, self-assessment tools, and example blueprints** to catalyse positive outcomes.

With the growing demand for DPI to address complex challenges across different societies, the tools' ability to be **tailored to national contexts** and needs is an added value. Case studies scrutinising best-practices are shared, alongside a series of practical steps which will help to accelerate achievement of the Sustainable Development Goals (SDGs) through DPI.

We invite you to explore and use this playbook to get you to the next stage of your DPI journey.

Sushil Pal
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India's G20 Presidency, 2023
Government of India

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Chief Digital Officer
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About the playbook

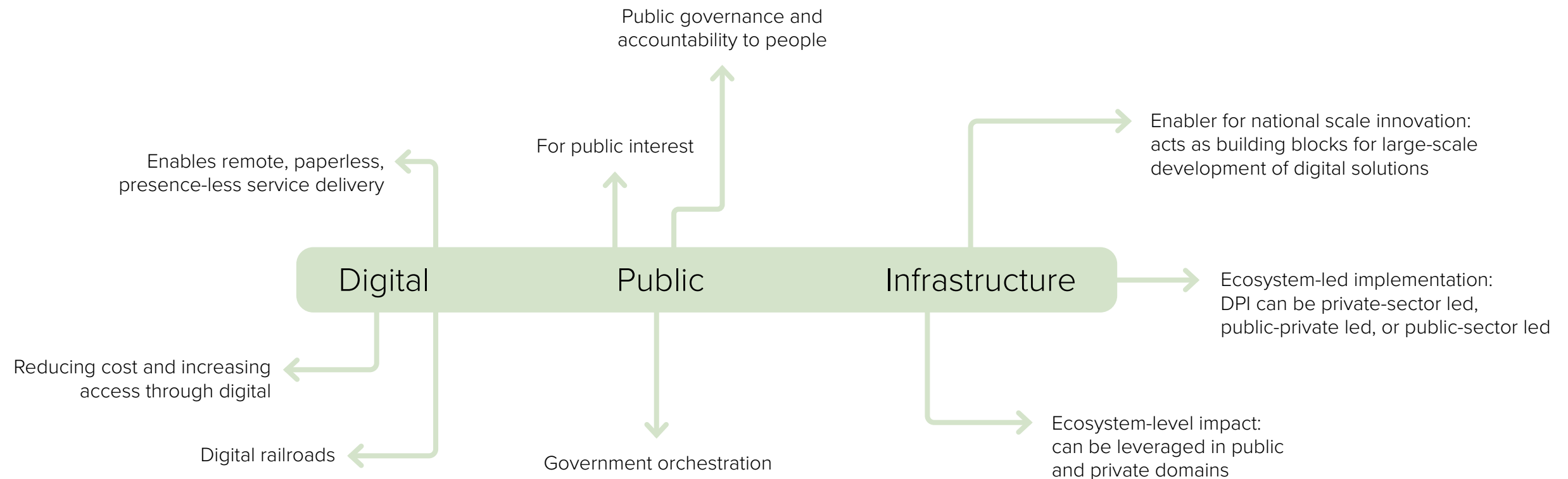
What is this playbook?

This playbook maps the journey from conventional public service delivery to the DPI approach. It demonstrates how building the appropriate technology architectures, governance schemes, and digital ecosystems enable safe, inclusive, and secure public and private services. It considers pressing issues encountered by countries as they formulate rights-based DPI. It offers examples and practical reference tools and scrutinises both challenges and best practices.

Who is this playbook for?

The playbook is designed from a country-centric lens as a catalyst to accelerate the SDGs. It is a tool for individuals, sectors, or governments who seek to improve services and safeguards for people via DPI. The playbook fosters a shared understanding of common goals among stakeholders working with DPI.

We recognize **DPI**¹ as a set of shared digital systems which are secure and interoperable, built on open standards and specifications to deliver and provide equitable access to public and/or private services at societal scale and are governed by enabling rules to drive development, inclusion, innovation, trust, and competition and respect human rights and fundamental freedoms.



How to use the playbook

What is a play?

Each play (or section) consists of guiding literature, frameworks, best practices, and checklists for you to unlock a foundational understanding of DPI.

The plays are modular; you can read and implement them independently of each other, based on your country's needs.

The six plays cover the entire journey of developing and deploying DPI. This includes a foundational understanding of DPI, scoping assessment, technology, governance, sustainability, and implementation of DPI.

What does each play contain?

Context: Compiles existing knowledge and discourse on the play's theme.

Framework: Provides a rubric for analysis of the context.

Examples: Demonstrates applications of the framework through real-world examples.


Checklist: Outlines questions for countries to consider.

How can you make the most of this playbook?

Navigate easily: All underlined text in this playbook has been hyperlinked for ease of use. Click on the links at the bottom of every page to navigate between and across plays.

Look out for key points: Takeaways and tips have been highlighted with the  symbol.

Read further: Links to additional resources are marked with the  symbol.

Print checklists and assessments: Some sections might require physical copies. Use the link to the printable file, marked with the  symbol.



Building blocks

Software code, platforms, and applications that are interoperable, provide a basic digital service at scale, and can be reused for multiple use cases and contexts. (GovStack)

Data minimization

The data protection principle which requires that the processing of data be adequate, relevant, and limited to what is necessary in relation to the purposes for which they are processed. (General Data Protection Regulation)

Digitalization

The process of transitioning existing businesses and services to using digital technologies, as well as the use of digital technologies and data (and the interconnection that results) in new activities. (Digital Impact Alliance)

Digital public good (DPG)

Open-source software, open data, open AI models, open standards, and open content that adhere to privacy and other applicable laws and best practices, do no harm by design, and help attain the SDGs. (Digital Public Goods Alliance)

Digital public infrastructure (DPI)

A set of shared digital systems which are secure and interoperable, built on open standards, and specifications to deliver and provide equitable access to public and/or private services at societal scale and are governed by enabling rules to drive development, inclusion, innovation, trust, and competition and respect human rights and fundamental freedoms. (India's G20 Presidency, 2023)

Digitization

The conversion of analogue data and processes into a machine-readable format, but that only transforms the physical analogue data itself into 1s and 0s. (Digital Impact Alliance)

Interoperability

The ability of different systems, devices, or applications to exchange and use information effectively—crucial in DPI as it enables integration, cooperation, and the exchange of information across digital systems. (European Data Protection Supervisor)

Open Network for Digital Commerce (ONDC)

An initiative by the Government of India aiming at promoting open networks for all aspects of exchange of goods and services over digital or electronic networks. (Press Information Bureau, India)

Open API (Application Programming Interface)

A publicly available interface that allows developers to access and utilize the functionalities of a particular system or service, enabling other programmes to make use of them as modules. The term “open” implies that the API specifications are openly available and can be accessed by any developer or organization. (Oxford Reference)

Open licensing

The use of licences that allow users to access, use, modify, and distribute copyrighted works such as software, content, or creative works with few or no restrictions. Open licensing promotes collaboration, sharing, and the free flow of knowledge and innovation. (Creative Commons, MIT)

Open protocol

A set of rules and specifications that govern the exchange of data and communication between different systems or devices. It is open in the sense that the specifications are publicly available for developers to integrate or implement without restrictions. (Foundation for Interoperability in Digital Economy)

Open-source

Refers to something, historically software, that people can modify, share, and re-use because its design or “source code” is made publicly accessible. Open-source products provide universal access through an open-source licence that legally enables it. (Digital Public Goods Alliance)

Open standards

Technical standards and specifications that are publicly available, developed through a collaborative and transparent process, and free from proprietary restrictions. These standards ensure that different systems and technologies can work together seamlessly, promoting interoperability and avoiding proprietary vendor lock-in. (International Telecommunications Union)

Privacy by design

Integration of data protection principles into the design of the technology itself. (General Data Protection Regulation)

Proprietary software

Any software that is copyrighted and bears limits against use, distribution, and modification that are imposed by its publisher, vendor, or developer. Proprietary software remains the property of its owner/creator and is used by end-users/ organizations under predefined conditions. (Techopedia)

Sustainable Development Goals (SDGs)

Universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity; adopted by the United Nations in 2015. (United Nations Development Programme)

Unified Payments Interface (UPI)

India’s fast payments solution that powers multiple bank accounts into a single mobile application (of any participating bank), merging several banking features, seamless fund routing, and merchant payments into one hood. It also facilitates “Peer to Peer” payments. (National Payments Corporation of India)

Vendor lock-in

When a customer is restricted and heavily dependent on a proprietary technology, leading to a situation in which a user is forced to pay high prices and stick with a technology that does not meet their needs due to contracts and the lack of data portability. (Digital Impact Alliance)

PLAY 1

Unbundling DPI

Creating safe, inclusive and secure digital systems through the DPI approach



In this play, you will find:



Context

What is the DPI approach?

What are the suggested principles for DPI?

Why should countries adopt DPI?

Who drives DPI development and adoption?



Framework

Which layers comprise the DPI approach?

How can countries locate their position on the DPI journey?



Examples

How have countries progressed towards the SDGs by adopting the DPI approach?



Checklist



What is the DPI approach?

Physical infrastructure, such as railroads, built through public investments laid the foundation for private innovation and societal development. Similar systems for the 21st century are now being built in the digital domain to **simplify the flow of people, money and information**, and are collectively referred to as DPI.

