National Agricultural Data Infrastructure

A Policy Guide

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The long-term effect of policy inaction of national governments to manage their data will be ***a weak national digital sovereignty*** *– that is the inability of national governments to exercise their power and authority to make free decisions affecting their citizens and businesses within the digital domain*

Adapted from Gawen, E. et al. (2021) Digital sovereignty is the power and authority of a national government to make free decisions affecting citizens and businesses within the digital domain

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Executive Summary

The ambitious target of boosting trade across the Commonwealth, in the process grow intra-Commonwealth trade to US$2 trillion by 2030 and expand investment through a bottom-up and member-led approach, remains an enormous hurdle for the 56 member countries. Achieving this target is expected to leverage the strength of the Commonwealth to support growth and create employment in the wake of declining global multilateralism and the rise of protectionism. With so much at stake, it is no surprise that food systems transformation has been recognised as a critical pillar for most Commonwealth countries. Yet the food import bill of Commonwealth members is rising rapidly, reaching $272 billion in 2023, and over the next decade, the Commonwealth's population is projected to grow by over 385 million, requiring an additional $100 billion in food imports to meet this increased demand (Commonwealth Secretariat, 2024a).

Against this backdrop, digitalisation of food production and trade can be a game changer in accelerating the ambitious target for the Commonwealth.

Data has become the engine of economic growth for many economies today and it is the fuel that propels digitalisation. But despite its huge potential, harnessing the gains of digitalisation for intra-regional trade faces a significant challenge due to the absence of a coordinated foundational layer for data in these countries. This has resulted in disaggregated, siloed and duplicated data systems, operational inefficiencies and data power imbalances which pose a huge barrier to the interoperability of digital services and products between countries in support of intra-Commonwealth trade.

In response to the above challenge, the Commonwealth Secretariat, through the Commonwealth Connectivity Agenda for Trade and Investment, and in collaboration with other technical partners, began exploring the concept of national data infrastructure for countries in 2022. Thereafter, the Connectivity Agenda developed a model of National Agricultural Data Infrastructure (NAgDI) through a collaborative process with some selected countries. The process includes diagnostic engagement by creating awareness on the data coordination issue, discussing and validating the model within the national context, building consensus on potential follow-up actions by stakeholders, and advocating for the design and establishment of a nationally coordinated approach to agricultural data management.

Three multi-stakeholder national dialogues were held in Malawi (2023), Ghana (2023) and Bangladesh (2024); one multi-stakeholder regional dialogue was held in the Caribbean (2024); and one multi-stakeholder dialogue was held at COP28 in Dubai (2024). As a follow-up to these dialogues, a Writeshop was held in Malawi in 2024 to develop a guide for investing in NAgDI, with experts representing the multi-stakeholder dialogues. The policy guide for investing in NAgDI presented in this document is a generic guide for all countries. The guide, which was collaboratively produced with the support of member countries and experts, was validated in 2025 through an online Webinar with over 60 experts globally. It provides a comprehensive overview of a sectoral approach to digital public infrastructure (DPI) aimed at establishing a coordinated and collaborative framework for agricultural data management across Commonwealth countries and beyond.

The NAgDI model takes a process approach by responding to 'how' countries should design and implement shared infrastructure for their agricultural data.

It is anchored on a holistic approach to infrastructure for agricultural data at country level, with infrastructure framed as a set of facilities and systems to include both technical (hard) and institutional (soft) components. The agriculture in NAgDI also takes a broad approach to include fisheries, livestock and forestry, and data in the areas to include user[1] data and

1 Referring to any data or different pieces of data, when brought together, can lead to the identification of a particular person or entity, including farmers, traders, enterprises, consumers, field IDs or polygons of farmers' fields.

content[2] data. This unique resource – agricultural data – requires national infrastructure that encompasses public and private sector partners being harnessed by countries.

Taking this holistic approach, the NAgDI initiative aims to support member countries to design and build standardised and interoperable national infrastructure for data exchange that creates a superhighway of quality data for intra-Commonwealth trade and investment facilitation. Ultimately, it seeks to assist countries to harness the potentials of the data economy by fostering collaboration, leveraging existing digital public goods and enhancing their data management capabilities to support innovation and improve decision-making and sustainable agricultural practices.

The vision of NAgDI is to strengthen and harmonise existing individual data systems[3] at country level through an interoperable national data infrastructure, enabling interconnected infrastructure at regional and global levels, thereby creating a superhighway for secure data exchange within and between countries, and across regions for macro-level decision-making.

The design of NAgDI to achieve its vision is built on two goals, namely (1) to foster an enabling environment for data exchange through policies and an independent governance model, and (2) to establish a secure, decentralised, interoperable and financially sustainable data exchange mechanism. The Commonwealth's model of agricultural data management at country level consists of four main components that are presented as investment areas:

- **Investment to develop policies and principles for NAgDI** – this involves mobilising resources to establish comprehensive policies and principles to guide the design and use of the infrastructure.
- **Investment to ensure independent governance and administration** – this involves constituting an independent oversight mechanism that ensures trust and reliability of the infrastructure.[4]
- **Investment to assemble technologies and systems** – this involves assembling and developing decentralised, secure, standardised and interoperable data exchange mechanisms.
- **Investment to develop a marketing and business strategy for NAgDI** – this involves mobilising resources for the initial establishment of the infrastructure and ensuring its financial sustainability.

Based on the outcomes of the four national dialogues, a key observation is that each country may have different existing foundational resources and be at different stages of maturity. Some countries with existing resources for data management, policies, governance, technologies and business may be able to implement it faster. As a result, this policy guide to investing does not propose financial or budgetary considerations.

The generic guide to investing in NAgDI outlines the details of the broad activity areas across all four investment areas in terms of a figurative five-year process of implementation.[5] The guide is meant to be used by countries to plan their implementation approaches and develop their implementation strategies for NAgDI, adapted to the context of their respective countries. The detailed mix of broad activities within each year illustrates the need to adopt a holistic approach to the implementation of NAgDI, which also determine the interdependencies in national and local contexts.

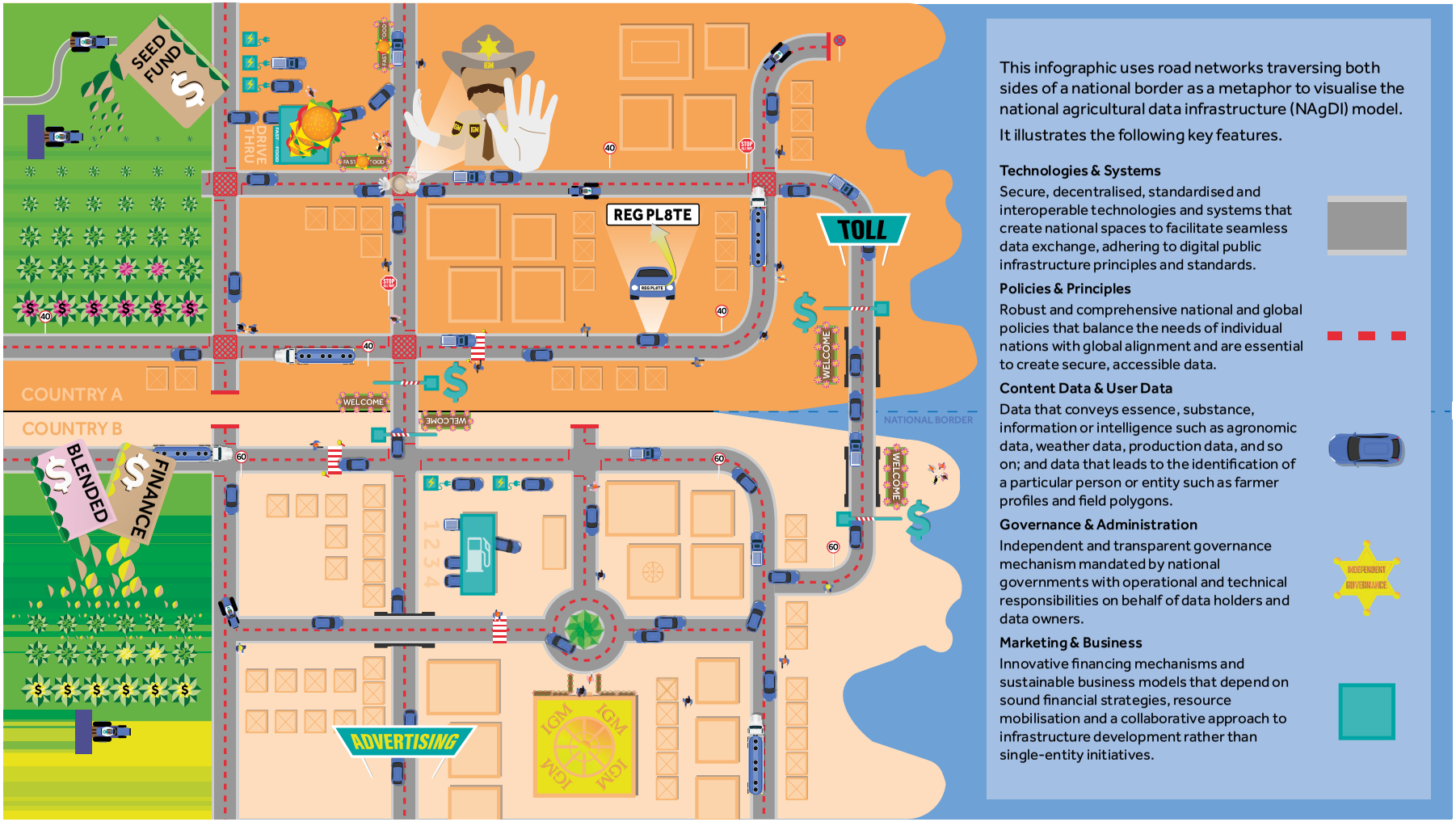
2 Referring to data that conveys essence, substance, information, meaning, purpose, intent or intelligence, either singularly or when in a combined form, in either its unprocessed or processed form, including soil, agronomic, weather, financial, insurance and market data.

3 The data systems here refer to the individual datasets (user data and content data) built by separate organisations and companies in countries for service provision. Examples include data systems by AgTech partners such as Hello Tractor, Farmerline, Trotro Tractor, Esoko, Digifarm and Digital Green, and others such as National Statistics Organisation, the Food and Agriculture Organization, the World Bank, National Research Institutes, CGIAR and NGOs operating in the same country.

4 A system or process to maintain a watchful eye over NAgDI that involves taking responsibility for the design, operation, implementation and outcome (quality and effectiveness) of the infrastructure.

5 The duration proposed is intended to illustrate that NAgDI requires medium- to long-term planning and implementation, while the actual implementation phase of NAgDI could be longer than five years, and structured in phases, depending on the current conditions in a country.

ES1 Visualising the NAgDI model



Nevertheless, the general areas of focus in each year can be summarised as follows:

- **Year one – advocate, engage and mobilise**. The focus of the first year should be on advocacy to identify lead institutions and securing high-level endorsement of NAgDI by national governments for multi-stakeholder engagement and initial resource mobilisation. The first-year activities should be heavily leaned towards investment to develop policies and principles intended to be applied to the other investment areas.
- **Year two – collaborate, analyse and plan**. The focus of the second year should be on the lead institutions, ensuring that stakeholders understand why and how to collaborate to design, develop and eventually use shared infrastructures. The year's activities should focus on analysis with evidence to inform planning. The strategic messaging should be around creating a shared national resource through cooperation among key partners.
- **Year three – design, develop and launch**. The focus of the third year should be on guiding the collaborative development and the launch of a working version of the national infrastructure in a way that is adapted to the country, with the potential to connect with other national infrastructures. For a successful designing process, an agreement on the independent oversight mechanism should be reached by the third year.
- **Year four – validate, implement and operate**. The focus of the fourth year should be on operationalising the infrastructure through a functioning NAgDI. This should be done by test proofing the technical and operational functionalities of the infrastructure in readiness for market in the final year. Activities should include validating the entire pilot process and implementing all possible components.
- **Year five – consolidate, market and scale**. The focus of the fifth and final year should be on strategic implementation in order to create opportunities for business engagement in readiness of the infrastructure for private sector investment. This will enable the infrastructure to transition from an initiative to a national asset with a sustainable business model.

An important question from national governments and partners is: *what are the benefits of such an infrastructure for my country, or why should I invest in such an infrastructure?* Some of the anticipated macro-level benefits of NAgDI for countries include:

- **Independent data verification for investors**. Before committing funds, investors scrutinise the veracity of data by startups and micro, small and medium enterprises. The independent oversight mechanism of NAgDI will independently verify and certify data for investors.
- **Better policy decisions on import and export**. Governments importing products based on inaccurate data could impact businesses. NAgDI will coordinate data sources from multiple partners to inform better policy decision-making.
- **Unified data estimates for countries**. Development organisations often report independently on the performance of countries with contradicting figures. NAgDI will ensure verification of such external reports through harmonisation and certification.
- **Source of revenue for businesses and the country**. The data economy of a country depends on its ability to harness the economic value of its data. NAgDI will empower countries to generate revenue from their data through access to reliable datasets.
- **Facing well-intended but disruptive external regulations**. Countries react to external regulation such as the European Union Deforestation Regulation. NAgDI is a proactive effort to respond to such future regulations that disrupt national policies and programmes.
- **Preparing countries for artificial intelligence (AI) and emerging technologies**. The economic potential of AI for countries is huge in the next decade. AI services perform better on organised data and NAgDI is about better data coordination by countries.

The operation of a functioning NAgDI will include sourcing datasets from the multiple existing data holders based on the agreed business model, independently verifying and harmonising the datasets for interoperability and producing macro-level decision products for clients upon request.

It should be noted that the success of NAgDI rests upon diverse adoption to ensure sustainability, with the value proposition to boost existing services through co-petition rather than competition, duplication and inefficient practices among services providers. Finally, data in general is domain agnostic, and NAgDI is just a use case of national data infrastructure for agriculture. Functionalities such as those in NAgDI can be scaled to other domains such as health and education and merged with foundational DPI to eventually result in a comprehensive national data infrastructure.

1. Opportunities and Challenges of the Agricultural Sector in the Data Economy

1.1 The Importance of the Data Economy to the Agricultural Sector

Data has become the engine of growth for many economies today, and this will increase in the future. Unlike resources such as gold and oil, data is an infinite and reusable resource. The more data is used the more useful it becomes as its applications are further revealed. Data can be replicated indefinitely and transported around the world at very low cost. Therefore, hoarding data in siloes reduces its usefulness. Data is also a source of power: those who have it can influence society, both positively and negatively. When unregulated, data-mining causes issues around privacy and power imbalance.

The global data economy comprises the overall impacts of the data market on the economies of nations, entities and individuals. It involves the generation, collection, storage, processing, analysis, distribution, use and reuse of data being enabled by digital technologies. The data economy is helping nations to drive innovation across industries. The increased volume of datasets is enabling governments and businesses to support timely research, identify emerging trends, make critical policy decisions, develop new solutions, inform investments and iterate products more rapidly than ever before. In turn, these processes are accelerating the innovation cycle by fostering creativity, driving competitive advantage and delivering new goods and services for consumers in sectors such as agriculture, climate, health, finance, education and mobility. Increasingly, precision analytics and customised and tailored services are being made available by innovators and businesses in line with the individual needs, preferences and behaviours of clients and customers.

The data economy is producing data-driven insights based on high-quality market intelligence and data analytics across various industries. It is the bedrock for emerging digital technologies such as artificial intelligence (AI), machine learning, blockchains and the internet of things that are enabling availability and access to information. Both public and private sector entities are leveraging advanced data analytics to identify inefficiencies, automate routine tasks and make data-driven decisions in real-time at a faster rate. This allows stakeholders such as policy-makers, businesses and other service providers to make informed decisions. The efficiency gains are translating into cost savings due to enhanced operational agility.

The data economy is also a springboard for nations, entities and individuals to have greater control over their personal data. Technological innovations based on these comprehensive datasets are enabling stakeholders to better manage their private data, fostering a more equitable data ecosystem. The data economy is likely going to determine the next world order, much like the role that the oil industry has played in creating economic power players in the past. But in most countries, it is an untapped resource with enormous potential depending on how it is mined. As a result, countries need to consider their data as any other national resource and create the enabling environment for it to be harnessed. Collaborative data-sharing initiatives between the public and private sectors will enable nations to have sovereignty over their data while also allowing businesses to compete and innovate more efficiently. It will create a solid foundation for the discovery of innovative solutions to address societal challenges such as climate crises, food insecurity, urban congestions and healthcare disparities. Better data coordination at country level will encourage transparency, foster trust and promote an increased sense of participation in the data economy for the public and private sector.