DPI creates exponential societal outcomes **within and across sectors**. It is composed of open, interoperable technology with transparent, accountable, and participatory governance frameworks to unlock innovation and value at scale.

DPI **accelerates progress towards the SDGs** and enables digital transformation within a country. By adopting the DPI approach, countries modernize their service delivery mechanisms in a **safe, inclusive, and secure manner** while respecting human rights, and protecting intellectual property rights. The approach is situated at the intersection of technology, governance, and local ecosystems.

The key pillars of the DPI approach:



Open, interoperable technology

Built on principles of openness, interoperability, and scalability, the technology architecture ensures that DPI are **resilient, adaptable, and capable of evolving** to meet the changing needs of society at scale.



Robust governance

DPI complements **regulatory and policy frameworks** by embedding governance principles directly into the architecture of the infrastructure to be inclusive and secure.






Resilient local ecosystems

DPI promotes **market innovation and efficient service delivery** by championing the private sector, civil society, academia, and its communities of practitioners.

What are the suggested principles for DPI?

By adhering to the following principles, countries can ensure **digitalization is aligned with the DPI approach**.

 Technology	 Governance	 Ecosystem
<p>Interoperability Enable interoperability by using open-source solutions with a technology-neutral approach.</p> <p>Modularity and extensibility Use a building block approach to accommodate changes to existing architecture without disruption.</p> <p>Scalability Use flexible design to easily accommodate growing demand without changing existing systems.</p> <p>Security and privacy by design Embed key security features within the core design to ensure individual privacy, data protection, and technology resilience.</p>	<p>Public benefit, trust, and transparency Maximize public benefit, trust, and transparency through laws, regulations, policies, and capabilities to ensure DPI is safe, secure, trusted, and transparently governed, promotes competition and inclusion, and adheres to data protection and privacy principles.</p> <p>Grievance redressal Define accessible and transparent mechanisms for grievance redressal, i.e., user touchpoints, processes, and responsible entities, with a strong focus on actions for resolution.</p> <p>Intellectual property protection Protect and provide adequate and effective enforcement of intellectual property rights for the rights-holders of technologies and other materials used in DPI based on existing legal frameworks.</p>	<p>Inclusivity Eliminate or reduce economic, technical, or social barriers to enable last-mile access, and avoid erroneous algorithmic bias.</p> <p>Human rights Adopt an approach that respects human rights at the planning, designing, building, and operating stages.</p> <p>Collaboration Encourage the participation of community actors at different stages of planning, designing, building, and operating to facilitate the development of user-centric solutions.</p> <p>Sustainability Ensure sustainability of DPI through multi-stakeholder participation that ensures adequate financing for uninterrupted operations and seamless user-focused service delivery.</p>

Why should countries adopt DPI?

Digitalization in countries is inevitable. An inclusive, innovative, and competitive one is not. The DPI approach helps countries embed **robust governance**, **safeguard its people**, and address the **four main purposes** identified below.



Inclusion

Countries are unable to deliver services to last-mile efficiency as existing mechanisms suffer from delays, leakages, and targeting errors—often excluding women and other marginalized communities. Through inclusive design, DPI help overcome such challenges by **streamlining service delivery and ensuring equity and empowerment**.



Resilience

Public emergencies (like COVID-19 and natural disasters) may impair conventional modes of service delivery. DPI helps overcome these barriers by enabling **uninterrupted, remote assistance** through digital networks operating at **national scale**.



Sovereignty

Centralized decision-making and legacy software restrict countries from imagining new digital solutions. DPI are open and interoperable, which offers countries the **autonomy and flexibility to plan, design, and implement** their digital systems.



Innovation

The DPI approach allows multiple stakeholders—governments, private sector, and civil society—to collaborate (through public-private partnerships, for example) and contribute to **innovation** in the digital ecosystem, enabling **fair market competition**.

 Use this list to identify other purposes of DPI that suit your country's context.

 [Click here](#) to learn more about gender-inclusive digital economies.



Who drives DPI development and adoption?

DPI ecosystems are composed of **multi-stakeholder arrangements** that contribute to both the technical and non-technical aspects.

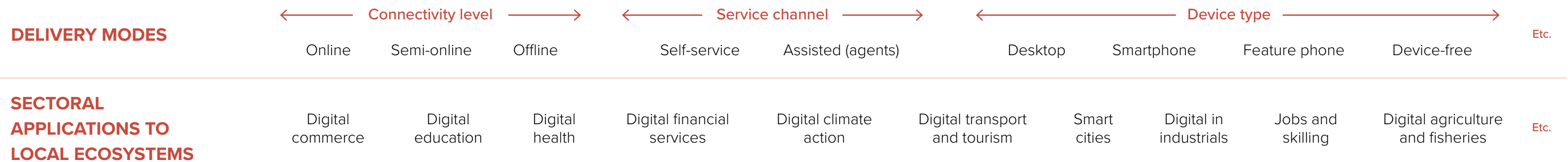
STAKEHOLDERS	TECHNOLOGY STACK Refer to page 26 (Play 3)	GOVERNANCE Refer to page 34 (Play 4)	SUSTAINABILITY Refer to page 42 (Play 5)
Public sector regulates, provides funding for, innovates, and contributes to the wide-scale implementation of DPI.	●	●	●
Private sector provides funding, technology innovation, technology standards for usage, and intellectual resources for DPI development.	●	●	●
Open-source community supports the development of standards and protocols, builds open-source technology, provides intellectual resources (e.g. through volunteering), and advocates for open-source adoption.	●	●	●
Development actors promote best governance practices, facilitate collaboration, and provide offline intermediation for on-ground DPI adoption.	●	●	●
Philanthropies provide grants for a fixed period of time, support the development of basic infrastructure, and promote private sector innovation.	●	○	●
Civil society organizations and end-users co-design DPI and help raise awareness about DPI.	●	●	●

- High engagement
- Medium engagement
- Low engagement
- No engagement

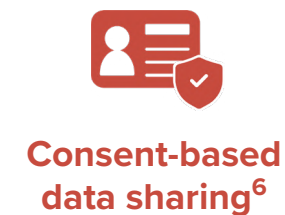
⊕ This is suggestive of stakeholders' involvement in DPI development and adoption—reflect on the extent of their involvement in your context.

What are the layers that constitute the DPI approach?

DPI refers to a set of shared digital systems which are secure and interoperable, built on open standards and specifications to deliver and provide equitable access to public and/or private services at societal scale and are governed by enabling rules to drive development, inclusion, innovation, trust, competition and respect human rights and fundamental freedoms¹.



CORE DPI² unlock DPI potential through open standards, open-source software, and open Application Programming Interfaces (API) that enable different DPI systems to communicate³.



Others emerging⁷...

+ Refer to page 29 (Play 3) for more information.

CORE DPI GOVERNANCE FOUNDATIONS

Strategic leadership and digital capacity
to set long-term ambition, align policy, secure financing, and set technical standards

Independent and accountable institutions
to prevent overreaches by the state and protect people's welfare

Legislative and regulatory frameworks
to promote inclusion and innovation, resolve disputes, and encode respect for privacy

Stakeholder collaboration
to collect user feedback and manage system performance

+ Refer to page 36 (Play 4) for more information.

1. Source: DEWG under India's G20 Presidency, 2023.

2. Core DPI functions defined in DEWG under India's G20 Presidency, 2023. These categories are dynamic in nature; they may evolve as more technologies mature and become core systems.

3. Source: DEWG under India's G20 Presidency, 2023.

4. The ability for people and businesses to securely verify their identity, as well as complementary trust services such as Electronic Signatures and verifiable credentials. Source: DEWG under India's G20 Presidency, 2023.

5. Easy and instant transfer of money between people, businesses, and governments. Source: DEWG under India's G20 Presidency, 2023.

6. Seamless flow of personal data across public and the private sectors, with safeguards for personal data protection as per relevant applicable data governance frameworks. Source: DEWG under India's G20 Presidency, 2023.

7. There may be other emerging core DPI tech functions, such as Discovery & Fulfilment and Geospatial DPI.

How can countries locate their position on the DPI journey?

Every digitalization journey is unique. Countries will have to make choices around **technology, governance and market participation** based on internal capacity, national priorities and development needs. Evaluating DPI along this chart helps countries track progress made in implementation across sectors.

+ Due to countries' varying needs, progression across these stages is unlikely to be as linear as depicted. Refer to [UNDP's Digital Development Compass](#) to compare progress in other countries.



Technology must be minimalist, adaptable, reusable, scalable, and resilient

Digital assets not yet operating as DPI

- A single government platform, app, certificate system, or database offering a service, but with low reusability at scale (e.g. limited API access to outside players, or a certificate without electronic verifiability)
- Multiple privately owned silo networks which are not interoperable

DPI in early stage of maturity

- Networks based on published open specifications, shared protocols, or open APIs (and DPI architecture design principles), but with low ecosystem adoption or low quality market ecosystem implementation
- Paper certificates with basic verifiability via digitally signed QR codes, but lacking API fetch access

DPI in later stages of maturity

- High scale interoperable networks with multiple public and private participants leveraging open APIs, open standards/specifications, or shared protocols
- Multi-modal access to the network via smartphone, feature phone, or no-phone (agent)
- Digital credentials with API-based access across multiple apps

Governance must protect public interest, human rights, data security, and privacy as well as settle disputes and hold parties accountable

Low degree of formal governance

- Absence of necessary legal and regulatory oversight to protect citizens from exclusionary policies and surveillance
- Few institutions with relevant mandates

Incomplete institutional mandates and regulatory frameworks

- Fragmented or unclear institutional mandates
- Reactionary policies or absence of a whole of government approach

Combination of institutions with mandates driving:

- Participatory community governance
- Consultative policy-setting, standard-setting
- Clear frameworks for dispute resolution

Local ecosystems (private and public) with innovation and market competition to empower user choice

- High barriers and costs to entry


- Medium barriers and costs to entry

- Low barriers and cost to entry

i [Click here](#) to learn more about Digital Ecosystem Country Assessments.

How have countries progressed towards the SDGs by adopting the DPI approach?

The following is an illustrative list of the **impact of DPI** across six SDGs.




1 NO POVERTY

By establishing systems to **identify vulnerable communities** (informal workers, women) and **roll out public services**

1.27 billion residents are enrolled on **Aadhaar**, India's digital identity infrastructure

13 unique public service provisions may be availed through **Nigeria's core digital identity verification service**




3 GOOD HEALTH AND WELL-BEING

By introducing systems to **enroll, schedule, and track doctor visits, medicines, and vaccinations** to support existing health infrastructure

2 days to develop a COVID-19 tracking platform post disease outbreak on **Sri Lanka's COVID-19 interface**

443 million vaccination certificates have been issued through **Pedulilindungi**, Indonesia's health interface



10 REDUCED INEQUALITIES

By instituting systems to identify vulnerable **populations with low financial literacy** and enable fast, **efficient, and accessible social transfers**

40 million individuals made their first-ever financial transfer through **Pix**, Brazil's payment ecosystem

6 million users registered on **PayNow**, Singapore's interoperable fast payments network—almost 100% population coverage



By instituting systems to **manage carbon offsets and trading, forest preservation, weather information and monitoring**, thus reducing response times to climate events

25 countries have adopted **Global Forest Watch** to access near real-time deforestation data accessible through open APIs to develop custom applications

91% reduction in greenhouse gas emissions estimated in Namibia, the first African country to implement a **Carbon Trading DPI**



By establishing **open ecosystems and data exchanges**, thus going beyond agriculture to support the **management of market linkages, water, and waste**

3.5 million Ethiopian farmers benefited through data exchanges combining their information with non-personal datasets (soil, weather, market prices) to improve agricultural practices

7.5 million smallholder farmers are set to benefit from the **Kenya Agricultural Observatory Platform's** accurate, real-time weather data that will help increase production and food security



By investing in learning management systems to **support education delivery digitally** and **improve access to digital resources** at larger scales

290 thousand e-contents in 30 languages available for teachers on **Diksha, India's digital learning ecosystem**, which has facilitated 5 billion learning sessions

18 educational institutions in Singapore use **OpenCerts** to issue digital certificates utilizing blockchain technology

Checklist

Use this checklist to **kickstart the DPI journey** in your country.



PLAY 2

Evaluating scope for DPI

Understanding how to assess development gaps for DPI intervention

In this play, you will find:



[Context](#)

What are the stages of a scoping assessment for DPI?
Which processes can be used for a scoping assessment for DPI?



[Framework](#)

How do you align the processes and stages of a scoping assessment for DPI most effectively?



[Examples](#)

How did Ethiopia conduct a scoping assessment for FarmStack?

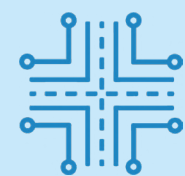
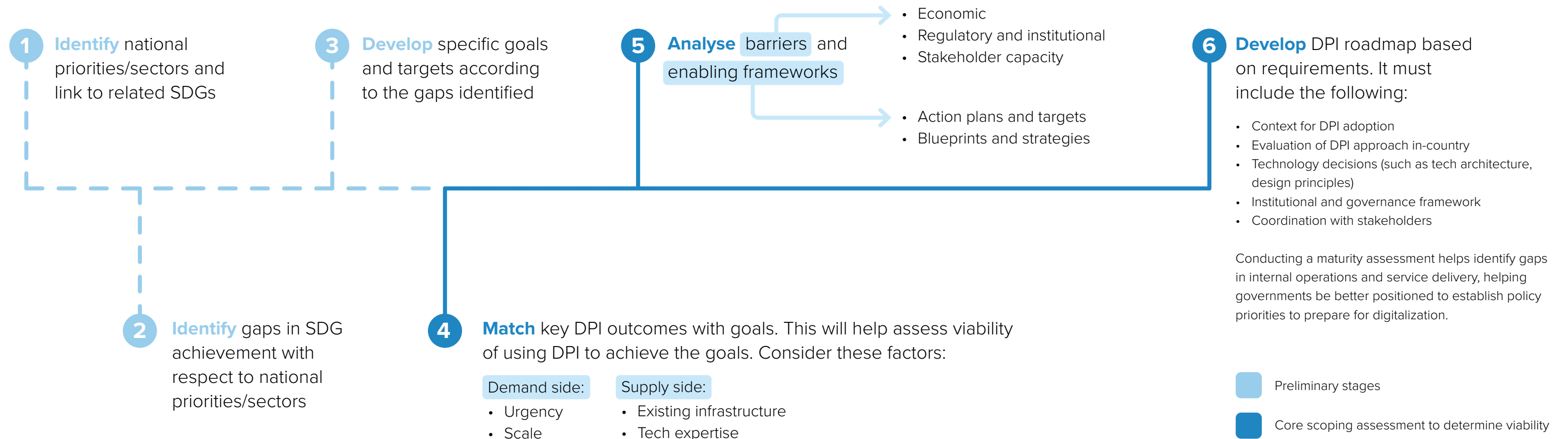


[Checklist](#)



What are the stages of a scoping assessment for DPI?

This roadmap explains the **six-stage scoping assessment** to be conducted before DPI adoption.



Why conduct a scoping assessment?

Since DPI is capable of catering to diverse uses, countries can benefit by assessing how they can be implemented in specific social, economic, and political contexts. **A scoping assessment allows countries to determine how DPI can be integrated into national efforts to achieve development priorities, such as the SDGs.** It also helps outline the scope and boundaries of DPI with respect to these national action plans. Carrying out a scoping assessment is an important prerequisite to successful DPI deployment.

[Click here](#) to learn more about digital maturity assessments.

Which processes can be used for a scoping assessment for DPI?

This list is suggestive—use a combination of these processes and add others, depending on your context.

PROCESS	MERITS	CHALLENGES
<p>Executive action includes the creation of task forces, working groups, and nodal agencies to realize national strategies and agendas to deliver DPI that protects people and fosters collaboration.</p>	<ul style="list-style-type: none"> • Awareness of national priorities • Takes least time 	<ul style="list-style-type: none"> • Possibility of excluding important perspectives
<p>Stakeholder engagement includes processes such as consultation, interviews, deliberation, participatory modelling, citizen science, co-design, etc. The appropriate process for stakeholder engagement may be determined in accordance with the degree of involvement sought.</p>	<ul style="list-style-type: none"> • Promotes inclusivity • Designs DPI rooted in lived user experience 	<ul style="list-style-type: none"> • Time and resource intensive • Stakeholders may not be able to effectively participate due to limited understanding of DPI
<p>Expert consultation includes expert interviews, surveys, consultations, and written analysis. Experts define the objectives of DPI, the scope of its adoption, its scaling capacity, resource allocation and forge partnerships of support.</p>	<ul style="list-style-type: none"> • Ensures endorsement by academia/scholars • Expedited insights and strategy development 	<ul style="list-style-type: none"> • Process may reflect views of single stakeholder group
<p>Data gathering and validation includes assessment of extant and new qualitative and quantitative data, to derive insights into the developmental landscape. Validated data provides empirical evidence of the need for DPI.</p>	<ul style="list-style-type: none"> • Objective, scientific, and reliable • Clearly evaluated outcomes 	<ul style="list-style-type: none"> • Data may not be available • Gathering data requires additional resourcing and capacity building • Possibility of bias

How do you align the stages and processes of a scoping assessment for DPI?

	Executive action	Stakeholder engagement	Expert consultation	Data gathering and validation	
1 Identify national priorities/sectors and link to related SDGs.	●	●	●	●	
2 Identify gaps in SDG achievement with respect to national priorities/sectors.	●	●	●	●	
3 Develop specific goals and targets according to the gaps identified.	●	●	●	●	
4 Match key DPI outcomes with these goals and targets. This will help assess the viability of using DPI to achieve these goals.	●	●	●	●	
5 Analyse barriers and enabling frameworks.	●	●	●	●	
6 Develop DPI solution roadmap based on requirements.	●	●	●	●	<ul style="list-style-type: none"> ● High engagement ● Medium engagement ● Low engagement
<p>+ Use this framework as a starting point to identify assessment processes that suit your country's context, development status, and national priorities.</p> <p>i Click here to learn more about conducting scoping assessments for identification systems.</p>					

How did Ethiopia conduct a scoping assessment for FarmStack?

FarmStack, Ethiopia's data exchange DPI, boosts the agriculture sector's output by disseminating data-driven insights derived from various actors across the farming supply chain. The **different stages involved in its scoping assessment** are detailed below.