The United Nations Sustainable Development Goal (SDG) 2 is about ending hunger, achieving food security, improving nutrition and promoting

sustainable agriculture. SDG 2 does not operate in isolation. For example, access to safe and nutritious food ensures healthy lives and promotes well-being for all (SDG 3); improving food security is essential in reducing inequalities among the most vulnerable (SDGs 5 and 10); tackling overconsumption and food waste is essential in ensuring sustainable consumption and production patterns (SDG 12); responsible use of resources in the agri-food industry helps protect life in the water and on land (SDGs 14 and 15). Given the complexity of the issues surrounding food security and agriculture, a holistic and systems approach is the most appropriate way to achieve a sustainable and inclusive global food system. This requires national and global partnership models that allow sharing of expertise and tools (SDG 17).

The Commonwealth is home to over 2.7 billion people spread across 5 continents and 56 countries, including advanced economies and developing countries. Agriculture and fisheries ensure food security and employment in most of the Commonwealth developing states. About 80 per cent of the farmland in sub-Saharan Africa is managed by smallholder farmers who provide up to 80 per cent of Africa's food supply. Agriculture contributes between 7 per cent and 17 per cent of gross domestic product in the Caribbean and has a significantly larger share of employment (typically between 10 per cent and 25 per cent). More than half of the population in 32 of the 56 Commonwealth member countries reside in rural areas and are engaged in smallholder agriculture.

Millions of smallholder farmers across the Commonwealth already face numerous risks to their agricultural production, which often undermine their household food and nutrition security. Key among them is increasing climate variability resulting in changing pest and disease outbreaks, increasing frequency and severity of droughts, increasing frequency and severity of floods due to extreme rainfall events and increasing occurrences of strong hurricanes and storms. All these increase crop failures and livestock mortality and the likelihood of poor yields, and thereby affect productivity within the sector. Resilience for smallholder farmers against climate variabilities mean efficient utilisation of appropriate adaptation technologies such as drought-tolerant crop varieties, better water and nutrient management for efficient productivity and resource utilisation, modern conservation agricultural practices, data-sensitive index-base insurance services as a cushioning mechanism against shocks and transparent trade regimes, among other things. All these are subject to up-to-date and relevant data for timely decision-making. Building resilience for smallholders with adaptation measures to reduce their vulnerability to climate change and cope with adverse consequences will mean strengthening data systems across countries.

1.2 The Challenge of Data Management

As outlined above, the future data economy holds great potential for individuals, entities, nations and society to move forwards on the sustainable development agenda. This holds true for all countries, including the Commonwealth member states. However, regardless of the massive potential of agricultural data for decision-making, there remains an immense inequity regarding access, representation, outcomes and benefits within global food systems due to management and coordination issues. The current model of data management must transition to a more inclusive approach, which requires large investments from all stakeholders, including the data owners.

The challenge is not about lack of data but rather fragmented and disaggregated data. The situation where the rights of individuals are protected, and the needs of all stakeholders are considered, has often been hampered by high barriers to data sharing and the widening skills gap between techies and the less technologically savvy.

In a typical national agricultural data ecosystem, multiple stakeholder groups – including farmers, governments, non-governmental organisations (NGOs), agribusinesses, donors, foundations, investors, researchers, digital platform operators, international organisations and technology firms – are involved in data collection, curation, processing, storage and sharing. However, these activities often occur around the same parameters and without coordination. When viewed within the scope of specific projects or initiatives, it may seem normal for various actors to manage data independently. Yet when numerous uncoordinated data management processes take place simultaneously across diverse stakeholders within a given geographic context – such as a country – it creates confusion and raises concerns.

Unfortunately, most countries lack the national infrastructure or space required to coordinate and manage this critical resource. The absence of national spaces or infrastructures has led to duplicated databases in some countries, the unwillingness of data holders to share data, operational inefficiencies, data collection fatigue on data subjects, failure to scale innovations that are based on data, unsuited investment and policy decisions being made based on the fragmented data points, and a data power imbalance between the data owners and data holders. The need for a coordinated approach to data management activities becomes evident, especially when attempting to develop a synthesis regarding the situation at national level.

Additionally, the data power imbalance, combined with potentially 'biased' computer programmes that are based on AI models, are leading to a greater digital divide because of inequity concerning the access, representation, outcomes and benefits of data to the minority and majority holders. In terms of national policies, this can also lead to countries ceding an enormous potential for individual and national revenue derived from such data to external stakeholders. The long-term policy implication of the absence of a national approach to data management will be weak national digital sovereignty: a situation where the power and authority of a national government to make free decisions affecting its citizens and businesses within the digital domain becomes impossible (Gawen et al., 2021).

Addressing the data management challenge calls for a collaborative approach by stakeholders within countries and among member countries. This has been the approach championed by the Commonwealth Secretariat with and on behalf of member countries across the Commonwealth for several years.

1.3 Purpose and Structure of the Document

The Declaration on the Commonwealth Connectivity Agenda for Trade and Investment (CCA) was adopted by the Commonwealth Heads of Government Meeting in 2019. The CCA is a member-led initiative with the goal to grow intra-Commonwealth trade to US$2 trillion by 2030 and promote expanded investment to support global growth, create employment and promote knowledge exchange among Commonwealth members. The CCA is structured around five interconnected workstreams: physical connectivity, digital connectivity, regulatory connectivity, business-to-business connectivity and supply side connectivity. The supply side connectivity workstream acts as the application of the other four workstreams within the agricultural and fisheries sectors for increased intra-Commonwealth trade and investment. As part of the activities under the workstream, the Commonwealth Secretariat produced a framework for digital agriculture as a policy guide to support member states to better leverage digitalisation in their agricultural and fisheries sectors (Commonwealth Secretariat, 2022). In 2023, the Commonwealth member countries approved a two-year Workplan for the supply side connectivity workstream that focused on digitalisation and data coordination in support of a food system transformation agenda in those countries. In line with the Workplan, an initiative on data coordination was launched as an expansion to the digital agriculture framework.

This document presents the main outcome of the two-year Workplan, namely a high-level policy guide on how countries should take a collaborative and coordinated approach to designing and developing shared national data spaces to reduce the current duplication of data collection and increase efficiency for service delivery. The document has five main sections:

- Section 1, as outlined above, provides the background to the data economy, opportunities and challenges with the current data management approaches for the agricultural sector.
- Section 2 introduces the concept of common data infrastructure, including the ongoing movement on DPI. It also provides a comprehensive and detailed description of the components of the Commonwealth's model of the DPI approach to agricultural data management or NAgDI.
- Section 3 presents a generic policy guide to investing in NAgDI by countries. The guide details how countries should mobilise the necessary resources to design and operate such common or shared infrastructure through a proposed five-year implementation and investment strategy. Section 3 also provides

details on how the components complement each other to achieve the vision of NAgDI.

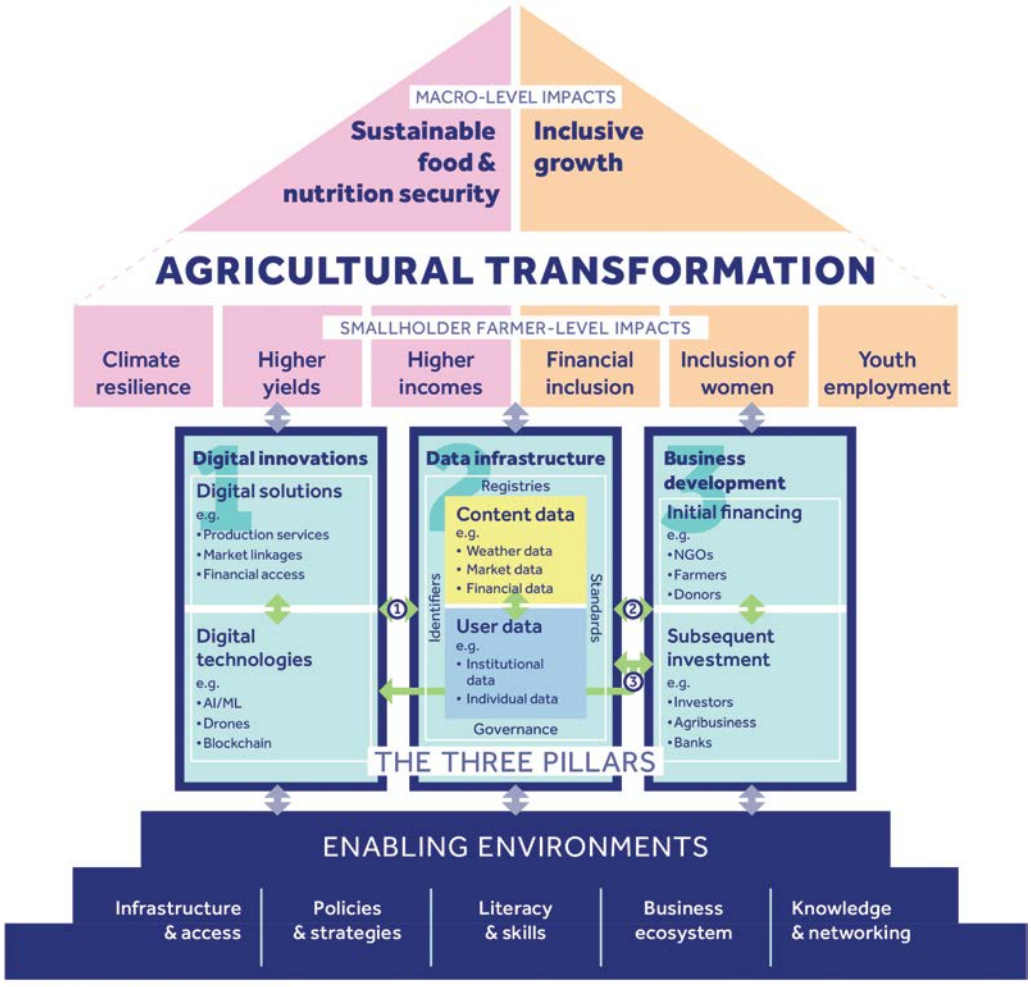
- Section 4 presents some approaches to achieving the operationalisation of the infrastructure, including how such a national infrastructure should operate and selected high-level use cases of what countries could gain by investing in the infrastructure.
- Section 5 provides the conclusion and recommendations using some generic principles for countries as they consider investing in NAgDI.

2. Common Infrastructure for Data in Countries

2.1 Digitalisation of Agriculture

Amid myriad global challenges, digitalisation has emerged as a beacon of hope in supporting the achievement of the SDGs. Digital technologies and services are enabling sustainable agri-food systems for production of better and safer food while preserving natural resources and biodiversity. But digitalisation is more than digital technologies and services. The framework for digital agriculture to support agricultural transformation, as developed by the Commonwealth Secretariat in 2022, defines digitalisation for agriculture as consisting of three pillars, namely digital innovations, data infrastructure and business development services, with the enabling environments for digitalisation serving as a base for the three pillars (Figure 2.1). The central pillar, as outlined in the framework, emphasises

Figure 2.1 Digital agriculture framework



Source: Commonwealth Secretariat (2022).

the role of agricultural data infrastructure as the bedrock upon which digital agricultural innovations function. This report acts as a policy guide to support member countries to better leverage digitalisation into their agricultural sector.

Following the publication of this digital agriculture framework, the Commonwealth Secretariat has been pursuing the expansion of the central pillar on data infrastructure and its connections to the other pillars. This is based on the argument that a key requirement for countries to transform their food systems with the support of digitalisation is better data coordination at country level through NAgDI.

2.2 Why Countries Need Infrastructure for Data

As already laid out in Section 1, data has become the engine of growth for many economies. Data is vital in the current global discourse around digital transformation, DPI and AI. Large investments have been made globally in data management (data acquisition, storage, aggregation, processing, analysis, sharing, etc.) over the past decade with the aim of encouraging better decision-making.[6] Initiatives such as the Global Partnership for Sustainable Development Data[7] and the Digital Public Goods Alliance,[8] as well as the current movements on DPI,[9] are excellent investments that could act as foundations upon which country-level data coordination can be designed and built. Within the agricultural sector, the early movement of Global Open Data for Agriculture and Nutrition,[10] the Consultative Group on International Agricultural Research (CGIAR) Big Data Platform[11] and the World Bank 50 by 2030 initiative – a multi-agency partnership initiative[12] – among others, cannot be overlooked.

Unfortunately, due to the challenge of siloed, fragmented and disaggregated databases, most countries are unable to harness its full potential. As a result, countries need to consider their data just like any other national resource, by creating an enabling environment for data to be harnessed. The sharing of data can create social and economic value for people, organisations and the wider economy (Open Data Institute, 2023). The Government of the United Kingdom argues that governments have an important role to play in laying the foundations for a flourishing data-driven economy by ensuring data sovereignty, including maintaining a secure, trusted data environment. This will involve pursuing policies that improve the flow of data and ensuring that companies that want to innovate have appropriate access to high-quality and well-maintained data (HM Treasury, 2018).

At the Commonwealth Trade Ministers Meeting (CTMM) in London 2023, the ministers emphasised the need to develop DPI and connectivity and ensure digital technologies are accessible and affordable for all (Commonwealth Secretariat, 2023). At the 2025 CTMM in Windhoek, Namibia, ministers noted the varying data capacities across member countries and highlighted the need for tailored support to ensure timely access to accurate data that strengthens national data coordination to build food security resilience across the Commonwealth.

2.3 Digital Public Infrastructure

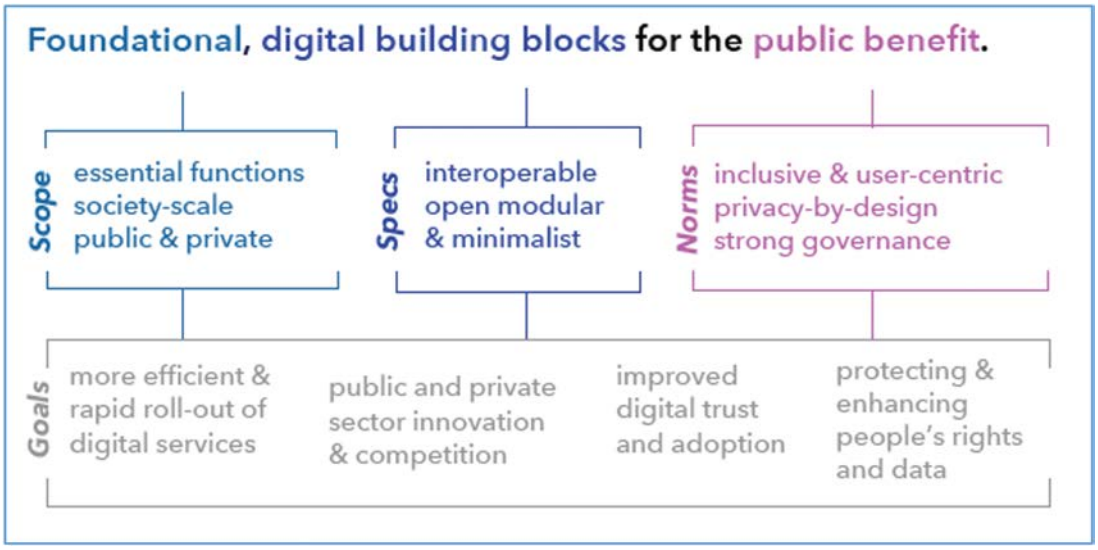
According to the World Bank, DPI is an approach to digitalisation that is focused on creating foundational, digital building blocks designed for the public benefit (World Bank, 2025). The World Bank provides examples of common systems that are built as DPIs to include digital identity and electronic signatures, digital payments and data sharing (Figure 2.2).

As a relatively new concept, DPI aims to provide foundational digital building blocks for public benefit. It differentiates itself from the traditional digitalisation efforts by emphasising shared, reusable building blocks that foster whole-of-society collaboration. Some of its core principles include openness, interoperability, data protection and user choice. While countries may take different approaches to the implementation of DPI, it generally requires strong and sustained political commitment, meaningful and frequent stakeholder engagement, institutional and technical capacity, and comprehensive legal and regulatory frameworks, among other success factors.