1 Identify national priorities/sectors and link to related SDGs.

The Digital Ethiopia 2025 Strategy outlined two priorities for the agriculture sector—building a Digital Agriculture platform and promoting Agri-tech entrepreneurship. These priorities are linked to the following SDGs:

- SDG 2: Zero hunger
- SDG 8: Decent work and economic growth
- SDG 10: Reduced inequalities

2 Identify gaps in SDG achievement with respect to priorities/sectors.

Gaps in achieving these SDGs stemmed from inefficiencies along the value chain, issues in collating agricultural advice, and inaccurate farming data.

3 Develop specific goals and targets according to the gaps identified.

Based on known gaps, the Digital Ethiopia 2025 Strategy establishes linkages between the actors in the value chain, promoting precision agriculture through advanced data collection techniques, providing farming insights and sharing expertise.

4 Match key DPI outcomes with these goals and targets.

Since these goals rely upon data dissemination from diverse sources at scale and across multiple stakeholders, DPI emerged as the effective solution.

5 Analyse barriers and enabling frameworks.

The Digital Ethiopia 2025 Strategy outlines the following:

Barriers:

- Cybersecurity and data protection
- Labour replacement
- Re-education
- Digital divides

Enabling frameworks:

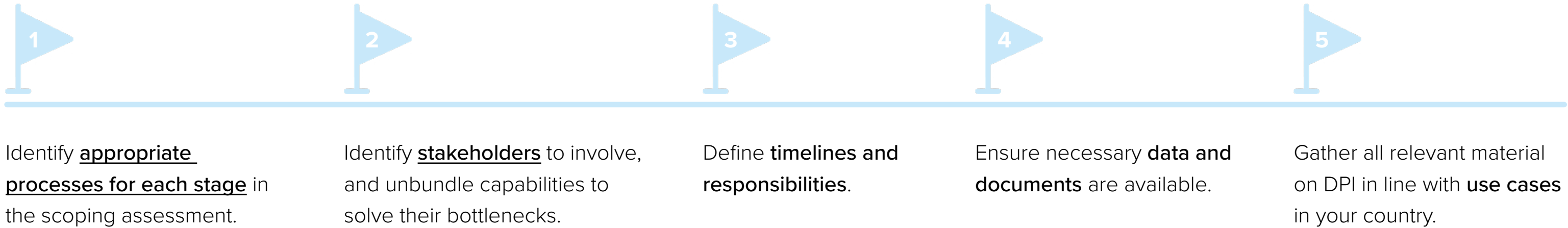
- Infrastructure
- Applications
- Stakeholder contribution to ecosystem development

6 Develop DPI solution roadmap based on requirements.

In light of this scoping assessment, Ethiopia adopted FarmStack as a DPI and developed a detailed roadmap for its implementation.

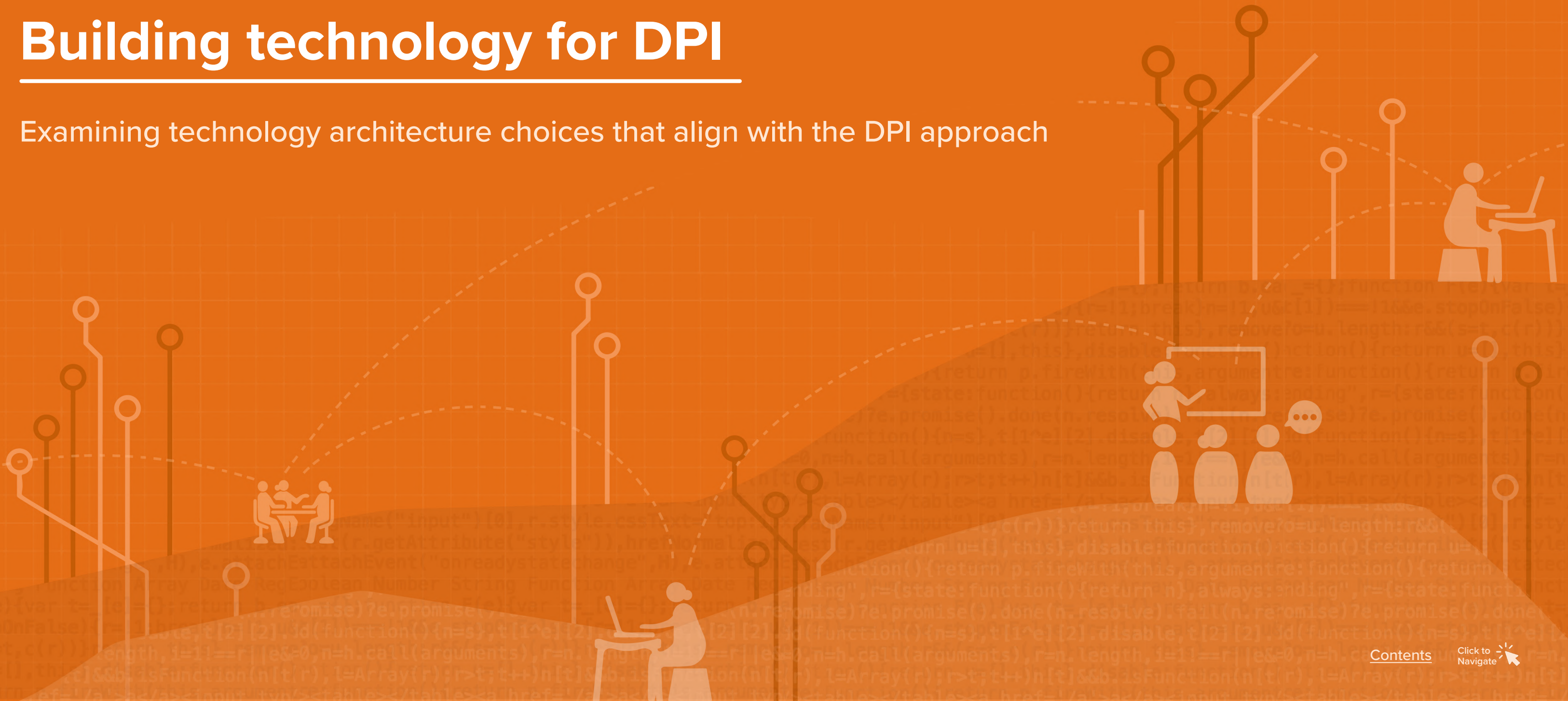
Checklist

Use this checklist to **prepare for the six-stage scoping assessment** for your country.



Building technology for DPI

Examining technology architecture choices that align with the DPI approach



In this play, you will find:



Context

What are the principles that guide DPI technology architecture?
What form the core DPI of a technology stack?
How can DPI technology be built for reusability and digital cooperation?



Framework

How can countries use building blocks, DPGs, and APIs to build technology for DPI?



Examples

How does the India Stack foster the creation of resilient local ecosystems?



Checklist



What are the principles that guide DPI technology architecture?

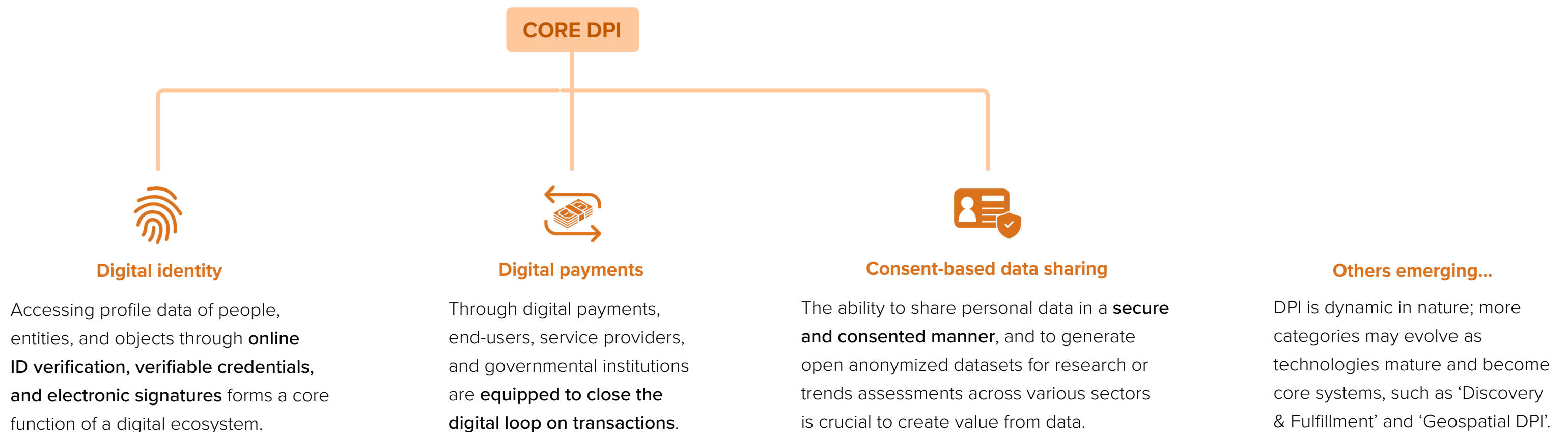
While a regular digitalization effort may adhere to one or more of the following principles, it must **fulfil all five in order to be considered DPI**.

Technical tools and guides to **operationalize these principles** are suggested below.