The DPI approach is expected to reduce redundancy and fragmentation of investments

6 https://dpimap.org/
7 https://www.data4sdgs.org/
8 https://www.digitalpublicgoods.net/registry
9 https://www.undp.org/digital/digital-public-infrastructure
10 https://www.godan.info/
11 https://bigdata.cgiar.org/ and https://bigdata.cgiar.org/resources/gardian/
12 https://www.50x2030.org/

Figure 2.2 Digital Public Infrastructure and Development: A World Bank Group Approach



Source: World Bank (2025).

in similar functionalities as digital ecosystems develop. Investing in a strategic set of underlying capabilities can also create efficiencies, strengthen security and enhance quality by using a shared provider for common functionalities. The interoperability and open modularity also provide a set of functions that can be integrated into diverse services with minimal disruption. Standards and protocols ensure that the foundational components or capabilities that comprise DPI can work together. The principles of inclusion, data protection and privacy, public oversight and accountability, and user choice and control are used to achieve the promise of safe and trusted digitalisation that leaves no one behind.

The infrastructure thinking around DPI is transformative, but when it comes to sector-specific applications, it is not clear if the current approach responds to the most important question of: infrastructure for what? As described above, the concept and implementation of DPI is transformative. However, the question remains as to how far the same principles of DPI building on foundational blocks can be expanded into the different sectors that they serve, such that there is a stronger incorporation of functionalities that are adapted to the sector. Thus, NAgDI explores data infrastructure in the agricultural sector at national level, for both countries that have already invested in the foundational building blocks and those yet to do that.

2.4 The Commonwealth's Model of DPI and its Approach to Agricultural Data Management

The approach and principles of foundational DPI underline the Commonwealth's model for managing agricultural data by countries. As a domain-specific infrastructure, the Commonwealth's model considers specific characteristics as they relate to the conventional digitalisation process of the sector over the past decade. Following the publication of the digital agriculture framework in 2022, the Commonwealth Secretariat engaged with multi-stakeholder groups to coordinate efforts around data with the long-term goal of achieving food security and livelihoods in countries through digitalisation. Multiple virtual and face-to-face bilateral consultations were carried throughout during the period to seek inputs from experts within the area. The process took place between 2022 and 2024 and resulted in the conceptualisation of the Commonwealth's model of DPI for agriculture. Over that period, the concept has been presented at international forums for feedback. The model, which is applicable at country level and scalable at regional level, is called 'National Agricultural Data Infrastructure'.[13]

13 NAgDI is a process that leverages the DPI approach to coordinate agricultural data at national level and deepens DPI approaches within the agricultural sector.

2.4.1 Understanding the term 'National Agricultural Data Infrastructure'

Just as other natural resources, such as oil and gold, require infrastructure for countries to exploit them, the Commonwealth's model of DPI approach to agricultural data management argues that countries should consider their data as a resource. When this happens, their 'national' resource (data) will require infrastructure to manage. To date, the thinking around DPI has been spearheaded through a *product-driven approach*. On the other hand, through consultations with its stakeholders, the Commonwealth postulates that DPI for the sectors such as agriculture should adopt a *process-driven approach* to deploy and deliver technological infrastructure in support of agriculture and food security. Therefore, the four words in NAgDI are explained in the following paragraphs.

National. The 'N' in NAgDI represents countries as the most appropriate unit of analysis. NAgDI is a national infrastructure and goes beyond government infrastructure. It is a public infrastructure for all stakeholder groups within the country – public, private, NGOs, international institutions, UN bodies, research institutes, etc. Such a national approach to data infrastructure also helps with the bottom-up coordination of other existing local and global data initiatives in countries.

Agriculture. The 'Ag' in NAgDI represents agriculture as a case. In a very broad sense, agriculture includes the production and distribution of fisheries, aquaculture, livestock, forestry, environment and climate that support food security and poverty alleviation. It should be noted that agriculture is being used here as a case. In other words, the 'Ag' in NAgDI could be replaced by other domains such as health or education, since data is domain agnostic.

Data. The 'D' in NAgDI represents data. In this context, agricultural data is classified into two main categories. On one hand, *user data* that refers to any data or different pieces of data, when brought together, can lead to the identification of a particular person or entity. Examples include data on farmers, traders, enterprises, consumers, research networks, extension networks, financial institutions, cooperatives, field IDs or polygons of farmers' fields. User data are required only if the identity of the source of data is required for quality control, exchange and communication with the source or as an eventual user of processed data. *Content data*, on the other hand, conveys essence, substance, information, meaning, purpose, intent or intelligence, either singularly or when in a combined form, in either its unprocessed or processed form. Examples include soil maps, agronomic data, weather data, financial data, insurance data, production data, yield data and market data. Content data can be used for analysis, comparisons and decision-making without requiring linkages with user data. However, at source, content data must be linked to user data, and similarly, for content data to be relevant in most cases to local entities, it must be linked with the context provided by the user data.

Infrastructure. The 'I' in NAgDI represents infrastructure, not a solution or service. Wikipedia describes an infrastructure as the set of facilities and systems that serve a country. It argues that, while hard infrastructure may consist of the physical networks necessary for the functioning of a modern industrial society, soft infrastructure may include all the institutions that maintain the economic, health, social, environmental and cultural standards of a country. In the context of NAgDI, an infrastructure is considered holistically to include both technical (hard) and institutional (soft) components. NAgDI is an infrastructure for data exchange, just as it can also be referred to as a space for data exchange. This is in line with the current conversation around the DPI approach to digital investments in the sector,[14] and the concept of Data Space,[15] mostly in the private sector. All shared public infrastructure such as roads, railways or telecommunication networks serves as a foundation to allow other innovations to thrive. According to the United Nations Development Programme (UNDP, 2022), countries with robust public infrastructure are better equipped to meet the needs of their people and accelerate action towards the United Nations SDGs. Similarly, NAgDI should be considered as public infrastructure and, as with other infrastructures, it may not be completely free to access.

2.5 The Process of Validating the NAgDI Model

Through financial support from the Open Society Foundations, and in collaboration with other partners, a multi-stakeholder process was deployed

14 Vital Waves (2025). A Digital Public Infrastructure Approach for the Agriculture Sector. A White Paper produced through a collaboration between Co-Develop, the Gates Foundation, the World Bank, Vital Wave, and OpenAgriNet. https://vitalwave.com/article-presentation/dpi-for-agriculture/

15 https://data.europa.eu/sites/default/files/report/Data_Spaces_Panel_Report_EN.pdf

in 2023 and 2024 to explore demand for such infrastructure by Commonwealth countries. This process was organised through engagement with a few countries by:

1. creating awareness on the issue,
2. discussing and validating the model within national context,
3. building consensus on potential follow-up actions by local stakeholders, and
4. encouraging member countries to explore the four components to design and implement their infrastructure.

The process began with diagnostic engagement with multiple stakeholders on the current situations of agricultural data management in support of climate-resilient agriculture in four selected countries: Malawi, Ghana, Bangladesh and Barbados. In each country, remote bilateral engagements were initiated with interested and available partners. These activities were followed by an online stock-taking exercise on the existing data management practices, legislation and perceptions of collaboration around data management through a web survey to inform the next steps. These were followed by a multi-stakeholder policy dialogue on the need for nationally coordinated approaches to developing and managing a model of DPI for agricultural data. The dialogues were held in Malawi (September 2023), Ghana (November 2023), Bangladesh (May 2024) and Barbados (June 2024), which confirmed and enabled the consolidation of the NAgDI model.

The dialogues were convened in collaboration with the respective governments in the four countries, with support from other national, regional and private sector organisations such as the Alliance for a Green Revolution in Africa (AGRA), the Caribbean Community, the Inter-American Institute for Cooperation on Agriculture and Aspire to Innovate (A2i) in Bangladesh. Other partners that contributed to the dialogues include the Centre for Digital Public Infrastructure, Varda Ag, UNDP, the Food and Agriculture Organisation, Farmerline Group, Accelerating the Impact of CGIAR, Climate Research for Africa, the Global Centre on Adaptation, the Global Alliance for Improved Nutrition and the International Food Policy Research Institute. The Barbados event was a regional dialogue involving representatives from Jamaica, Guyana, Trinidad and Tobago, Belize, St Kitts and Nevis, Dominica, Saint Lucia, St Vincent and the Grenadines, The Bahamas and Antigua and Barbuda. In all, more than 400 delegates participated in these face-to-face dialogues and contributed to the discussions. Each of the national dialogues enabled the production of a policy brief for that country.[16]

The main outcomes of the national dialogues were a clear appreciation of the concept of NAgDI being able to respond to the data management needs of the countries in the agricultural sector, and the need for involvement of the higher offices of the countries to initiate a process which can then be addressed by the respective ministries, in close collaboration with private sector partners. Therefore, NAgDI is accepted as an infrastructure that also provides the data management space for mutual exchanges in the agricultural sector, while at the same time preparing countries for exchanges between each other. Each country was also able to identify a range of use cases for NAgDI in its context and was able to identify the local stakeholder institutions for their NAgDI. Finally, as a principle that cuts across the implementation approach to NAgDI, the infrastructure should build on existing systems or use standards and protocols that are already in use elsewhere, which facilitate interoperability.

With this in mind, and the variety of insights gained from the four dialogues, a Writeshop was organised with the participation of over 20 champions of NAgDI from nine member countries to put together a proposed core set of actions for implementation and to brainstorm on the approach to resource mobilisation for NAgDI. The outcome of the Writeshop has confirmed the principle of not reinventing the wheel but making full use of all existing resources in the countries. This includes the emerging digital public goods and infrastructure investments that can be adapted to the agricultural sector, national data policies and regulations, and public and private sector data assets and resources, as well as institutions and organisations with expertise and experience in governance, administration and business development. Therefore, the broader dialogues that the Commonwealth Secretariat has started

16 Refer to the Policy Briefs for Bangladesh Commonwealth Secretariat (2024b), the Caribbean Commonwealth Secretariat (2024c), Ghana Commonwealth Secretariat (2024d), and Malawi Commonwealth Secretariat (2024e).

with partners should continue at national level. As an approach to help countries mobilise resources, another recommendation for the Secretariat was to develop a policy guide to investing in NAgDI for member countries to consider adopting as a generic approach, with local adaptations. Similarly, to support advocacy for investment in NAgDI, the Writeshop confirmed the need for producing an industry report on the cost of policy inaction by countries to invest in NAgDI.

2.6 The NAgDI and Its Components

The vision of NAgDI is to strengthen and harmonise existing individual data systems at country level through an interoperable national data infrastructure, enabling interconnected infrastructure at regional and global levels, thereby creating a superhighway for secure data exchange within and between countries, and across regions for macro-level decision-making. Therefore, the vision itself is embedded in the broader vision of enabling the Connectivity Agenda at regional and global scale: if Commonwealth countries each implement their NAgDI, it will be easier to integrate them into a global interoperable system to facilitate knowledge exchange, finance and trade.

NAgDI is conceptualised as comprising four main components that need to be addressed during its establishment and implementation. These four components are interconnected and interdependent and are being considered as investment areas for a typical NAgDI in a country. Within each NAgDI, a country will strive to achieve the vision by setting two goals for the operationalisation of the NAgDI. The achievement of these two goals is interlinked with addressing the four components as investment areas, each of which are operationally linked to corresponding strategic objectives and result areas**.** The following points describe the components:

- *Component 1 – policies and principles* guiding the infrastructure, including international norms, conventions and political commitments that set the scene, as well as the localisation of these principles to fit the national and local environment.
- *Component 2 – governance and administration* of the infrastructure through an independent model that ensures trust and reliability for use of the infrastructure.
- *Component 3 – technologies and systems* for the infrastructure that provide the functionalities to enable available and appropriate technologies to operate in support of data integration, harmonisation and exchange among its users.
- *Component 4 – marketing and business* strategies around the infrastructure both to mobilise the initial resources to establish the infrastructure and, through a business model, to operationalise, maintain and sustain the infrastructure.

From a national perspective, any institution or group of institutions should first understand the above generic vision of NAgDI, which first must be internalised and contextualised at the country level. This enables the policy-makers to appreciate the contribution of NAgDI to the regional dimensions of trade and knowledge exchange as well as the understanding of the value of aggregation of data and knowledge at national level, using the infrastructure for supporting collaboration among all local constituents of the agricultural and related sectors.

2.7 Road Infrastructure Analogy for NAgDI

The NAgDI model, comprising four components, can be illustrated using the analogy of road infrastructure. Using the road infrastructure analogy demonstrates the similarities that exist between the functionalities of each of the components of NAgDI and the core elements of any road infrastructure. These are illustrated in Figures 2.3 - 2.6.

2.7.1 Tarmac and Bridges

Figure 2.3 shows a network of roads or tarmac along with its associated systems such as bridges. The figure represents the technical component of the larger road infrastructure to enable the flow of vehicles, passengers and goods within each of the countries (A and B) but also with borders to enable the cross-border flow of goods and services. The design and construction of the tarmac happens in a decentralised manner in each country, to meet the context of sovereign countries, but are at the same time in alignment with global standards. The tarmac across both countries is interoperable to allow for different vehicles of all sizes to make use of it. Equal opportunities exist for commercial vehicles, government vehicles and private vehicles to use the tarmac. Therefore, drivers from different countries can drive across borders without making any technical modifications to their vehicles to fit onto such a technical infrastructure. Where load capacities of the bridges and tarmacs exist, alternate routes are provided for them, which will have to be clearly marked.

For NAgDI, Figure 2.3 represents a decentralised, secure, standardised and interoperable data exchange mechanism that connects multiple data-holding institutions and data-consuming entities, both within and between countries.

On the other hand, Figure 2.3 also shows the absence of markings, road signs or guides on the tarmac for road users. And without the road signs, markings, guide, policies and principles, the technologies and systems cannot function well for users. Figure 2.4 brings in the road signs, markings, guide, etc. to layer onto the tarmac.

2.7.2 Road Signs and Markings

Figure 2.4 shows an overlay of road signs, markings, guide, etc. onto the tarmac. It represents the underlying principles that make the technical infrastructure functional by different users, and includes the demarcation of lanes on the tarmac, clear signage for safe exist on highways and traffic lights on when to stop. It should be noted that every sovereign nation has policies, rules and regulations for their road infrastructure. Some of the policies may be specific and local, and identified and

Figure 2.3 Technologies and systems of road infrastructure and NAgDI.

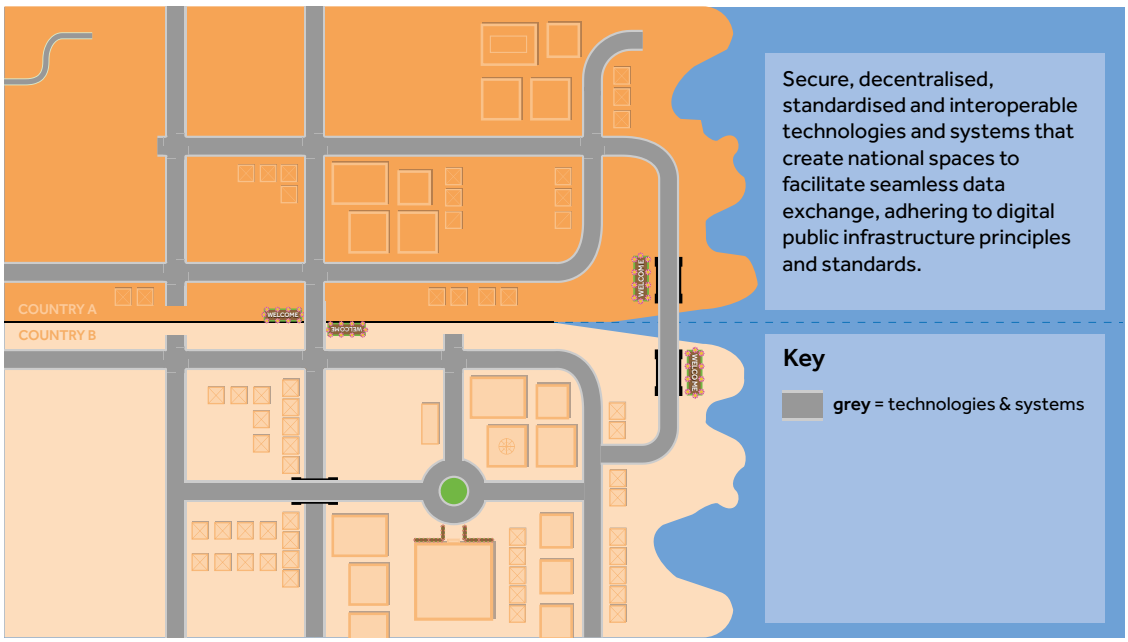
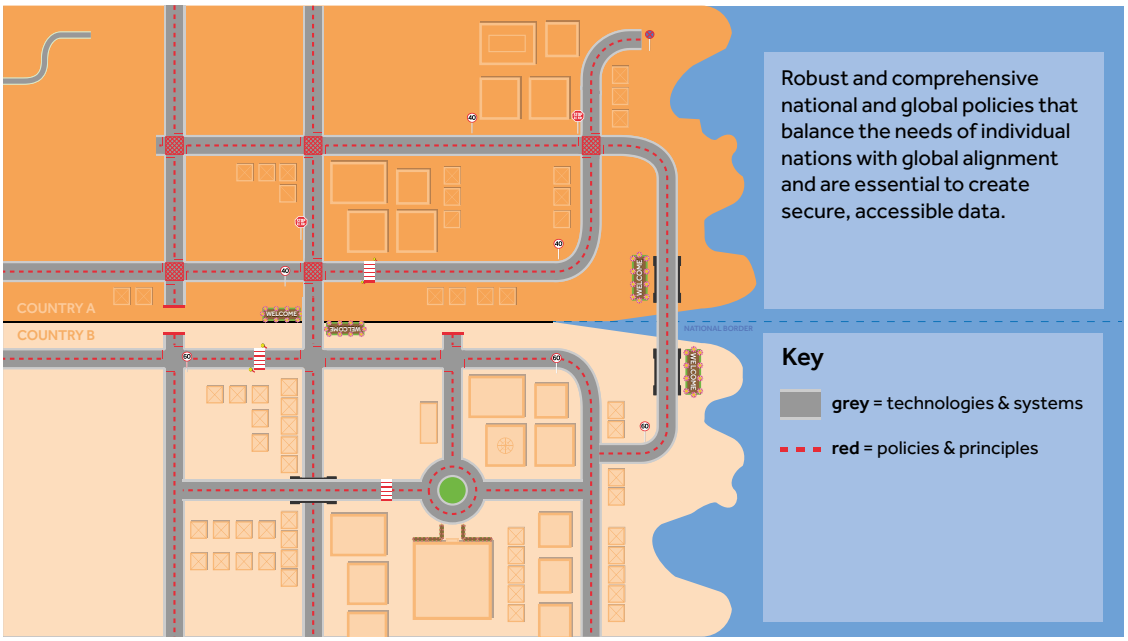


Figure 2.4 Policies and principles of road infrastructure and NAgDI.



adapted to the country's regulations. For example, speed limits for road users may differ from country to country, and foreign road users must respect the rules of each country. While some countries might have speed cameras to enforce the rules, others might have law enforcement agencies physically present on the highway with speed guns. In some countries, once you own a vehicle, you are required to pay tax, while in other countries, you might own a vehicle but you would not pay the road tax until you drive it on the highway.

On the other hand, some of the rules might be globally recognised by foreign users, enabling them to align and integrate with neighbouring countries and their citizens. For example, different designs and representations of 'zebra crossings' for pedestrians may be found in different countries but at the same time giving the same meaning to all users. All these guiding principles and policies provide for safe operation and use of the technical system of the road infrastructure, the administration and operation of the road network, and the business and revenue-generating strategies such as the tolls, road taxes and payment of fines, to ensure maintenance and repairs of the infrastructure.

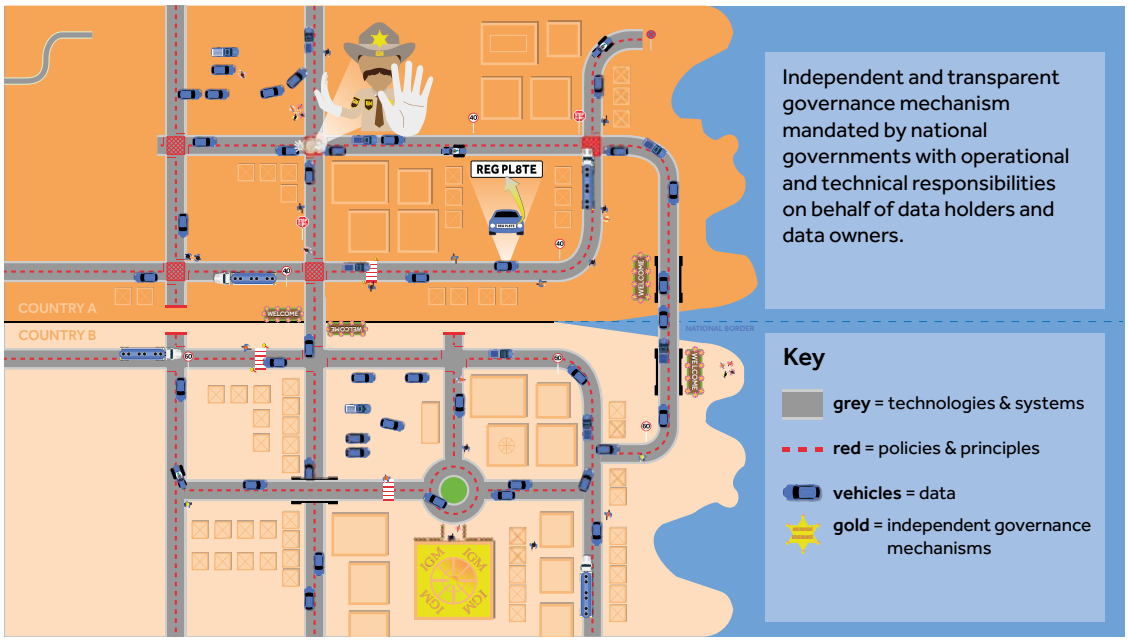
For NAgDI, Figure 2.4 represents policies and principles that foster an enabling environment for the creation and management of dependable, accessible and secure data for all users (data-holding institutions and data-consuming entities) both within and across the countries.

However, having rules and regulations without enforcement are essentially ineffective and symbolic, as they are not actively applied or followed. Hence, Figure 2.5 adds the governance and administration of the infrastructure layer.

2.7.3 Enforcement of Regulations

Figure 2.5 illustrates the governance and administration (not ownership) aspect of the road infrastructure: technical and operational. Once vehicles and pedestrians move within and across the tarmac, there is a need to enforce to rules and regulations. This component ensures that the different users operating on the shared infrastructure represent legitimate users of the road and are respecting the policies and regulations. This is subject to an availability of a referee, a steward or a custodian entity implementing the safety regulations for use of the roads. For example, the tasks of the referee may include ensuring an independent assessment of bridges, tunnels, etc., for the safety of users; making sure that drivers have the right qualifications for different types of vehicles; ensuring that vehicles are checked regularly for their roadworthiness; ensuring users obey the speed limits rules using speed cameras or speed ramps, or through a physical presence on the road; ensuring that fines are redeemed using the

Figure 2.5 Governance and administration of road infrastructure and NAgDI.



appropriate mechanism; and ensuring that broken-down road signs are replaced and road accidents are responded to in a timely manner, to ensure smooth functioning of the infrastructure. Different countries may have different models and entities for this component of the infrastructure, from a single entity to multiple entities playing different roles.

On another note, the identification of the users is critical for the enforcement of the rules. The number plates of the vehicles in this case play an important role. By capturing the identity of the user, actions can easily be taken for the safety of all users.

For NAgDI, Figure 2.5 represents an independent oversight mechanism that ensures adherence to agreed rules and regulations through day-to-day operations and technical management to promote trust in the overall architecture of the infrastructure. This component provides a trusted administrator to ensure that all stakeholders of the infrastructure are satisfied. In the world of data management, it acts as a custodian of the infrastructure on the behalf of the data holders and data owners without having any vested interest in the data. Just as in the road infrastructure, the user data such as farmer profiles, profiles of input dealers and filed IDs are critical in creating value for the data in the infrastructure.

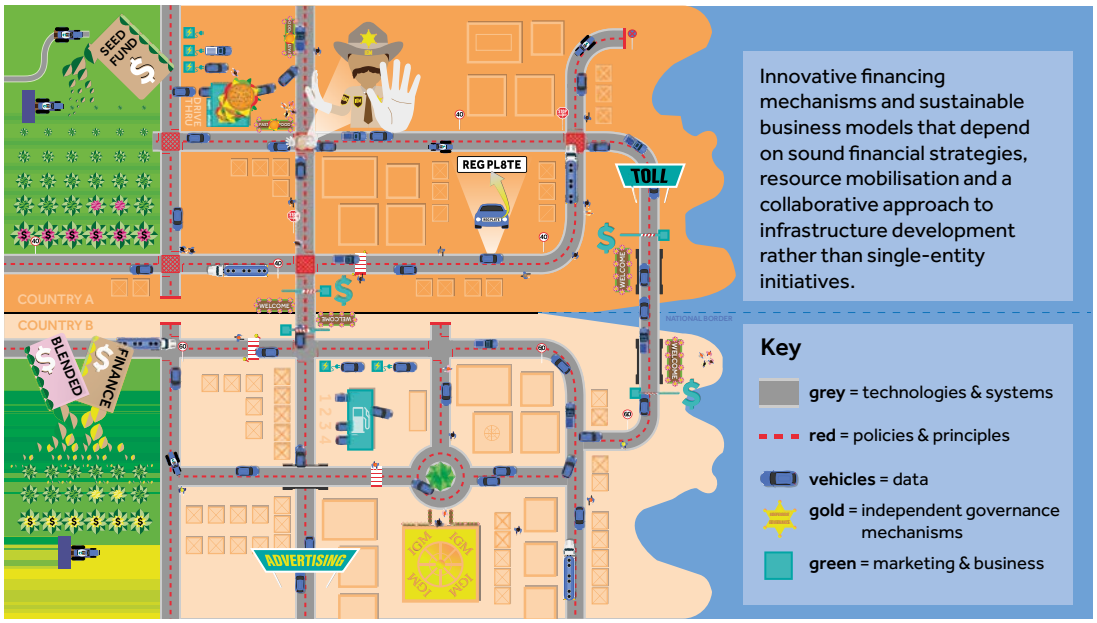
However, technologies, policies and governance without the accompanying incentives will not build and sustain any infrastructure. Hence, Figure 2.6 brings in the financing and investment aspect of the infrastructure.

2.7.4 Construction and Maintenance of the Infrastructure

Figure 2.6 illustrates the elements of marketing and the business model for the operation of the road infrastructure, starting with sources of finance for the initial construction of the road infrastructure, followed by its maintenance and upgrades. Funding sources such as seed funds, blended finance, loans and grants are possible options for the initial financing of road infrastructure. On the other hand, income from the users of the infrastructure through toll booths, road taxes, licensing fees, fines and penalties, among others, are sources of funds in support of the maintenance and sustenance of the road infrastructure. Additionally, once the infrastructure is built, it creates a platform for private sector innovations such as setting up charging stations, fuel stations and fast-food shops along highways that bring in revenue for the maintenance of the infrastructure. These funds are used to support updates to road guidelines, improvements to road signs, replacement of broken-down signs, etc. The revenue generated also helps with the design and upgrades to the technologies such as speed cameras, CCTV and overhead bridges. It also supports the administration of the infrastructure by law enforcement agencies, training and capacity building for users, etc.

For NAgDI, Figure 2.6 represents the marketing and business component that supports strategic

Figure 2.6 Marketing and business around the road infrastructure and NAgDI.



marketing, which aligns with the interests of stakeholders to secure financing and investments for sustainable infrastructure. It includes the identification of the initial financing mechanisms of the infrastructure in each country as well as the business models to support massive adoption and sustained use by all stakeholders. Figure 2.7 combines the four components using the analogies described above.

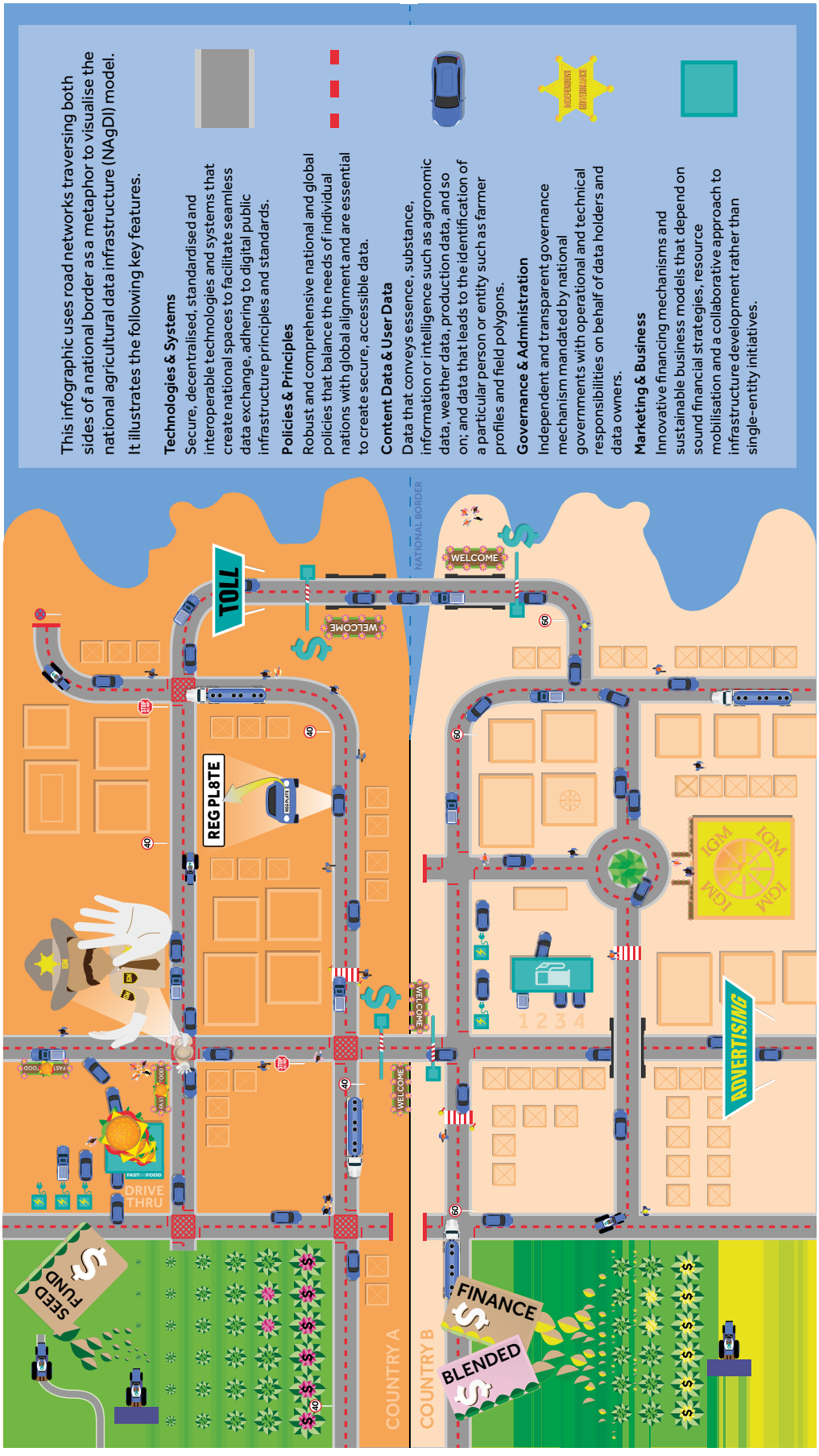


Figure 2.7 Visualising the NAgDI Model.

2.8 Overview of NAgDI and Its Investment Areas

Having a broad understanding of how the four interlinked components can complement each other in achieving the vision of NAgDI in the context of the country will enable countries to make decision on the next steps. Within this broader understanding, institutions in the countries can collectively assess and decide to what extent they can achieve the result areas in the short term and with their available resources, and what will need to be proposed as new interventions in the medium and long term. Based on the available resources, the country can start implementing parts of the infrastructure, while others will be implemented when the resources and local capacity are available. This also informs the timeline of activities regarding what needs to be done simultaneously with regard to the resources available.

To be able to digest the different elements of the operationalisation of NAgDI, this section focuses on the main investment areas around the four components, with the broad activities within each result area providing modules that can be considered for investment and funding. Hence, a country can use a mixture of both perspectives and the modular approach to construct its own holistic approach over time.

Figure 2.8 summarises the vision of NAgDI, its two main goals and how these goals relate to the four components, with each component and the associated strategic objective, result area and four broad activities that can be adapted and expanded by each country.

2.8.1 Investment to Collate and Develop Policies and Principles for NAgDI

This investment area contributes to goal 1 to foster an enabling environment for data exchange through policies and an independent governance model. The strategic objective of the investment is to create an enabling environment for the creation and management of a reliable, secure and accessible infrastructure (Figure 2.9).