PRINCIPLES	TOOLS AND GUIDES
<p>Interoperability</p> <p>Making a system interoperable allows different digital systems to exchange and use information effectively. In an interoperable digital commerce network, end-users can purchase products from multiple service providers through a single shopping cart.</p>	<ul style="list-style-type: none"> • Open standards and specifications • Well-defined protocols and standards
<p>Modularity and extensibility</p> <p>An extensible system meets a population’s changing requirements by using modular reusable building blocks. These may be plugged in different systems to activate new features.</p>	<ul style="list-style-type: none"> • Minimal standardization of data collection formats • Minimalist, modular components
<p>Scalability for innovation and inclusion</p> <p>Designing a scalable system allows a wide-range of service providers and users to access digital solutions. This promotes innovation across the digital ecosystem.</p>	<ul style="list-style-type: none"> • Open APIs • Digital signatures and QR codes • Reusable software development kits
<p>Federation</p> <p>In order to overcome the inherent cybersecurity risks associated with centralized databases, it is critical to have a federated data architecture.</p>	<ul style="list-style-type: none"> • Federated databases • Digitization of existing registries • Wrapper APIs to connect multiple registries
<p>Security and privacy</p> <p>Building a zero-trust architecture ensures that end-users are protected from digital harms.</p>	<ul style="list-style-type: none"> • Tokenization and masking • End-to-end encryption • Granular electronic consent • Digital signatures

What form the core DPI of a technology stack?

Core DPI carry out essential functions which should be accessible at a low cost; this allows the technology stack to facilitate cross-sectoral innovation and population-scale impact. By building these core DPI using **open protocols and standards**, countries can enable network interoperability. This streamlines access to multiple services.



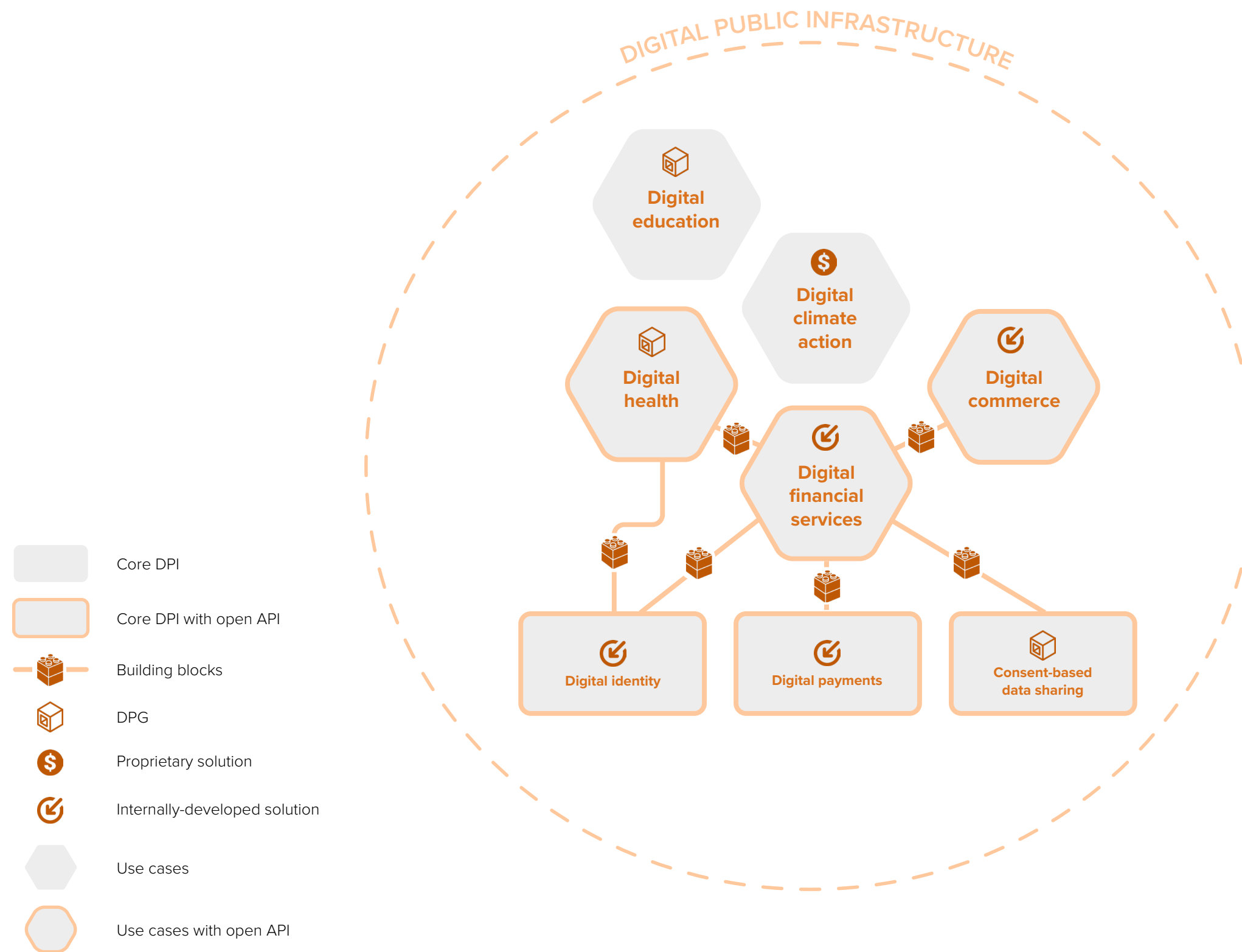
[Click here](#) to learn about how multiple countries conducted digital readiness studies prior to implementation.

How can DPI technology be built for reusability and digital cooperation?

Countries can use DPGs, building blocks, and open APIs to build shared digital systems, enabling equitable access and innovation through **cross-country collaboration**.

Digital Public Goods (DPGs)	Building blocks	Open Application Programming Interfaces (API)
<p>These are open-source software, open data, open AI models, open standards, and open content that are developed worldwide and available to openly license.</p> <p>The Digital Public Goods Alliance (DPGA) maintains a registry where all recognized DPGs can be discovered.</p> <p>How are they relevant to DPI? A country's DPI can include multiple proprietary and/or open-source solutions like DPGs. In turn, DPGs may be core in nature (digital ID and verification, digital payments, and money transfers) or sector-specific (health, education, e-governance, climate, etc.)</p> <p>i Click here to learn more about how DPGA and GovStack work together to implement DPI.</p>	<p>These are reusable components—software code, platforms, and applications, that help scale basic digital services. They connect multiple digital services and enable large-scale interoperability.</p> <p>The GovStack Initiative reviews digital solutions to certify them as building-block compliant and develops technical specifications for building blocks.</p> <p>How are they relevant to DPI? The multiple digital systems of a country's DPI can be connected via common protocols, standards, and applications to achieve unification and streamline access. Building blocks help to achieve this as they are reusable components, making services accessible on a decentralized, population-scale network.</p> <p>i Click here to learn more about how GovStack helps countries build DPI using building blocks.</p>	<p>These are a sub-set of building blocks that allow service providers and users to publicly access the functionalities of a particular system or service, enabling innovators to make use of them as modules—for instance, a health application can plug in a digital payments functionality by using an open API.</p> <p>How are they relevant to DPI? Open APIs prevent the need for certain components to be developed from scratch, promoting reusability through plug-and-play.</p>

How can countries use building blocks, DPGs, and APIs to build technology for DPI?



Core DPI, by way of performing certain functions (such as authenticating users or facilitating digital payments), are beneficial for countries creating a DPI. Countries can either **either build or use readily-available DPGs** as core DPI, **internally develop** their own solution, or **procure proprietary solutions**.

These core DPI can then be built upon and connected by building blocks to develop applications for specific sectors, such as healthcare and agriculture. Building blocks and DPGs enable countries to use **'plug-and-play' elements** to rapidly create DPI.

Using open APIs (a building block) in both core DPI and other applications makes it possible for public and private innovators to build solutions over this existing infrastructure. This approach **overcomes siloed, fragmented implementation** which requires new systems to be built from scratch.

(Left) For instance, a sector-specific application for health or e-commerce could utilize the core digital payments DPI by integrating it as a service through an open API. However, all core DPI should **ideally have open APIs** for integration.

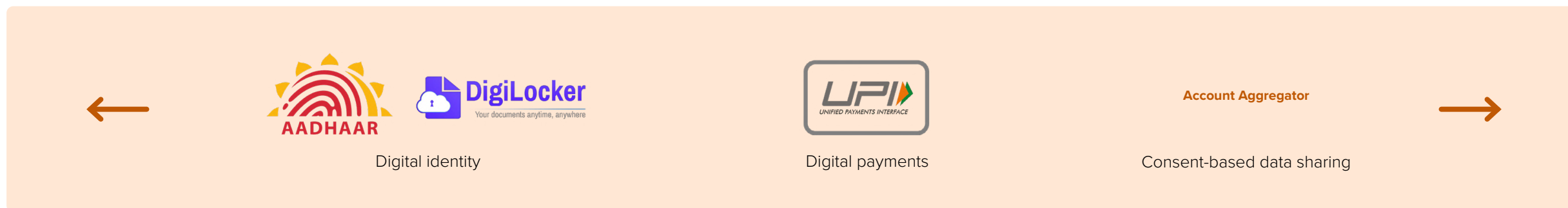
+ Applications shown are suggestive. Reflect on your national priorities to determine which digital solutions you need.

How does the India Stack foster the creation of resilient local ecosystems?

The following chart demonstrates how India's technology stack is designed. Having the core DPI in place enabled the creation of local ecosystems in multiple sectors.