Comprehensive global and national principles and policies are essential to create secure, accessible data infrastructures. In this context, this investment area will strive to establish a comprehensive policy framework for the design, roll-out and use of the infrastructure and its content: the data. The policies and principles also provide guidance for the design and implementation of the other three investment areas: governance and administration, technologies and systems, and marketing and business.

Principles can refer to international norms, conventions and political commitments that set the scene. Policies might imply the localisation of these principles in the local enabling environment. These principles and policies should balance the needs of individual nations with global alignment. They should also build on existing policies, guiding principles and norms that may have already been established by national information and communication technology and data management authorities.

The broad activities carried out under this result area are all geared towards developing policies and principles to guide the design, implementation and use of the infrastructure (Figure 2.9). Early in the process, it will involve advocacy, especially on the part of policy-makers, to secure high-level endorsement by the national government that paves the way for multi-stakeholder engagement and resource mobilisation strategy development. This may take the form of identifying a lead institution, most likely a government ministry, to champion the initiative. The lead institution can lead the conduct analysis of key issues relating to the infrastructure to develop an issue paper and an advocacy strategy aimed at stakeholder institutions.

Soon after acquiring buy-in from the policy-makers on the concept of the infrastructure, advocacy with stakeholders can progress to engagement through stakeholder analysis, identification of relevant stakeholders and jointly defining key roles. This will involve identifying and engaging institutions with existing mandates relating to legislation, policy and systems. Further engagement activities, with the help of the champion policy institution, shall include negotiating the delegation of mandates and seeking the endorsement of mandate delegation through the ratification of official documentation, as well as initiating discussions around the options and means for joint resource mobilisation.

The policies and principles developed under investment area 1 are centred around advocacy, engagement and desirable outcomes of the infrastructure, which guide the development of policies and principles for the NAgDI. These

Figure 2.8 Overview of the operation of a National Agricultural Data Infrastructure.

VISION of NAgDI: To strengthen and harmonise existing individual data systems at country level through an interoperable national data infrastructure, enabling interconnected infrastructure at regional and global levels, thereby creating a superhighway for secure data exchange within and between countries, and across regions for macro-level decision-making.

Goal 1

Foster an enabling environment for data exchange through policies and an independent governance model

Goal 2

Establish secure, decentralised, interoperable and financially sustainable data exchange

Investment to collate and develop policies and principles to guide the infrastructure

Strategic Objective 1	Results Area 1	Broad Activities	Component 1: Policies & Principles
To create an enabling environment for the creation and management of a reliable, secure, and accessible infrastructure	A comprehensive policy framework for the establishment of NAgDI through an inclusive consultation process	**Broad Activity 1** Advocacy for endorsement of the infrastructure **Broad Activity 2** Stakeholder engagement on establishing the infrastructure **Broad Activity 3** Policy analysis and defining the outcomes of the infrastructure **Broad Activity 4** Defining and developing policies and principles for the infrastructure	

Investment to ensure independent governance and administration of the infrastructure

Strategic Objective 2	Results Area 2	Broad Activities	Component 2: Governance & Administration
To ensure an independent technical and administrative oversight of the infrastructure for trust and reliability	An effective, equitable and impartial oversight of the technical and administrative operations of NAgDI	**Broad Activity 5** Setting up multi-institutional mechanisms for coordination and implementation **Broad Activity 6** Facilitating and finalising agreement on governance model for the infrastructure **Broad Activity 7** Operationalising the technical oversight mechanisms of the infrastructure **Broad Activity 8** Operationalising the administrative oversight mechanisms of the infrastructure	

Investment to assemble technologies and systems for the infrastructure

Strategic Objective 3	Results Area 3	Broad Activities	Component 3: Technologies & Systems
To create a decentralised, secure, and interoperable data exchange mechanism that fosters innovation and supports data-driven collaboration	A standardised and interoperable data exchange mechanisms for secure and consent-driven data sharing	**Broad Activity 9** Identifying standards and protocols and adapting digital public infrastructure **Broad Activity 10** Assembling a decentralised system to facilitate data exchange **Broad Activity 11** Operationalising the infrastructure with existing datasets **Broad Activity 12** Facilitating an inclusive, scalable data exchange ecosystem	

Investment to develop marketing and business strategy in support of the infrastructure

Strategic Objective 4	Results Area 4	Broad Activities	Component 4: Marketing & Business
To support strategic resource mobilisation to finance the infrastructure and attract investment for accessible and sustainable use	A self-sustaining business model that supports the long-term sustenance of the infrastructure	**Broad Activity 13** Mapping of agricultural data stakeholders and assess product-market-fit **Broad Activity 14** Setting up the initial financing instruments **Broad Activity 15** Developing business models for operational investments **Broad Activity 16** Continuous marketing of the infrastructure for its value-adding use	

Figure 2.9 Overview of the investment area on the component 'Policies and Principles' for NAgDI.

Investment to collate and develop policies and principles to guide the infrastructure			
Strategic Objective 1 To create an enabling environment for the creation and management of a reliable, secure, and accessible infrastructure	**Results Area 1** A comprehensive policy framework for the establishment of NAgDI through an inclusive consultation process	**Broad Activity 1** Advocacy for endorsement of the infrastructure **Broad Activity 2** Stakeholder engagement on establishing the infrastructure **Broad Activity 3** Policy analysis and defining the outcomes of the infrastructure **Broad Activity 4** Defining and developing policies and principles for the infrastructure	**Component 1: Policies & Principles**

principles and policies are also intended to be applied to the other three investment areas, such as identifying guidelines for data standards and interoperability as well as identifying data-sharing protocols aligned with findability, accessibility, interoperability and reusability (FAIR) principles for engagement around data. Similarly, the identification of existing DPI resources to match anticipated technical functionalities can be initiated.

Having obtained the endorsement of the policy-makers, activities shall involve stakeholder analysis, identification of relevant stakeholders and engagement to jointly define the key roles of stakeholders and appreciation of their comparative advantages in being involved and contributing. Additionally, baseline research must be carried out to identify global and local policies, data contributors, intermediaries and users as well as to understand stakeholder interests and needs.

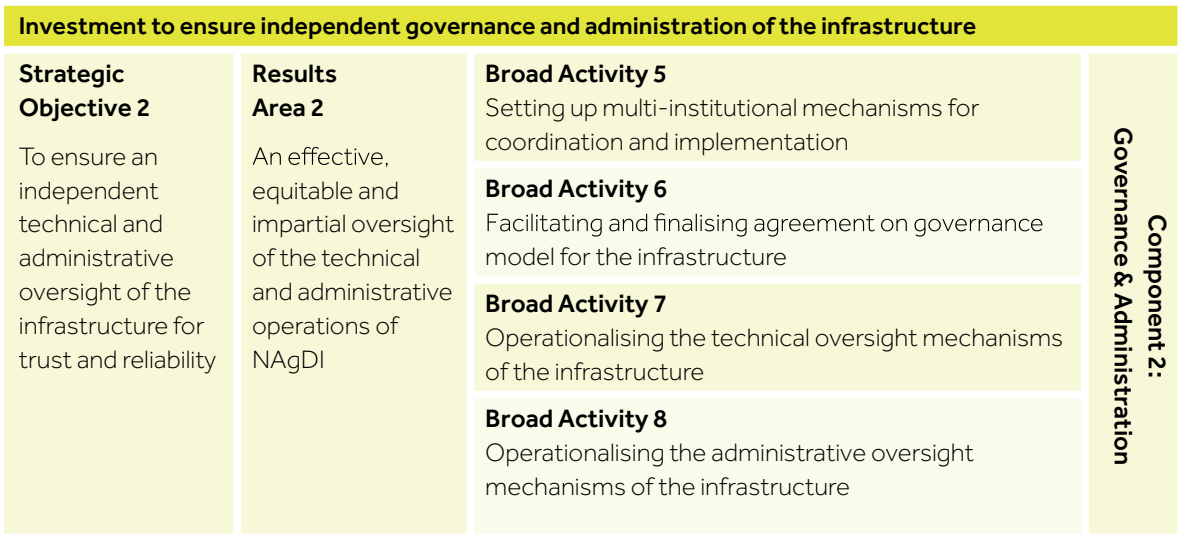
Engagement and stakeholder dialogue processes shall aim at deliberating on policy options, validating the outcomes of the ongoing process, agreeing on policy gaps for the establishment of the infrastructure and carrying out ex ante impact assessment of alternate policy options in order to choose the appropriate ones. These processes shall lead to the definition of procedures for more holistic and stronger interagency partnerships, establishing working groups on policies and principles, governance and administration, technologies and systems, and marketing and business.

In the long term, operations under this investment area might terminate at some point, with mandates handed over to investment area 2, addressing governance and administration for regular updates and changes to the guiding policies and principles to meet the changing demands of the infrastructure.

2.8.2 Investment to Ensure Independent Governance and Administration

This investment area also contributes to goal 1, to foster an enabling environment for data exchange through policies and an independent governance model. The strategic objective of the investment is to ensure an independent technical and administrative oversight of the infrastructure for trust and reliability (Figure 2.10). This investment area builds on and administers the policies and principles laid down under investment area 1 by providing mechanisms for updates and changes to the guiding policies and principles to meet the changing demands of the infrastructure. This investment area ensures the establishment and functioning of an independent governance model around NAgDI, even though the initiation may have been led by a ministry. The independent governance and administration model will ensure trust and reliability of the infrastructure. It will ensure the policies and principles relating to financing, investment, technologies and systems are followed for the benefit of all users. The governance mechanism will help to establish the NAgDI, guide and oversee its functions and performance, and begin the administration processes to ensure that

Figure 2.10 Overview of the investment area on the component 'Governance and Administration' for NAgDI.



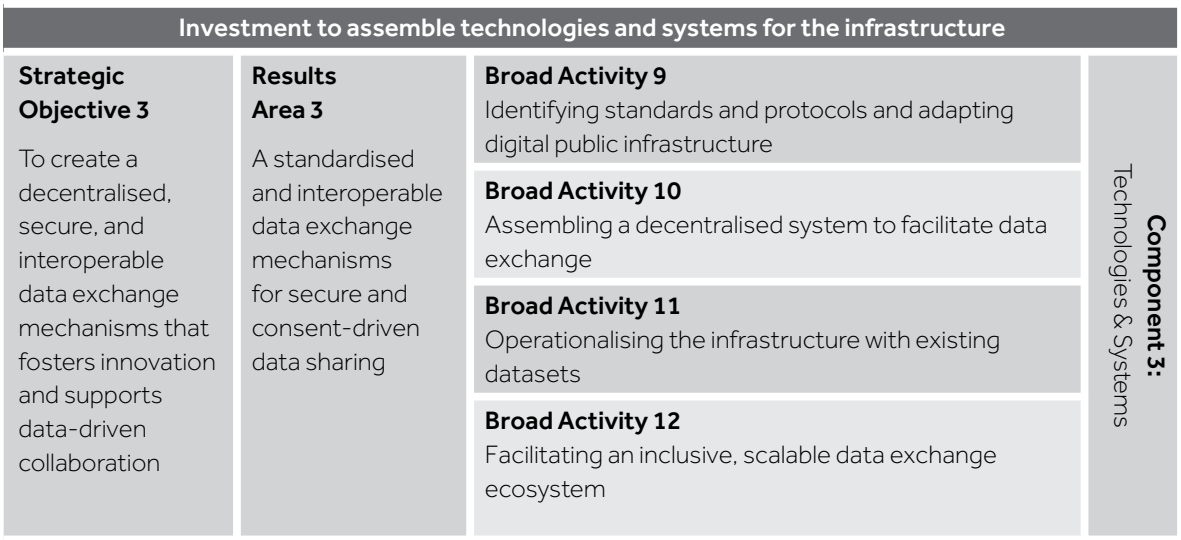
the conditions of use, etiquette, commitments of use, etc. outlined in the policies and principles are adhered to. The governance model will also ensure that updates and changes to the guiding policies and principles are made, in order to meet the changing demands of the infrastructure. Hence, its aim is to ensure the independent oversight of the technical and administrative operations of the infrastructure regarding trust and reliability. Additionally, a country could also establish an external regulator or peer-review mechanism to oversee, monitor and check the functioning of this oversight mechanism.

The foundation of the broad activities within this investment area is the process of engagement and collaboration among partners, around the components of the infrastructure. Engagement and stakeholder dialogue processes should lead to the establishment of working groups on policies and principles, governance and administration, technologies and systems, and marketing and business. These groups shall be designed with flexibility in mind, in order to welcome new members with expertise and an interest in contributing over the years. Analytic work to dissect the technical, governance and economic aspects of the infrastructure should increase with stakeholder identification, establishment of consortium and subgroups, definition of roles and procedures, and validation of outcomes. These processes shall lead to the definition of regulations and procedures for more holistic and stronger interagency partnerships to operationalise the NAgDI.

The product of these participatory, collaborative discussions and negotiations, deliberating on the implementation of policy options that have been selected earlier, will be the agreed-upon policies and regulations that will enable the operationalisation of the NAgDI. With these details finalised, the process of endorsement and ratification of NAgDI by policy-makers should be finalised, along with the functioning of an independent oversight mechanism for the infrastructure, the oversight of the technical operations of the NAgDI and eventually the oversight of the administrative operations of the infrastructure. The activities of the working group on technologies and systems shall also include identifying existing DPI resources to match technical functionalities with needs and implementing a mechanism to review and adopt guidelines for data standards for interoperability, data-sharing protocols and DPI building block functionalities. Mechanisms will also be established to build linkages among relevant institutions that are ready to support the establishment of the infrastructure.

The activities of the working group on the marketing and business plan for the NAgDI should include considerations on mobilising financial resources for the infrastructure, both for the initial establishment costs and for sustaining the infrastructure once operational. The strategy for mobilising the initial financing may include options such as mandatory levies from all key stakeholders within the agricultural sector in the country, seed

Figure 2.11 Overview of the investment area on the component 'Technologies and Systems' for NAgDI.



funds and development finance. It should also identify strategic networks in data management to leverage potential financing opportunities, mapping out stakeholders according to their interests and priority areas of focus, identifying potential funding sources and presenting financing plan to funders and key stakeholders. The business model should aim to attract both public and private sector investments.

The end result of this investment area is to arrive at a defined set of rules and procedures that stakeholder groups have agreed to, based on the appreciation of their comparative advantages; a functioning independent oversight mechanism for the infrastructure; and a clearer description of the macro-level benefits of the infrastructure to citizens and businesses. The accompanying strategy should be around creating a shared national resource through synergy and cooperation among key partners, firstly by carrying out deeper analysis of the infrastructure and its components and then by launching a planning process to inform the design and implementation.

2.8.3 Investment to Assemble Technologies and Systems

This investment area contributes to goal 2, to establish secure, decentralised, interoperable and financially sustainable data exchange mechanisms. The strategic objective of the investment is to create a decentralised, secure and interoperable data exchange mechanism that fosters innovation and supports data-driven collaboration (Figure 2.11). This investment area addresses the core technological issues around the data exchange mechanism, which should utilise open standards and should enable access to multiple users within and between countries. It will provide the functionalities to enable available and appropriate technologies to operate for data integration, harmonisation and exchange. It will also build on the significant technical progress that has been made through the digital public good DPG and DPI movement. As a result, key building blocks of the foundational DPI are available for adaptation and deployment by countries. The basic principles for design and deployment have been developed and tested around the world. What might be needed for the agricultural sector is the vertical integration of the sector-specific building blocks that simultaneously provides the connection with the layer of foundational DPI, connects with the existing agricultural data systems in the country and supports the service provision layer of operators in the agricultural sector, the latter interfacing with the agricultural community.[14]

The broad activities under this investment area should converge towards the assembly of a functioning standards-based data exchange mechanism that is secure and interoperable within and between countries. Activities around the data exchange mechanism should be piloted at community levels, based on data-sharing agreements with key stakeholders, before scaling to higher levels. Wherever possible, the approach should be to build on the existing DPGs to assemble a decentralised

architecture for data-sharing pipelines or any other existing systems in the country. Standardised templates and tools for data holders to connect with the exchange mechanism must be developed and made available. Application Programming Interfaces (APIs) for innovators and service providers need to be deployed to integrate new services and solutions while fostering opensource technologies for ease of maintenance. The data-sharing process can be rolled out incrementally using existing open datasets and eventually encompass new data sources and new users of data that would have been prepared through capacity development to interface with such functionalities. Criteria for the evaluation of data exchange are being developed and refined (Eaves and Rao, 2025).