These are examples of **end-user solutions developed by the public and private sector**. By using and building over open protocols, the government, private sector, and civil society are enabled to participate in the digital ecosystem.



These form the building blocks of India stack's **core DPI**.

- [Click here](#) to learn more about the socio-economic implications of the India stack.
- [Click here](#) to learn more about how ONDC is set to revolutionize digital commerce in India.

Checklist

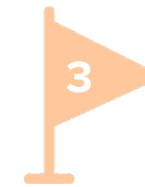
Use this checklist to **reflect on technology architecture** in your country.



Determine if your country already has any of the **core DPI** and if they meet the **technology architecture principles** for DPI.



Ascertain if these existing digital solutions have reusable components that are **open and interoperable**.



Identify **sectors and use cases** in which building blocks and DPGs can be useful to build your technology stack.

PLAY 4

Equipping institutions to govern DPI

Developing institutions and capacities for DPI



In this play, you will find:



Context

What are the principles for governance of DPI?
How can institutions embed the DPI approach?



Framework

How can countries navigate capacity questions in the context of DPI?



Examples

How did Estonia embed the DPI approach in X-Tee?
How did Estonia institutionalize X-Tee?




Checklist




What are the principles for governance of DPI?

Governing DPI involves applying the following **four principles at every stage**. These principles may be operationalized through the **legal, policy, and technical pathways** listed below.

 **Inclusion** promotes social welfare goals by mitigating the risks of exclusion, and upholds constitutional rights.


How can it be operationalized?

- Integration with offline systems and processes
- Capacity building
- Internal feedback loop
- Budgets for inception and growth

 **Privacy** builds trust in digital infrastructure, and upholds data protection principles and national regulations, where applicable.


How can it be operationalized?

- Clear notice mechanisms for data processing
- Provisions for free, informed, clear and revocable consent
- Purpose limitation and data minimization in collection and storage
- Disclosure obligations for data breaches
- Agency over personal data
- Encryption and security safeguards on processing and storage
- Regular security audits and risk assessments
- Decentralized data storage

 **Co-creation** harnesses diverse perspectives and expertise, and fosters a shared understanding of the DPI approach among multiple stakeholders.

How can it be operationalized?

- Codified consultation processes
- Open protocols and tech sharing for open innovation
- Mandates on interoperability and modularity in design and operation
- Regulatory sandboxes
- Diverse advisory board

 **Accountability** provides clarity on the roles, responsibilities, and duties of various actors, and builds trust in the digital infrastructure.

How can it be operationalized?

- Well-defined procurement process
- Clear criteria for appointments to institutional bodies
- Autonomous, responsive grievance redressal mechanism
- Publication of DPI vision and strategy documents
- Independent oversight system

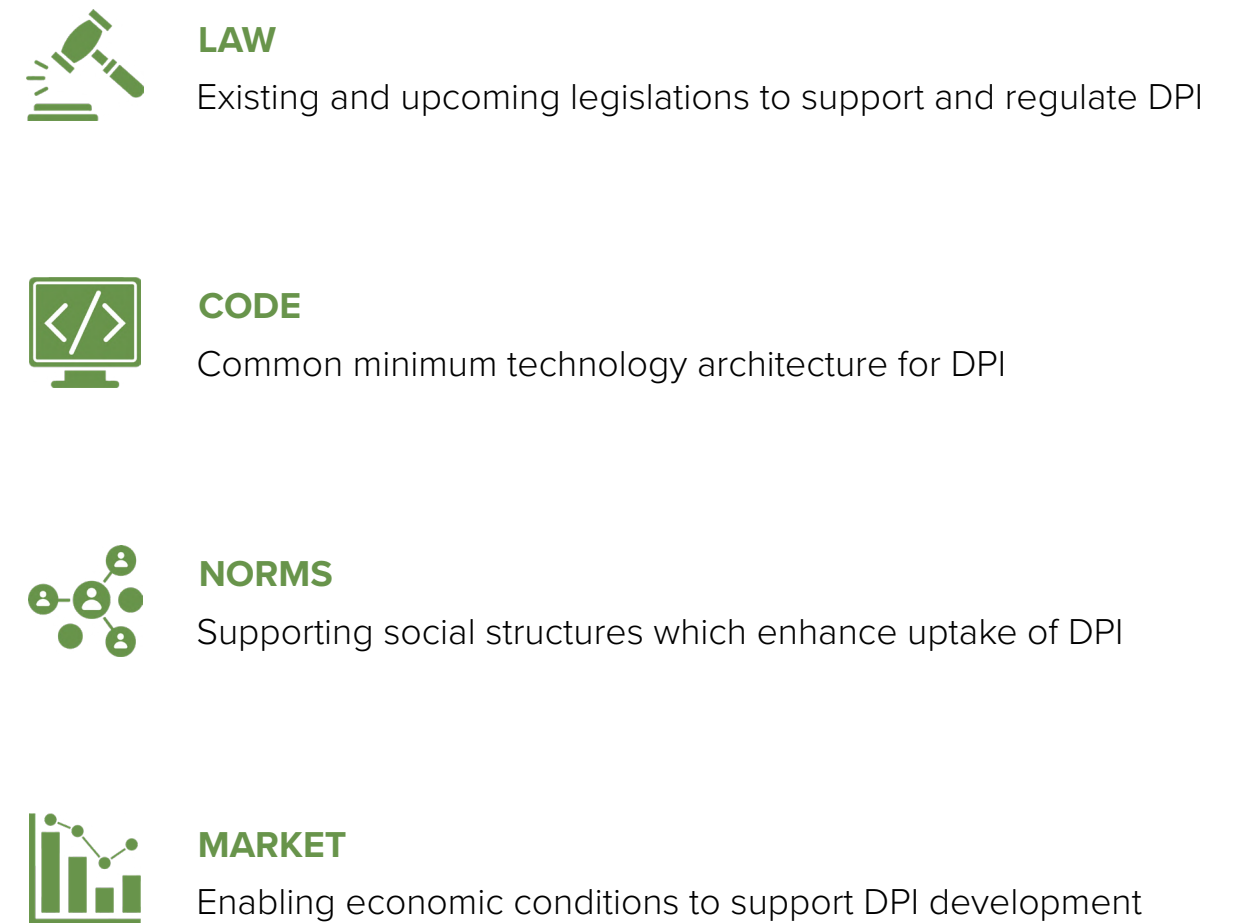
How can institutions embed the DPI approach?

After the scoping assessment is completed, the DPI approach needs to be **advocated for and embedded within a country's institutions.**

The core DPI governance foundations are as follows:



The DPI approach may be embedded via a combination of four dimensions:



How can countries navigate capacity questions in the context of DPI?

The capacity to implement DPI has three components: **technical, governance, and operational capacity**. The following illustrates functions under each component and the **stakeholders with the capacity to perform them**. Use this list to reflect on functions relevant to your country.

+ High stakeholder involvement is necessary to build capacity required for local ecosystems to thrive.

Key functions for DPI implementation	Public sector	Private sector	CSOs and end-users
 Building DPI and/or additional layers	●	●	●
 Monitoring systems and assessing security risks	●	●	●
 Performing periodic appraisal of implementing agencies	●	●	○
 Providing trust services such as certification and time-stamping	●	●	○
 Engaging in policy advocacy	●	●	●
 Facilitating co-design	●	●	●
 Convening expert consultations on DPI	●	●	●
 Auditing systems and ensuring compliance with data protection principles	●	●	●
 Redressing grievances	●	●	●
 Building offline architecture to improve access to DPI	●	●	●
 Enrolling new users	●	●	●
 Providing support services (updating user details, integration with other DPI, etc)	●	●	●
 Coordinating with other agencies/organizations for day-to-day functions	●	●	○
 Addressing compliance issues	●	●	●

 Technical capacity

 Governance capacity

 Operational capacity

 High contribution

 Medium contribution

 Low contribution

 No contribution

X-Tee, Estonia's data exchange DPI, facilitates the integration of public services. Estonia's experience may be understood through the following four dimensions:



LAW

- **Application of data exchange layer of information systems, 2003** sets out the principles to manage and operate X-Tee.
- **Personal Data Protection Act (PDPA), 2018** outlines rights and obligations in relation to privacy and data protection.
- **Cybersecurity Act, 2018** lists provisions to strengthen the security of digital systems.



CODE

- **Common APIs** facilitate data integration across various ministries.
- **Interoperability** enables automatic user registration across multiple public portals.
- **Open standards** ease development of new DPI layers.
- **Reusable components** enhance security, monitor transactions and user experience.
- **X-Tee End-to-End Monitoring Tool** (XRdE2E tool) monitors security servers.
- **Privacy by design**, data minimization, security, and authentication protect user data.



NORMS

Estonia was one of the most digitally advanced countries in the region as early as the 1990s. The uptake of DPI was driven by **strong political will**.



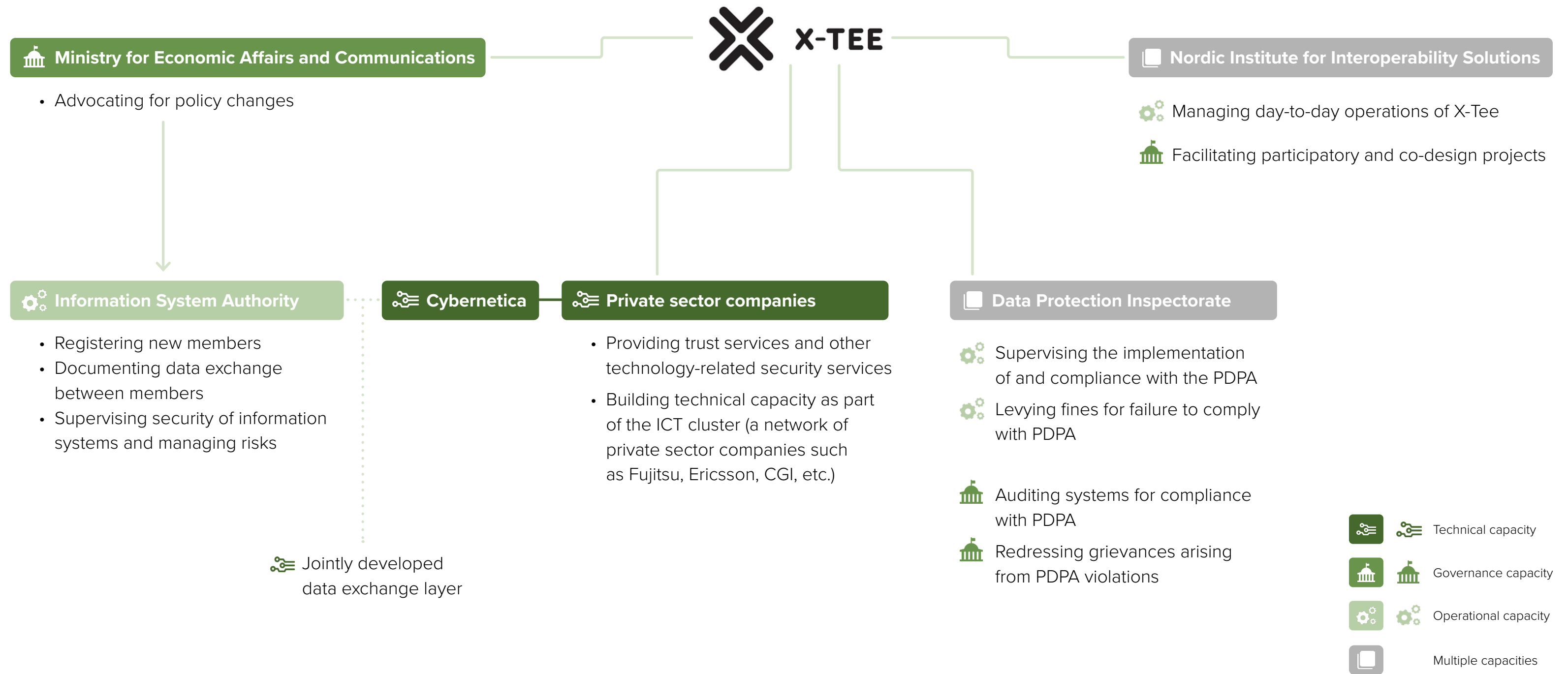
MARKET

- The **Information System Authority (RIA)**, in partnership with **Cybernetica**, an Estonian company, developed the first version of X-Tee.
- The government leveraged **private sector expertise** to build X-Tee through the Estonian ICT cluster, a collaborative platform for IT companies.

+ Applying these dimensions depends on internal needs and capacity. Reflect on what this might look like for your country.

How did Estonia institutionalize X-Tee?

The implementation of DPI is holistic when **agencies and organizations with varied expertise** are engaged in **roles that match their respective capacities**, such as in the example detailed below.



Checklist

Use this checklist to **enhance institutional readiness** for the implementation of DPI.



Formulate suitable **governance practices** that align with the principles of the DPI approach.



Outline different pathways to **advocate for the DPI approach** in your country.



Identify champions to lead digital transformation in your country.



Evaluate your country's **capacity to institutionalize** DPI.

PLAY 5

Sustaining DPI

Exploring financial and non-financial instruments to support DPI in the long term

In this play, you will find:



Context

Which financial instruments can support DPI?
Which non-financial instruments can support DPI?



Framework

How can these instruments be used to maintain core DPI?



Examples

How have these instruments been used to develop DPI?



Checklist



Which financial instruments can support DPI?

Procuring funding for a DPI is a critical, lifelong process. Financial instruments, such as the ones detailed below, are **mechanisms lend monetary support towards DPI**.

FINANCIAL INSTRUMENT	MERITS	CHALLENGES
Public budgets are sums of money allocated for public expenditure by a state entity	<ul style="list-style-type: none"> • Backed by state policy • Steady flow and stable value • Subject to public scrutiny 	<ul style="list-style-type: none"> • Influenced by changes in national priorities • Dependent on political buy-in
Grants are sums of money that are commitment-based or philanthropic in nature	<ul style="list-style-type: none"> • Aligns DPI with welfare goals • Ideal for funding the R&D aspects of DPI • Often large amounts of money, with limited control over usage 	<ul style="list-style-type: none"> • Unreliable for long-term financing as most grants are provided for a fixed period of time with uncertain terms of renewal • Limited public accountability
Private capital is a sum of money invested in an entity or infrastructure in exchange for ownership rights	<ul style="list-style-type: none"> • Possibility to raise more capital • Forges strategic partnerships with investors • Ideal for funding the R&D aspects of DPI 	<ul style="list-style-type: none"> • Typically focused on short-term goals • Could create the micro-economic issue of principal-agent conflict
Debt is a sum of money borrowed for a fixed period of time, with accompanying interest payments	<ul style="list-style-type: none"> • Lowest risk for funder • Ownership rights remain with the entity/country 	<ul style="list-style-type: none"> • Interest payments can cause fiscal burden • Restrictive terms of operation

+ Use this list to reflect on which instruments suit your country's context based on national priorities and existing infrastructure.

Which non-financial instruments can support DPI?

Non-financial instruments, such as the ones detailed below, refer to **non-monetary or in-kind support** towards DPI. Partnerships and pro bono arrangements, for example, find application across various stages of the DPI journey.

NON-FINANCIAL INSTRUMENT	MERITS	CHALLENGES
<p>Capacity refers to the specific skills, insights or abilities that are supplied towards a goal/entity</p> <p>+ Refer to page 38 (Play 4) to understand how to navigate questions of capacity.</p>	<ul style="list-style-type: none"> Enables projects to benefit from the leadership of long-term practitioners 	<ul style="list-style-type: none"> Lack of monetary incentive makes it challenging to engage experts in the long-term
<p>Shared resources refer to elements of technology/ DPG resource that are provided for mutual gains</p>	<ul style="list-style-type: none"> Promotes greater societal gains and richer innovation 	<ul style="list-style-type: none"> Nature of partnership between private players and the state uncertain
<p>Volunteering refers to technical, pro-bono support provided by communities or collectives with subject matter expertise</p>	<ul style="list-style-type: none"> Promotes contribution towards nation-building Builds partnership and community value between technology developers and DPI thinkers 	<ul style="list-style-type: none"> Absence of funding relationship may generate conflict of interest Lack of monetary incentive makes long-term engagement difficult




+ Use this list to reflect on which instruments suit your country's context based on national priorities and existing infrastructure.

How can these instruments be used to maintain core DPI?








For DPI to be sustainable, their development and maintenance requires the **usage of financial and non-financial instruments**. The following provides a layout for how these instruments that can be used across core DPI.

+ The level of engagement depicted is suggestive—use this framework to outline the contributions required to develop and maintain your country’s core DPI.

	Digital identity	Digital payments	Consent-based data sharing
Financial instruments	Public budgets	High contribution	Medium contribution
	Grants	Low contribution	Low contribution
	Private capital	No contribution	Low contribution
Non-financial instruments	Debt	High contribution	Low contribution
	Capacity	High contribution	Medium contribution
	Shared resources	Low contribution	High contribution
	Volunteering	High contribution	Medium contribution

-  High contribution
-  Medium contribution
-  Low contribution
-  No contribution

How have these instruments been used to develop DPI?

INSTRUMENT		EXAMPLE
FINANCIAL	Public budgets	 <p>India's National Health Authority was allocated US\$41 million from the national budget in 2023-24 for the Ayushman Bharat Digital Mission. Within ten months of its nationwide launch, 20 government platforms and 32 private health applications were integrated and contributing to scaling the network.</p>
	Grants	 <p>In response to a shift in geopolitical conditions in 2022, USAID contributed US\$25 million to further develop Ukraine's e-governance app, Diia. With support from the TAPAS project, Diia has been in development since 2019, and its first version was developed by EPAM, a private software firm. It has also seen varying contributions from UNDP Sweden, Swiss-funded EGAP, EU4Digital, and others over the years.</p>
	Private capital	 <p>As of June 2023, 65 banks were shareholders of the NPCI, an umbrella organization that operates the Unified Payments Interface in India. There are currently 22 third-party applications developed by private sector firms for end-users to avail UPI for digital payments.</p>
	Debt	 <p>The World Bank approved a US\$250 million loan to strengthen population and civil registration while increasing the usage of digital identification for service delivery in Indonesia.</p>
NON-FINANCIAL	Capacity	 <p>The Pix Forum (for Brazil's digital payment system) comprises 200 participating institutions that serve as a permanent advisory committee, with representation from market players to Banco Central do Brasil, which is responsible for the management and operation of the payments ecosystem.</p>
	Shared resources	 <p>GovTech, Singapore's implementing agency for its Smart Nation and Digital Government Office, is co-creating solutions with people by using their inputs at various stages of technology development. The Singapore government is estimated to spend US\$3.3 billion.</p>
	Volunteering	 <p>In 2022, the Unique Identification Authority of India published a call for volunteers with expertise in technology and public administration to develop the Aadhaar ecosystem further. iSPIRT, a not-for-profit think tank also provides pro-bono support for service providers looking to make use of business opportunities provided by Aadhaar.</p>

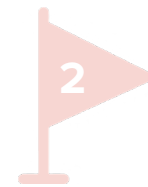
[Click here](#) to learn more about funding models used for DPI efforts in other countries.