The working group on technologies and systems should finalise the validation, implementation and operationalisation activities using the tools and templates previously developed. This can then transition into an implementation group, under the supervision of the governance and administration entity, to carry out the day-to-day and technical operations of the infrastructure. The deployment of secure APIs and data-sharing endpoints to protect data integrity and the adaptation of the infrastructure for local language and cultural relevance should remain a continuous improvement process. Other functionalities to be defined include deploying privacy-compliant mechanisms for consent-driven data sharing, and adopting or developing secure APIs and data-sharing endpoints to protect data integrity.

One of the milestones for the working group should be the achievement of a functional data exchange mechanism of the NAgDI that is ready for complete piloting. The validation process should continue with the resilience and scalability testing of the exchange mechanism to ensure reliability. Targeted outreach campaigns should be rolled out within and outside the country to engage data contributors, data users and potential investors, based on the potentials of the macro-level products of the infrastructure. Training and capacity-building activities should accompany the development of the technical data exchange mechanism to improve knowledge management, learning, monitoring and evaluation for assessment, feedback and improvement of the exchange mechanism. Hackathons and innovation challenges can be organised to promote innovation in data management, while the development of complementary offline functionalities can further support stakeholders' data engagement.

In addition to the technical aspects, steps must be taken to ensure that agreed protocols, administrative guidelines, operational policies, etc. are adhered to within the exchange mechanism, to remain coherent with the policies and regulations established. Similarly, the business accessibility and sustainability of the NAgDI should also be tested using the business model and data analytics carried out on the registered and available datasets using the agreements with key stakeholders. The result of the activities under this investment area should be the achievement of a standardised and interoperable data exchange mechanism for secure and consent-driven data sharing.

2.8.4 Investment to Develop Marketing and Business Strategy

This investment area contributes to goal 2, to establish a secure, decentralised, interoperable and financially sustainable data exchange mechanism. The strategic objective of the investment is to support strategic resource mobilisation to finance the infrastructure and attract investment for accessible and sustainable use (Figure 2.12). This investment area addresses an important question around who pays for the infrastructure and how is it paid for. It formulates and maps out the strategy and implementation approach to financing NAgDI, from the initial financing to options for sustainable business models for self-sustenance. Being a new kind of infrastructure that is not tangible, but rather virtual and invisible, it will require significant efforts to demonstrate its unique value proposition to policy-makers, as well as the long-term business case for the private sector. The initial marketing efforts to mobilise resources to establish and operationalise the infrastructure should aim at identifying the existing data holders and demonstrating the added value of NAgDI to their current datasets. It will entail sufficient level of trust and confidence in the space to enable them to open their data systems for sharing. The key issues will be providing guarantees that their data is safe and that their competitors will not take advantage of the infrastructure to exploit them. Stakeholders will also need reassurance around the vision of NAgDI supported by macro-level use cases that demonstrate that its products and services do not compete with the existing data holders. Arguments on the benefit of NAgDI to enhance their services, access to a larger set of data derived

Figure 2.12 Overview of the investment area on the component 'Marketing and Business Plan' for NAgDI.

Investment to develop marketing and business strategy in support of the infrastructure			
Strategic Objective 4 To support strategic resource mobilisation to finance the infrastructure and attract investment for accessible and sustainable use	**Results Area 4** A self-sustaining business model that supports the long-term sustenance of the infrastructure	**Broad Activity 13** Mapping of agricultural data stakeholders and assess product-market-fit **Broad Activity 14** Setting up the initial financing instruments **Broad Activity 15** Developing business models for operational investments **Broad Activity 16** Continuous marketing of the infrastructure for its value-adding use	**Component 4: Marketing & Business**

from the pooling of data resources and access to an enlarged market will be critical. Developing viable a business strategy with revenue streams as incentives to attract massive adoption, use and scale of the infrastructure will be the key to its sustainability. As a public infrastructure, equity of access – both financial and technical – will be important.

The broad activities carried out under this investment area are geared towards matching the offer of NAgDI to the perceived needs of the stakeholders, such that advocacy and convincing arguments can secure the initial financing needed to build the infrastructure; thereafter the business model for the operationalisation of NAgDI leads to a self-sustaining infrastructure. While the initial buy-in from the policy-makers on the need for a NAgDI for a country may have gained the support of a champion for the establishment of the infrastructure, the initial consultations with stakeholders of NAgDI could also be accompanied by a baseline study of needs, which can continuously be improved upon through the multi-stakeholder consultation process undertaken in the early phases of advocacy, definition and design of the infrastructure. Such documentation of the needs of the stakeholders, both from the public and private sector, can be used to mobilise the initial resources for the design, set-up and establishment of the infrastructure. The working groups established early in the development process should also be able to inform the initial investment and subsequent costing of the NAgDI.

The working group on marketing and the business plan for the NAgDI will not work in isolation but rather in collaboration with the other groups. As part of its operation the working group should leverage international-level interoperability of data and collaboration, as well as existing modules of DPI, in its advocacy for the initial mobilisation of resources. Having gathered information from the stakeholders, it should develop elevator pitches for each stakeholder group according to their data needs and interests. This further helps to inform the overall marketing strategy for the NAgDI, based on the potential offered by the macro-level products of the infrastructure. Working with the Technology and Systems working group, targeted outreach campaigns will be rolled out both within and outside the country to engage data contributors, data users and potential investors. The design of the business model should be iterative, with the initial generation of revenues supporting the mobilisation of other sources of funding. Thus, the use cases of the infrastructure, with emphasis on the macro-level decision processes,[17] should be differentiated from the use cases of the digital agriculture service providers who are targeting the agricultural communities. These processes are also initiated at different stages of the development of NAgDI.

The focus of the marketing strategy should be on the creation of a shared infrastructure that is inclusive and accessible to all potential partners

17 Examples of macro-level decision processes and use cases of NAgDI are described in Section 4.2.

– a safe and trusted foundation upon which multiple innovations and services can be built. The detailed marketing plan should outline the strategies to attract investors, along with the deployment of a marketing strategy playbook for the infrastructure acting as a model of DPI for agriculture. This will enable stakeholders to engage with the infrastructure early in the design and implementation phase, which will also increase trust in the infrastructure and its mode of operation. The development of a business model canvas for the infrastructure should be started founded on the baseline study of needs and multi-stakeholder consultation process undertaken to develop the strategy. Pilot phases will be required on the establishment of data-sharing agreements with key stakeholders and the commercialisation of value addition, as well as the business models around data analytics services and recognition of data contributors for their viability. Complementing the marketing and business plan, the advocacy and engagement activities in the early stages of the establishment of NAgDI will merge into training and capacity building across the stakeholder groups, adopting knowledge management, learning, monitoring and evaluation as the approach to inform implementation of NAgDI. Overall, the working group will have to ensure the efficient use of the funds for the design, set-up and transition to a sustainable operational model of NAgDI, adapted to the local context.

The descriptions of the four interconnected components of NAgDI described in this section provide an overview of the main strategic objectives and result areas associated with each component as an area for investment. The description of the activities across each of the four components provides an idea of the iterative processes involved and gives insights into some of the internal dependencies of the activities. However, while these components are distinguishable from each other, the implementation of different broad activity areas under each component is often interconnected across the components, and dependencies exist among broad activities under the four components. Therefore, in the process of a country planning its investments in the establishment and operationalisation of its NAgDI, it is useful to have a sense of the timelines of the activities and the clustering of complementary activities for more effective implementation of NAgDI. This aspect is covered in Section 3, such that institutions in a country can make use of their understanding of the investment areas by component as well as the scheduling of activities under the components to determine the country's optimal course of action.

3. The Generic Guide to Investing in NAgDI

3.1 A Figurative Five-Year Guide for the Implementation of NAgDI

As envisioned, the Commonwealth Connectivity Agenda for Trade and Investment is a country-led initiative, and the NAgDI model is one of the tools being made available by the Commonwealth Secretariat to member countries. Based on the national dialogues organised in the four Commonwealth countries, and the consolidation of insights gained across these discussions, the main observation is that as the context of each country is different, and countries can be at different starting points, there is no single prescribed formula for implementation. As a result, this policy guide to investing does not include financial or budgetary considerations. Furthermore, the approach cannot be linear or piecemeal but holistic albeit modular and complementary in nature. The reflection on the outcomes and recommendations from the national dialogues have expressed the need for a suitable time frame for the initiation, planning and operationalisation of a NAgDI, given that such a collaborative process must build trust and play out over a longer period to allow for the partnerships to mature and trust to be built regarding the partnership around NAgDI.

Therefore, for the purpose of providing some guidance in the planning process, the Commonwealth Secretariat, in collaboration with a group of champions of NAgDI identified during the national dialogues, proposes as guidance to countries a figurative timeline of five years for the establishment of a NAgDI. This is based on the premise that operationalisation of NAgDI requires institutional collaboration, development and adoption of policies, governance structures, resources mobilisation and the assembling of systems. This figurative timeline is meant to convey the importance of medium- to long-term planning for the implementation of NAgDI, but it could also be over a longer period broken down into phases. Therefore, based on this five-year generic guide, countries can better formulate the implementation strategy that best suits their context. The policy guide to investing in NAgDI has been developed as broad guidance on how the different activities across the four components of NAgDI can be implemented over time, based on the recommendations gathered during the national dialogues. From the Commonwealth Secretariat's perspective, each country's approach to the design and implementation of NAgDI will differ, but following the generic process it enables them to ensure interoperability between country infrastructures across the Commonwealth and beyond. Some countries with existing data management assets and policies may be able to implement it faster.

Ideally, the strategy for implementation should include a high-level approach to areas of focus for all the investment areas of NAgDI. These might also include specific functionalities or enhancements that will be developed and delivered within a certain time frame. Clear descriptions and acceptance criteria should be provided for each activity. The strategy must outline leadership and collaboration, with an emphasis on national governments driving the process in close collaboration with other stakeholders. Other stakeholders should be encouraged to lead specific approaches and activities collaboratively for inclusion and sustainability. The types of institutions that can lead, the others that can collaborate, and if possible the specific names of institutions should be clearly defined in the strategy. Markers and key performance indicators (KPIs) should be provided, such as timelines that indicate when each activity is planned for action and significant events or achievements that mark important milestones. It is imperative to have markers, in the first place, to make stakeholders aware of the estimated time frames for their tasks, even though markers can be adjusted. These help to set expectations and provide a sense of progress. The KPIs should help countries measure the progress and success of NAgDI design, development, operationalisation and use. The NAgDI strategy for implementation should include measurable metrics and KPIs for self-evaluation and learning as well as for potential

financiers, donors and investors. This also aligns with documentation and learning using the metrics. Therefore, the implementation strategy should also contain guidance on how to document the learnings from each country's experiences, such that they can be shared with others and foster collaborative learning across countries and regions.

Table 3.1 illustrates a likely scenario for the implementation of the components and their broad activities over an implementation period of five years, if a country has few existing assets for agricultural data management and the potential for buy-in by policy-makers. The scenario illustrates some chronology in the implementation of the broad activities within each component, and hence investment area. However, it also shows the need to simultaneously implement other activities of different components, either for their complementarity or synergy. As one looks further down the timeline, there are more activities that are continued over the periods when others get started, while eventually some activities end with the start of others.

Given that there is no one single approach to the implementation of the NAgDI, the concepts of the component-based investment areas also have to be considered with the timeline as illustrated in Table 3.1 . Thus, the key message is that the implementation of NAgDI is not a singular and sequential process but rather has to be seen in a holistic manner and monitored by several specialised teams simultaneously (i.e. the governance and administration entity alongside the working groups). Thus, the mobilisation of financial, human and technical resources needs to be planned to take place in a coherent manner and can also be spread out over time, while being accompanied by a collaborative mode of planning and implementation. Beyond each country's implementation of the guide to investing, the Secretariat remains available to play its role as the hub for the 56 member countries across its five regions and to explore collaboration opportunities with the existing global, regional and national initiatives to further NAgDI across the Commonwealth.

The sections below provide a chronological description of the scenario, which also provides an insight into the coordination and complementary interventions that are needed over each of the five years of implementation towards a fully functional NAgDI.

3.1.1 Strategic Interventions Timeline in Year One

Advocate, Engage, Mobilise

The goal of the first year of NAgDI implementation is to secure high-level endorsement by the national government that will open the door for multi-stakeholder engagement and resource mobilisation strategy development. The strategy for the year shall be around advocacy, stakeholder engagement and the initiation of resource mobilisation. In general, activities would be heavily anchored on investment area 1: 'Policies and Principles'. It should, however, be noted that the policies and principles developed under investment area 1 are also intended to be applied to the other three investment areas. Hence, work on the other three investment areas shall also be initiated. While some of the specific activities might, under the investment area 1, be completed within six months, others might continue throughout year one and into the later years.

It is recommended that activities in the first six months should cover areas such as identifying a lead institution, preferably a government ministry to champion and drive the process. It should include **advocacy** by conducting robust lobbying to seek high-level endorsement for the NAgDI process to be initiated. This policy guide to investing in NAgDI should be used as the reference document for submitting such a request to the government. While the process of seeking endorsement continues, the lead institution shall conduct an analysis of key issues relating to the infrastructure to develop an issue paper and an advocacy strategy. Advocacy activities shall also include identifying and engaging institutions with existing mandates relating to legislation, policy and systems. Further advocacy activities shall include negotiating the delegation of mandates and seeking the endorsement of mandate delegation through ratification of official documentation. Also, agreements on functions, delegated mandates and legislative frameworks shall be established. Other activities within the first six months shall include identifying, adopting and adapting templates, guidelines for data standards and interoperability as well as identifying data-sharing protocols aligned with FAIR principles for engagement around data.

While most of the activities within the first six months shall continue through the first year, the second half of the year one shall target **engaging** partners around

Table 3.1 Illustration of a figurative timeline for the guide for implementation of the NAgDI in a country

Five Year Implementation Strategy of NAgDI																								
Duration			Year 1				Year 2				Year 3				Year 4				Year 5					
Implementation Strategy			Advocate, Engage, Mobilise				Collaborate, Analyse, Plan				Design, Develop, Launch				Validate, Implement, Operate				Consolidate, Market, Scale					
Result Areas	Broad Activities	Detailed Activities	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20		
Policies & Principles to foster an enabling environment in the creation and management of a reliable, secure, and accessible infrastructure																								
A comprehensive policy framework for the establishment of NAgDI through an inclusive consultation process	**Advocacy for endorsement of the infrastructure**	Identify a lead institution, preferably a government ministry to drive the process																						
		Conduct an analysis of issues to develop an issue paper and an advocacy strategy																						
		Conduct robust lobbying and negotiate delegation of mandates																						
		Seek endorsement through ratification of official documentation																						
	Stakeholder engagement on establishing the infrastructure	Conduct stakeholder analysis, identify relevant stakeholders, and jointly define their roles																						
		Define procedures for more holistic and stronger inter-agency partnerships																						
		Engage multiple stakeholders to validate the outcomes of NAgDI																						
		Establish working groups on specific policy mandates to establish the NAgDI																						
	Policy analysis and defining the outcomes of the infrastructure	Undertake baseline research to identify global and local policies, data contributors, intermediaries and users																						
		Conduct stakeholder dialogues to deliberate on policy options																						
		Agree on policy gaps for the establishment of NAgDI																						
		Carry out ex-ante impact assessment of alternate policy options to choose appropriate ones																						
	Defining and developing policies and principles for the infrastructure	Define a framework for the independent oversight mechanisms for NAgDI																						
		Define a framework for NAgDI business model to attract both public and private sector investments																						
		Define a framework for standards and interoperability of NAgDI technologies and systems																						
		Develop the NAgDI policies and principles to be ratified by the government																						
Governance & Administration to ensure an independent oversight and technical operations of the infrastructure for trust and reliability																								
An effective, equitable and impartial oversight of the technical and administrative operations of NAgDI	**Setting up multi-institutional mechanisms for coordination and implementation**	Identify and engage institutions with existing mandates relating to legislation, policy & systems																						
		Establish agreements on function, delegated mandates, legislative frameworks																						
		Build linkages among relevant institutions for the establishment of a NAgDI system																						
		Develop strategies to ensure technical and day-to-day operations of the infrastructure																						
	Facilitating and finalising agreement on the governance model for the infrastructure	Establish collaborative mechanisms and rules of engagement																						
		Establish codes of conduct for the governance model																						
		Establish and ensure representation of all stakeholders																						
		Designate leadership for the independent oversight mechanism																						
	Operationalising the technical oversight mechanisms of the infrastructure	Implement the strategy for technical operation of the infrastructure																						
		Ensure policies and principles of the infrastructure are followed																						
		Ensure the technical security of the infrastructure																						
		Ensure the business accessibility and sustainability of the infrastructure																						
	Operationalising the administrative oversight mechanisms of the infrastructure	Implement the strategy for day-to-day operations of the infrastructure																						
		Ensure agreed protocols, administrative guidelines, operational policies, etc. are adhered to																						
		Ensure continuous and effective capacity development across the stakeholder groups																						
		Ensure knowledge management, learning, monitoring and evaluation to inform progress																						