Checklist

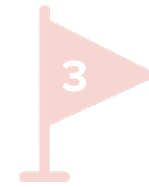
Use this checklist to **reflect on how you can build an ecosystem** that is sustainable and welcomes innovative contributions from private sector and communities.



Identify the **financial** and **non-financial** instruments available to adopt the DPI approach.



Evaluate which instruments are best suited based on **known constraints and requirements**.



Identify **processes to procure funds**.



Assess the **internal budget** available to finance DPI.

Implementing DPI

Aligning national priorities with the DPI approach to prepare for implementation

Digital Public Infrastructure

In this play, you will find:



Context

How does the DPI approach differ from conventional approaches to digitalization?



Assessment



Framework + Examples

How can countries *Plan • Design • Implement* the DPI approach?



How does the DPI approach differ from conventional approaches to digitalization?

The DPI approach is based on **open and interoperable technology architecture, robust governance frameworks, and market innovation** with multi-stakeholder involvement. The following chart explains how it differs from conventional approaches to digitalization:

Category	Conventional approach to digitalization	DPI approach
<p>Technology architecture of DPI should be designed to meet a specific purpose and facilitate inclusive, flexible digital ecosystems.</p> <p>+ Refer to page 28 (Play 3) for principles on the technology architecture for DPI.</p>	<ul style="list-style-type: none"> • High-cost, closed-loop solutions that create barriers for integration • Power concentrated in private entities or the state • Reinforcement of the digital divide, excluding communities of end-users • Limited protection against harms for users 	<ul style="list-style-type: none"> • Open, interoperable, and scalable digital stack that promote innovation and adaptability to changing needs • Digital solutions co-designed with users to promote adoption • Do-no-harm by design • Developed to extend access to marginalized communities
<p>Governance facilitates mass user adoption by establishing trust in DPI through regulatory frameworks, transparency, and multi-stakeholder participation.</p> <p>+ Refer to page 36 (Play 4) for principles on the governance of DPI.</p>	<ul style="list-style-type: none"> • Absence of supportive legislation and policy environment for digitalization efforts • Unilateral procedures in setting regulations • Lack of transparency on internal mechanisms for governance of digital solutions • Lack of well-planned and regulated cybersecurity infrastructure 	<ul style="list-style-type: none"> • Consultative processes for policy-making, creating institutional mechanisms for accountability through transparent processes and a mandate for grievance redressal • Designated institutions and leadership for development, roll-out, and oversight of DPI • Cybersecurity infrastructure, and instituting mechanisms to protect users from technological harms
<p>Sustainability of DPI requires long-term participation from multiple stakeholders through financial and non-financial contributions.</p> <p>+ Refer to page 46 (Play 5) on how to sustain DPI.</p>	<ul style="list-style-type: none"> • No clarity on sources of funding to sustain the long-term use of digital solutions • Unilateral implementation 	<ul style="list-style-type: none"> • Collaborative approach to sustaining a DPI by creating buy-in among private sector players, development actors, civil society organizations, and end-users

How does the DPI approach differ from conventional approaches to digitalization?

The following explains how a conventional **digital health system** differs from a digital health system implemented using the DPI approach.

Conventional approach to digitalization	DPI approach
Closed ecosystem means end-users are restricted to one health provider .	Open digital ecosystem allows end-users to access a wide range of health services, facilities, and professionals .
Centralized data control curtails data-sharing abilities . Users do not have control over consented sharing of their sensitive health information.	Federated data architecture allows integrated data-sharing abilities . Users control access and sharing of sensitive health information.
Proprietary technologies and systems, defined by monopolistic control and lack of innovation . People do not have access to a varied marketplace of providers.	Open technologies and systems promotes innovation and large-scale integration, giving people access to a competitive marketplace of providers .
Siloed approach to implementation prevents integration with other digital systems, restricting health systems from working with each other.	Interoperability with other digital systems ensures integration amongst all health systems , and a single point of access for end-users.
Absence of people-centric governance leads to lack of accountability, exposing users to harms such as misuse of health data , poor security, and surveillance.	Participatory governance processes and well-defined policies promote transparency, protect users from harms, and provide for grievance redressal.

Use the following questions to **evaluate if you are aligned with the DPI approach**.



Open, interoperable technology

- Is the digital solution developed on **open protocol**—is it designed to enable innovation?
- Is the network **interoperable**—do end-users and service providers have a single point of access?
- Is the digital solution available to the ecosystem through **open APIs**, thereby facilitating innovation and inclusion?
- Is the digital solution **minimalist, extensible, and scalable**?
- Are your credentials **verifiable**?



Robust governance

- Does the digital solution **serve a specific need**, purpose, or national priority?
- Have different needs and constraints of **vulnerable communities** in accessing DPI been accounted for?
- Are there mechanisms ensuring **participatory governance** of the digital solution?
- Is the digital solution **developed in collaboration** with private sector stakeholders?
- Is there enacted **legislation for personal data protection** and security?
- Is there a **regulatory framework** that protects users, outlines institutional mechanisms, and creates accountability?
- Are there institutions specifically designed to **oversee the development of DPI** across multiple phases?



Resilient local ecosystems

- Does the digital solution **enable innovation and provision of high quality services** at national scale?
- Does the digital solution **enable access to and enhance trust** in both private and public services?
- Does the digital solution allow market players to **combine multiple layers** of the DPI?
- Is the digital solution **sustainable**?



Pinpoint the problem

In response to the dengue epidemic, Philippines developed AEDES, an automated information portal that predicts cases from climate and digital data.

Refer to Play 2 to learn more about evaluating the scope for DPI.



Learn from other countries/sectors

Many countries (including Sri Lanka, Morocco, and Guinea) implemented a citizen-identity system using the Modular Open-Source Identity Platform (MOSIP).

This playbook documents multiple international examples.



Map your stakeholders

Consider which aspects of your solution might upset the status quo and how you might address these concerns.

Refer to Play 1 for the DPI stakeholder map.



Improve stakeholder involvement

Move beyond developers and government agencies to include end-users, civil society organizations, and volunteers. Brazil's Pix was developed with participation from users and market agents.

Click here to learn more about Pix.



Designate DPI champions

The Government Chief Information Officer of Digital Estonia, Luukas Ilves, has been involved in multiple initiatives to make public sector projects attractive for private sector employees.

Click here to learn more about e-Estonia.



Communicate progress

The National Payments Corporation of India (NPCI), releases monthly data on the volume and value of transactions facilitated through the United Payments Interface (UPI) for increased transparency.

Click here to view the dashboard.



Identify metrics for success

Singapore's digital readiness blueprint focuses on supply-side factors like expanding digitalization by leveraging existing infrastructure (mobile and internet penetration), while identifying demand-side measures to aid communities' interactions with technology.

Click here to learn more about evaluating digital readiness.



Scale incrementally

In response to COVID-19, Jamaica first launched CommCare—a digital system to collect data on vaccine delivery. Digital infrastructure for vaccination open credentialing (DIVOC) was only introduced later.

Click here to learn more about Jamaica's COVID-19 response.



Create an implementation checklist

CDPI's checklist for implementation and execution guidance are a good resource to think about how to bring digital infrastructure in your country to life.

Click here to refer to the CDPI checklist.



Anticipate challenges

After facing multiple large-scale cyber attacks, Estonia established a data embassy in Luxembourg to ensure uninterrupted access to digital services.

Click here to learn more about data embassies.



Design for the future

Think about which elements of the DPI will remain constant and which elements are likely to change in the future. For example, technical safeguards for privacy must evolve alongside future innovation.



Try unconventional methods

As DPI is not a one-size-fits-all solution, testing technology with participants from vulnerable groups can help make your DPI more inclusive.

Click here to refer to Co-Develop's report on DPI.



Publicize impact

Diia, a mobile application connecting 19 million Ukrainians to 120+ government services, has set new standards for resilient digital systems.

Click here to read more about Diia.



Reuse existing national assets

Existing government databases can be converted to ID registries that are verifiable by third parties using QR codes to authenticate.

Refer to Play 3 to learn about technology architecture principles.



Test using sandboxes

Sandboxes (controlled environments where technology and regulations are tested) allow for enhanced adaptability. India's digital health ecosystem, Ayushman Bharat Digital Mission (ABDM), allows healthcare service providers to test their compatibility with ABDM's APIs, and discover new use cases that are suitable for the ecosystem.

Click here to learn more about ABDM.

Click here to access an A4 printable version.



How can countries Plan • Design • Implement the DPI approach?

The PDI for DPI Framework is rooted in principles of inclusion, privacy, co-creation, and accountability. Its dynamic nature requires simultaneously initiating multiple processes across three phases.

Refer to Play 4 to learn about these governance principles.

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