Five Year Implementation Strategy of NAgDI																								
Duration			Year 1				Year 2				Year 3				Year 4				Year 5					
Implementation Strategy			Advocate, Engage, Mobilise				Collaborate, Analyse, Plan				Design, Develop, Launch				Validate, Implement, Operate				Consolidate, Market, Scale					
Result Areas	Broad Activities	Detailed Activities	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20		
Technologies & Systems to create an inclusive, decentralised, secure and interoperable data exchange mechanism that fosters innovation and supports data-driven collaboration																								
A standardised and interoperable data exchange mechanism for secure and consent-driven data sharing	**Identifying standards and protocols and adapting digital public infrastructure**	Identify, adopt and adapt templates, guidelines for data standards for interoperability																						
		Identity data-sharing protocols aligned with FAIR principles for engagement around data																						
		Engage stakeholders with existing DPI resources to match functionalities with needs																						
		Adopt a mechanism to review and update the standards, protocols and DPI block functionalities																						
	Assembling a decentralised system to facilitate data exchange	Build on existing DPI to assemble a decentralised architecture for data-sharing pipelines																						
		Deploy privacy-compliant mechanisms for consent-driven data sharing																						
		Adopt or develop secure APIs and data-sharing endpoints to protect data integrity																						
		Adapt the infrastructure for local language, cultural relevance and offline functionality																						
	Operationalising the infrastructure with existing datasets	Launch implementation with data-sharing communities and existing open data collections																						
		Conduct resilience and scalability testing of the infrastructure to ensure reliability																						
		Pilot the system at community levels before scaling to regional and national levels																						
		Deploy APIs for developers to integrate new services and solutions while fostering open-source																						
	Facilitating an inclusive, scalable data exchange mechanism ecosystem	Ensure availability of tools for data holders to connect with the exchange mechanism																						
		Strengthen partnerships with tech innovators, governments, and NGOs to sustain data-driven decision-making																						
		Host hackathons and innovation challenges to promote innovation in data management																						
		Develop complementary offline functionality to support sectoral stakeholders' data engagement																						
Marketing & Business to support strategic resource mobilisation that aligns with the interests of stakeholders to secure investment for accessible and sustainable infrastructure																								
A self-sustaining business model that supports the long-term sustenance of the infrastructure	**Mapping of agricultural data stakeholders and assess product-market-fit**	Conduct research to understand stakeholder interests and needs, responsive to data																						
		Identify strategic networks in data management to leverage potential financing opportunities																						
		Map out stakeholders according to their interests and priority areas of focus																						
		Identify potential funding sources & present final financing plan to funders & key stakeholders																						
	Setting up the initial financing instruments	Develop a strategy for mobilising the initial financing and operational investments																						
		Review and validate the strategy for funding the infrastructure with policy makers																						
		Target and secure the identified funding and engage stakeholders early in the process of implementation																						
		Ensure funds are used to design, set up and transition the infrastructure to a sustainable business																						
	Developing business models for operational investments	Create business model canvas for NAgDI based on baseline study of needs & multi-stakeholder feedback																						
		Leverage international-level interoperability of data and collaboration in defining a business plan																						
		Establish data-sharing agreements with key stakeholders and commercialisation of value addition																						
		Implement business models around data analytics services, recognition for data contributors																						
	Continuous marketing of the infrastructure for its use	Develop a detailed marketing plan outlining strategies to attract investors																						
		Compile a marketing strategy playbook for NAgDI as a model of DPI																						
		Develop elevator pitch for each stakeholder group according to their data needs and interests																						
		Conduct targeted outreach campaigns to engage potential investors and stakeholders																						

the infrastructure. Activities shall include stakeholder analysis, identification of relevant stakeholders and jointly defining key roles. Additionally, baseline research must be carried out to identify global and local policies, data contributors, intermediaries and users, as well as to understand stakeholder interests and needs. The engagement and stakeholder dialogue processes shall aim at deliberating on policy options, validating the outcomes of the ongoing process, agreeing on policy gaps for the establishment of the infrastructure and carrying out ex ante impact assessment of alternate policy options to choose the appropriate ones. These processes shall lead to the definition of procedures for more holistic and stronger interagency partnerships, establishing working groups on policies and principles, governance and administration, technologies and systems, and marketing and business. These working groups shall be designed for flexibility of membership among existing partners and enable new members with specific expertise and interest to contribute to and even drive the process over the years. Activities shall also include the identification of existing DPI resources to match technical functionalities with identified needs and adopting a mechanism to review and update the standards, protocols and functionalities of DPI blocks. Year one will also start the process of building linkages among relevant institutions for the establishment of the infrastructure.

Activities in year one shall also be **mobilising** financial resources for the establishment of the infrastructure. A key part of this is the development of a strategy for mobilising the initial financing to include options such as mandatory levies from all key stakeholders within the agricultural sector in the country, seed funds and development finance. It should also identify strategic networks in data management to leverage potential financing opportunities, mapping out stakeholders according to their interests and priority areas of focus, identifying potential funding sources and presenting the financing plan to funders and key stakeholders.

3.1.2 Strategic Interventions Timeline in Year Two

Collaborate, Analyse, Plan

The goal of year two of NAgDI implementation is to ensure that stakeholders understand why and how to **collaborate** to design, develop and eventually use the infrastructure. The strategic messaging should be around creating a shared national resource through synergy and cooperation among key partners by carrying out deeper analysis of the infrastructure and its components and then beginning a planning process to inform the design and implementation in the following years. This may also dovetail with ongoing processes of developing a common national blueprint or data management architecture that includes the NAgDI and connects to available resources from foundational DPI and potentially other similar initiatives in other sectors. Year two activities could be fairly distributed across all the four investment areas to build on the foundational work carried out in the first year. As stated earlier, most of the activities from year one will continue into year two, with some running into the later years, based on the local context.

By the end of the first half of the second year, the endorsement by policy-makers and the ratification process by decision-makers should be completed, and most of the advocacy work supported by research and analysis should also be concluding. Analytic work to dissect the technical, governance and economics of the infrastructure should intensify, accompanied by stakeholder identification and mapping, the establishment of consortia and subgroups, the definition of roles and procedures and the validation of expected outcomes. Based on the **analysis**, strong linkages must be built among relevant institutions for the establishment of the infrastructure. Some of the technical activities initiated during year one, such as the identification of templates, guidelines for data standards for interoperability, data-sharing protocols, existing DPI resources and the review of standards, protocols and DPI block functionalities shall be continued. The identification of strategic networks and potential funding sources to leverage potential financing opportunities, and mapping of key data holders and potential datasets, should inform the development of the strategy for mobilising the initial financing and operational investments. Information on the nature and types of the key stakeholders and their datasets is also critical for the technical work.

The planning process should revolve around the definition of frameworks for the independent oversight mechanisms of the infrastructure, the standards and interoperability of the technologies and systems, and the business model to attract both public and private sector investments. These frameworks should inform the development of the NAgDI policies and principles to be ratified

by the government, including the strategies to ensure technical and day-to-day operations of the infrastructure. Extensive **planning** activities relating to the technical infrastructure should be carried out at this stage, including the options of building on the existing DPGs to assemble a decentralised architecture for data-sharing pipelines or any other existing systems in the country. Other planning activities should aim at deploying privacy-compliant mechanisms for consent-driven data sharing, adopting or developing secure APIs and data-sharing endpoints to protect data integrity, and adapting the technical infrastructure for local language, cultural relevance and offline functionality. A review and validation of the strategy for funding the infrastructure with policy-makers, as well as targeting and securing the identified funding early in the process, should be achieved by the end of the second year.

By the end of the second year, enough awareness and visibility around the infrastructure would have been created across the country, with the roles of the various stakeholder groups in the process clarified and agreement on a clearer approach to explaining the macro-level benefits of the infrastructure to citizens and businesses.

3.1.3 Strategic Interventions Timeline in Year Three

Design, Develop, Launch

The goal of the third year is to collaboratively develop and launch a working version of the national infrastructure in a way that is unique to the country, with the potential to communicate with other national infrastructures. Most of the collaborative, analytic and planning activities from year two will continue, while most of the year one activities would have been completed during the first half of the third year. Significant work must be carried out by the working groups under the governance and administration, technologies and systems, and marketing and business components of the infrastructure to achieve the goal.

The **design** process that involves definitions of frameworks for the independent oversight mechanisms, standards and interoperability, and business model should continue. These should lead to the development and adoption of NAgDI policies and principles to be ratified by the government. A decision on the model and structure of the independent governance mechanism should be reached and steps taken to authorise it. Key decisions on the technical infrastructure, such as whether to build on the existing DPGs for the decentralised architecture or develop any new systems, should be finalised. The review and validation of the funding strategy for the infrastructure should be completed, with clear targets for securing the initial financing for the infrastructure. Closer collaboration between the three investment areas should occur at this stage to ensure synergy between the technical, governance and economic aspects of the infrastructure.

The **development** process should begin by establishing partnerships with technology innovators, governments, service providers and NGOs to sustain innovation, establishing collaborative mechanisms and rules of engagement, establishing codes of conduct for the governance model, and establishing and ensuring the representation of all stakeholders. The leadership for the independent oversight mechanism should also be designated, by this time, to start the preparation for the oversight activities. The transition of the management of the infrastructure from the lead government ministry to the independent oversight mechanism should begin by this time to ensure that it becomes fully operational in the fourth year. The designated leadership should begin the operationalisation of the code of conduct relating to its own operation: the technical and economic components of the infrastructure.

The development of business model canvas for the infrastructure should be elaborated based on the baseline study of needs and multi-stakeholder consultation process undertaken to develop the strategy. Countries should also leverage international-level interoperability of data and collaboration as assets in defining their business plans. A proportion of the initial financing should be secured by year three from the identified funding sources in the resource mobilisation strategy. The efficient use of funds for the design, set-up and transition to a sustainable business should be ensured.

The data exchange mechanism should be **launched** by the second half of the year, with the roll-out of the data-sharing process using existing open datasets. The system should be piloted at community levels before scaling to higher levels. Resilience and scalability testing of the technical infrastructure

should be carried out to ensure reliability. By the end of this year, all the elements for constituting a functional data exchange mechanism of the NAgDI should be in place, ready for complete piloting. The established data-sharing agreements with key stakeholders and commercialisation of value addition should be piloted. The business models around data analytics services, recognition for data contributors, etc. should also be piloted to test their viability.

3.1.4 Strategic Interventions Timeline in Year Four

Validate, Implement, Operate

The goal of the fourth year is to operationalise the entire infrastructure through test proofing the technical and operational functionalities, in readiness for market in the final year of implementation. This should be done by validating the entire pilot process, implementing all possible components and ensuring the full operation of the infrastructure.

The infrastructure development and piloting activities from year three should continue into the fourth year. This will be achieved through the implementation of the frameworks that have been established, the deployment of the policies and principles by the independent oversight mechanism and the smooth operation of the codes of conduct. The implementation of the strategy for day-to-day and technical operations of the infrastructure should continue to ensure its technical security. The deployment of secure APIs and data-sharing endpoints to protect data integrity and the adaptation of the infrastructure for local language, cultural relevance and offline functionality should also continue. The **validation** process should continue with the resilience and scalability testing of the infrastructure to ensure reliability. Additionally, the business accessibility and sustainability of the infrastructure should also be tested using the business model and data analytics carried out on the registered and available datasets using the agreements with key stakeholders.

During the second half of the fourth year, the focus should be on **implementing** the full roll-out of the strategy for day-to-day and technical operations of the whole infrastructure. Steps must be taken to ensure that agreed protocols, administrative guidelines, operational policies, etc. are adhered to. Training materials should be available and capacity building across the stakeholder groups implemented. During years one to three, the advocacy and engagement activities should have interlaced with and transitioned towards capacity building, such that knowledge management, learning, monitoring and evaluation can further inform improvements in the implementation of NAgDI. Technical solutions, standardised templates and tools for data holders to connect with the exchange mechanism must be developed and made available. Similarly, APIs must be deployed for innovators and service providers to integrate new services and solutions while fostering open-source data management approaches. The use cases of the infrastructure should be differentiated from the use cases of the digital agriculture service providers by emphasising the macro-level decision products.

By the end of the fourth year, all the components of the infrastructure should be **operational** and functioning, so they can be consolidated in the final year. The infrastructure should be ready for adoption by potential users, such that data holders as well as innovators and service providers can connect and start engaging with the infrastructure. Significant efforts regarding the marketing and business model component of the infrastructure should be made at this stage to create and demonstrate value for the infrastructure. The business model canvas should be fleshed out to showcase the value proposition of the infrastructure, key activities, key resources, key partnerships, customer segments, channels for distribution of products, customer relationships, revenue streams and cost structure. An elevator pitch should be developed for each stakeholder group according to their data needs and interests, and targeted outreach campaigns are to be organised to engage potential investors and stakeholders. A detailed marketing plan outlining strategies to attract investors, and a marketing strategy playbook for the infrastructure acting as a model of DPI for agriculture, should be prepared.

3.1.5 Strategic Interventions Timeline in Year Five

Consolidate, Market, Scale

The goal of the fifth year of implementation is to take the infrastructure to market and create opportunities for business engagement that

transitions it from an initiative to a sustainable business. This should be done by bringing together all the components, including the policies and principles, the governance and administration, and the technologies and systems.

The fifth year should continue with the validation, implementation and operationalisation activities from the previous year, as well as reviewing and updating the tools and templates that have been developed. The focus should be on the **consolidation** of the different aspects developed through the investment areas so far, and on creating a shared infrastructure that is inclusive and accessible to all potential partners – a safe and trusted foundation upon which multiple innovations and services can be built. The infrastructure, ready for adoption by potential users by the end of year four, should be monitoring and documenting how data holders as well as innovators and service providers are connecting to and engaging with the infrastructure.

This is also the time to be fully implementing the **marketing** plan and the strategies to attract investors. The deployment of the playbook for the infrastructure and its effectiveness in improving understanding among potential users and data contributors of the NAgDI as a model of DPI for agriculture needs to be documented as stories of change. Targeted outreach campaigns should be rolled out within and outside the country to engage data contributors, data users and potential investors. During these campaigns, the delivery of elevator pitches for each stakeholder group according to their data needs and interests should be captured and used during social media campaigns to enhance the message about the uses of the infrastructure, while the capitalisation of experiences of the users serve as testimonials for the value addition of NAgDI, at the user, organisational and national levels. The use cases of the infrastructure with emphasis on the macro-level decision products, which are different from the use cases of the digital agriculture service providers, should be highlighted as examples of the multifaceted benefits of NAgDI.

Further engagement with potential users of the infrastructure can be addressed through more hands-on engagement approaches, such as through the organisation of hackathons and innovation challenges to promote innovation in data management, especially among youth and women. Additionally, for a more inclusive dissemination of the use of NAgDI, the development of complementary offline functionalities to support stakeholders' data engagement would enable a larger target audience for NAgDI. Through the process of consolidation and intensive marketing, it is anticipated that the user base of NAgDI can be enlarged. This becomes the precursor of a **scaling** approach to NAgDI, as the stories of change, empowerment and collaboration along the data management processes, facilitated by NAgDI, become better known by the agricultural community. This process is dependent on certain external factors, such as access to online services, level of digital literacy of the target population and availability of resources to expand NAgDI. However, the potential benefits of several countries which have established their NAgDI being able to exchange agricultural data on climate resilience within a regional ecosystem, exchange data on agricultural products and trade within the context of regional cross-border trade, and share of knowledge from a regional perspective, are all demonstrative of the potential of NAgDI at scale.

4. Approaches to the Operationalisation of NAgDI

4.1 Collaboration as the Foundation for the Implementation of NAgDI

Section 2 described the concept of NAgDI and its vision within the context of a country, as well as the collective contribution of NAgDI in multiple countries towards regional cooperation, exchange and trade. The components of NAgDI and their associated broad activities were also presented within each component. However, as described in Section 3, these activities are interconnected across the four components. Investments in the establishment of NAgDI will depend on the already existing assets in the country, the ambition that the stakeholders target for their NAgDI, the existing policies and the enabling environment for interinstitutional collaboration: administratively, technically and financially. The guide to investing thus steers the process of developing an implementation plan for NAgDI within a country and will require investments in preparation of and synchronisation with the activities over the chosen timeline for implementation.

From its conceptualisation to the national dialogues on the establishment of a NAgDI, collaboration has been the basis and common element of all the approaches to implementation of such an infrastructure. The national dialogues brought together potential partners working on different aspects of agricultural data management and use, with the outcome that they identified and recommended different collaborative approaches to the establishment of a NAgDI in their context. As the champions of NAgDI from each of the dialogues consolidated their insights and recommendations from the national dialogues for the design and implementation approaches to NAgDI, the collaborative and consultative approach prevailed in the proposed approach to the establishment and implementation of NAgDI.

As a facilitator of the concept and process of designing the implementation approach to NAgDI, the Commonwealth does not intend to move forwards alone but rather identify as many complementary ongoing initiatives that can be partnered with to constitute the basis of NAgDI. These initiatives, experienced institutions and data management assets and resources have been identified during the Commonwealth's interactions with various stakeholder groups, and some examples of these are listed below.

4.2 Examples of National Use Cases of NAgDI

The ambition and scope of NAgDI in a country is not determined by the aggregation of the expressed needs of the users but rather by the collective ambition of the stakeholders for the country. Therefore, the scope of NAgDI can most often be pegged to a national policy ambition, which enables the initial buy-in of the policy-makers who can mobilise funds for the establishment of NAgDI and champion the initiation of the development process. Thereafter, once the consultative, inclusive and collaborative processes have begun, the needs of groups of stakeholders can be brought on board. Below are a few examples of potential use cases and applications of NAgDI that have been identified during consultations with the Commonwealth countries based on typical specific requests:

1. **Better policy decisions on import and export.** National governments make policy decisions based on data that impact businesses and individuals. Failure to make such decisions on accurate data could result in grave consequences. For example, importing food products based on inaccurate data sources could impact agribusinesses in the country. NAgDI will coordinate the multiple data sources from the private and public sector to inform better policy decision-making.
2. **Independent data verification for investors.** Micro, small and medium-sized enterprises and entrepreneurs are central

to innovation and the productivity of many economies globally. Before committing funds, investors scrutinise the veracity of a startup's data. This data verification process also acts as a cornerstone for establishing a foundation of trust and credibility for startups. The independent governance mechanism of NAgDI with authoritative registries, and the ability to independently verify and certify data from investees for investors, provides the basis for this trust between investors and investees.

3. **Unified data estimates for countries.** Different development organisations often launch reports separately on the performance of countries based on certain indicators. These reports use different methods and produce contradicting figures with no verification and certification from the countries in which the research was carried out. Such reports with contradicting figures do not reflect the true image of the countries and may drive away development finance as well as private sector investments. A functional NAgDI allows for the verification of such external reports, harmonisation of the outputs and certification by countries. The NAgDI will also empower countries to generate revenue as development partners will be willing to pay to access such reliable datasets.

4. **Facing well-Intended but disruptive external regulations for countries.** The European Union Deforestation Regulation (EUDR) is an example. The EUDR is a landmark law targeting deforestation and forest degradation. But the introduction of the law also underscores the critical importance of robust data management frameworks needed by countries to meet the demands of modern regulatory landscapes. Countries and businesses are now reacting to this external regulation with consequences if failed to comply accordingly with regulations. NAgDI is a proactive effort and is expected to respond to such future regulations that intentionally or unintentionally take advantage of vulnerable countries (Addom, 2024).

5. **Preparing the country for AI and emerging technologies.** AI software and services alone could generate a total economic potential of US$15.5 to $22.9 trillion annually by 2040 (McKinsey, 2024). These AI services perform better on organised data. NAgDI will enable better data coordination, thereby creating the foundation for AI models to run by enabling access to representative data from countries in the global datasets.

These are just a few use cases that NAgDI could support. The goal is not to compete with the existing data systems that provide different levels of service to their customers, but rather to strengthen these individual data systems to provide better services, enable macro-level decisions and empower countries to better harness their data resources in the interest of citizens and businesses.

In this process, some examples of existing investments in governance mechanisms, processes, systems and technologies that have been identified during consultations with Commonwealth countries and potential collaborators on NAgDI have been identified. These are listed in categories below.

4.3 A Useful Analogy for the Operationalisation of NAgDI in Support of Service Providers

During the Writeshop with champions of NAgDI from the national dialogues, the anecdotal analogy of NAgDI with a catering business was brought up to illustrate how NAgDI supports and encourages collaboration among the community service providers as users of NAgDI. Just as everyone must eat, and what we eat is based on the ingredients available and our culinary skills, or how we decide to procure our food and from which provider, similarly, data is required and consumed by everyone, but the quality of our decision-making depends on the data we make available to ourselves through a market–consumer platform. Box 1 provides the insights of the analogy of NAgDI and the way restaurants provide quality service and food to the consumers.

Box 1 Applying the analogy of culinary skills and the restaurant business to data infrastructure supporting community service providers

Everyone needs to feed themselves with nutritious food. The food we eat depends on the availability of the ingredients, our cooking skills, or our ability to select and order food from our preferred restaurant among the many that exist in the neighbourhood. Similarly, NAgDI should emulate the provision of food to us by formalising its mechanism to provide a quality service when required, just as restaurants operate.

While we could gather the ingredients and try to prepare our meals following a recipe, it can often be more efficient and effective to trust the specialists in the specific cuisine to offer us a reliable and consistent dish. Restaurants have recipes for meals that are also in public domain. In making their choices, customers compare the ingredients, how they are combined and prepared, the cost, etc. and make requests for meals of their choice. The restaurant then combines the ingredients that are sourced from different producers, follows the recipe and prepares the meal for the customer for the agreed cost. Over time, the restaurant gains expertise and is known among the customers as a reliable provider of the service.

Similarly, NAgDI will act as a national space for data exchange and will have access to multiple sources of datasets (ingredients) – that is content and user data – through its registered data holders in the countries. NAgDI can prepare sample recipes (macro-level data products) by combining multiple ingredients (existing datasets) from data holders and make them available for its potential customers. Furthermore, processes also take place within the NAgDI; for example, upon request for macro-level data at country level by an investor or financier, such as the market size of a commodity, NAgDI, through the independent governance entity, sends the request to all registered data holders in the space that have data on the commodity. Revenue agreements are reached with the registered data holders depending on the frequency of data pulled from their data systems to prepare the information or knowledge requested by the investor.

Once the request is granted, the infrastructure verifies the quality of the datasets, pulls data from the multiple sources (ingredients), then prepares the information (the market size of the commodity) for the investor. The necessary policies and regulations are followed to ensure the data is used for the purpose for which it was requested, and the investor pays for and gains access to the product. To reduce future duplication, the 'meal' prepared for the investor (the market size of the commodity), using the ingredients sourced from multiple data holders, becomes an asset within the NAgDI ecosystem and could be stored in a separate space by the service provider to ensure reuse in case of future requests.

4.4 Examples of Digital Public Goods and Assets Investments

- **The Digital Public Goods Alliance.**[18] A multi-stakeholder initiative which aims to accelerate the attainment of the SDGs in low- and middle-income countries by facilitating the discovery, development, use of and investment in digital public goods.
- **Centre for Digital Public Infrastructure (CDPI).**[19] A global team of DPI builders helping countries to co-design localised solutions that scale by providing a pro bono, software-neutral, technical architecture advisory service. The CDPI's mission is to catalyse countries' digitisation journeys with high-impact DPI to drive inclusive, innovative and competitive national growth.
- **Co-Develop.** A global, nonprofit fund accelerating the adoption of safe and inclusive shared DPI at scale. Co-Develop has compiled a book of case studies of DPI implementation.[20]

18 https://www.digitalpublicgoods.net/
19 https://cdpi.dev/
20 https://www.codevelop.fund/about-dpi-exemplar-stories

- **GovStack.**[21] The GovStack initiative aims to build a common understanding and technical practice on fundamental reusable and interoperable digital components, referred to as 'Building Blocks'. The initiative aims to enable countries to kick-start their digital transformation journey by adopting, deploying and scaling digital government services. Governments can easily create or modify their digital platforms, services and applications by simplifying cost, time and resource requirements.
- **X-Road.**[22] Open-source software that provides a unified and secure data exchange between organisations in a collaborative ecosystem. X-Road is a centrally managed, distributed data exchange layer between information systems. It streamlines data exchange processes, enhances security and facilitates interoperability, enabling organisations to derive greater value from their data assets.
- **50-in-5.**[23] A multi-partner-supported, country-led advocacy campaign. 50-in-5 was launched in November 2023, with the goal that by 2028 the campaign will have helped 50 countries design, launch and scale at least one component of their DPI stack in a safe, inclusive and interoperable manner.
- **UN Universal DPI Safeguards Framework.**[24] The UN has coordinated a multi-stakeholder initiative towards ensuring a safe and inclusive digital society. It aims to minimise risks across all layers of digital transformation – technical, normative and organisational – while ensuring maximum adherence to standards and regulations.
- **Agricultural Data Exchange (ADeX).**[25] A collaborative venture of the Government of Telangana, the Indian Institute of Science, Bengaluru and the World Economic Forum's Centre for Fourth Industrial Revolution, India to create India's first data exchange platform for farmer services based on the India Urban Data Exchange. ADeX will open data to allow farmers to benefit from a variety of new data-driven services. ADeX brings the providers and users of all pertinent agricultural data together, as well as providing access to other information such as weather and satellite images.
- **AgriStack.** The Indian Government initiative aimed at digitally transforming Indian agriculture by creating a unified digital ecosystem for farmers. It integrates farmer data, land records and scheme benefits into a centralised digital platform. The Farmer Registry is a key component of AgriStack, which records farmers' identities, land ownership and scheme participation to enable seamless access to government services, subsidies and financial aid.
- **FarmStack.**[26] An open-source protocol developed by Digital Green which powers the secure transfer of data. It is a form of digital infrastructure for secured data sharing for food and agriculture. FarmStack helps users share data directly with each other and enforce a usage policy that restricts unintended misuse of data.
- **Malawi Data Protection Act.**[27] Malawi's Data Protection Act officially came into force on 3 June 2024, after being gazetted in February 2024. The Act aims to provide a comprehensive regulatory framework for protecting personal data in the country. It designates the Malawi Communications Regulatory Authority as the data protection authority to oversee the law's implementation.
- **Kenya Digital Agriculture Platform.**[28] The Kenya Agricultural and Livestock Research Organisation operates a digital platform with different embedded dashboards,[29] as well as a Data-Sharing Platform based on Farmstack.
- **Bangladesh Food Systems Dashboard.**[30] Based on the Global Food Systems Dashboard developed by Global Alliance for Improved Nutrition (GAIN), Bangladesh has digitised and maintains information on key

21 https://govstack.gitbook.io/
22 https://x-road.global
23 https://50in5.net
24 https://www.dpi-safeguards.org
25 https://adex.org.in
26 https://digitalgreen.org/catalyzing-the-data-sharing-ecosystem-introducing-farmstack/
27 https://macra.mw/download/25/rulesregulations/252806/data-protection-act-2024.pdf https://macra.mw/download/22/adverts/252805/personal-data-protection-booklet.pdf
28 http://kadp.kalro.org/
29 https://keep.kalro.org
30 https://www.foodsystemsdashboard.org/countries/bgd

food system indicators, related to food and nutrition security, at the national and local levels in the country on the Bangladesh Food System Dashboard.

- **Malawi National Agricultural Management Information System (NAMIS).**[31] NAMIS is under development by the Ministry of Agriculture, Malawi, and the conceptual framework and design document are available online.
- **Cloud Carib.**[32] Headquartered in the jurisdiction of The Bahamas, Cloud Carib is a provider of cloud services in the Caribbean and Latin American regions focused on delivering secure and hybrid infrastructure solutions and managed services to the region through locally operated data centres and strategic alliances with leading technology partners. Its services and solutions are built with privacy, data sovereignty and performance in mind, ensuring that business-critical applications are always secure and available.
- **Mergdata.**[33] Farmerline's cloud-based mobile and web software that enables organisations to digitally collect and link data from farmers, farms and farming communities. The software has been built with features that ensure quality data collection along the value chain transactions across developing regions. The insights gathered enable organisations to formulate solutions that will ensure sustainable crop production and measure impacts while securing customer loyalty.

31 https://developmentgateway.org/wp-content/uploads/2020/10/Conceptual-Framework-for-the-Design-of-the-NAMIS_19.pdf
32 https://www.cloudcarib.com/
33 https://mergdata.com

5. Conclusions and Recommendations

5.1 Conclusions

Increasingly, data is becoming a key driver of economic growth for countries and the global community. Data is also the fuel for the digitalisation of sectors such as agriculture, health and education. In the current digital age, a country's data and its sovereignty should be treated as critical resources that require special attention.

For decades, data in many countries has been managed in ways that multiple individuals and businesses, acting in their own business interests, have been investing in and exploiting this resource. The current approach to its management in countries can lead to its overuse and eventual destruction, even though it would be in everyone's best interest to protect it. While data is considered a non-depletable resource, the concept of the tragedy of the commons, which highlights the conflict between individual rationality and collective well-being when dealing with shared resources, could be applied to data. Unfortunately, data has not been treated as a common and shared resource in many countries.

Taking a shared approach to the management of a country's data has been the central theme of this document. This will not only make business sense to the private sector players but it also has policy implications for the public sector. The national infrastructure model described in this document is guided by some of the following principles:

- *Incremental, one step at a time.* The national infrastructure model should be understood as a process rather than a product. It is a step-by-step process which also depends on the existing resources that countries already have in place. It could take a horizontal approach, as described using the four components, or a vertical approach, in which the infrastructure is built for one commodity and scaled out to others.
- *Horizontal or vertical approach.* It can take a horizontal approach, in which countries build the infrastructure for generic agricultural data, that is both content data and user data from few partners with complementary datasets and then scale it up or expand it as more users join the infrastructure. It can also take a vertical approach, in which countries might decide to start with specific commodities, such as the case of kava, cocoa, coffee, rice, etc., and then scale it by adding other commodities. With the vertical approach, partners with resources around specific commodities can work together to build the infrastructure.
- *Long-term, country-level capacity building.* A national data infrastructure for countries means empowerment for countries by harnessing the full benefits of their national resource: agricultural data. The NAgDI approach enables national governments to create the enabling environment for private sector investment to strengthen national data systems at country level.
- *Public but not necessarily completely free.* The national infrastructure should be designed as a public infrastructure with equal access, but it may not be completely free to use. Data is sensitive, and while certain components of the infrastructure could be open, in other cases access must be controlled and monetised.
- *Interoperable infrastructure.* While the short- to medium-term goal of the infrastructure is to empower countries, the long-term vision is for these national infrastructures to facilitate data exchange regionally and globally. Hence, interoperability between the national infrastructures is key.

This policy guide to investing in the infrastructure is a high-level guide for countries and is expected to enable countries to understand the resources needed prior to initiating NAgDI; to help them to assess potential use cases, customer segments and expectations from stakeholders; to guide them to align goals for NAgDI along national interest lines while setting realistic objectives within the bounds of stakeholder expectations; to enable planning for NAgDI cross-component functioning and visualisation of dependencies; and

to enable countries to map out estimated timelines on proposed activities, outputs, outcomes and budgeting.

5.1.1 Continuing the Journey of NAgDI with Commonwealth Stakeholders

Beyond the publication of this document, the Commonwealth Secretariat will continue with the following:

1. **Community of practice.** Engage with the community of practice[34] that has been established during the national dialogues, as well as including potential partners in the discussions. Thus, the guide to investing will be discussed further among the stakeholders such that details of their proposed approach or actual approaches to implementation are documented and shared, contributing to the knowledge base around NAgDI.
2. **Advocacy and awareness.** In collaboration with partners, a series of webinars will be organised to discuss this document and the more detailed implementation approaches that were drafted during the Writeshop with NAgDI champions. With the momentum developed, it is hoped that a collection of Commonwealth countries will be successful in mobilising resources to get the process of implementation of NAgDI started. Meanwhile, the gathered proposed approaches will constitute the beginning of the NAgDI playbook that countries have also requested. Collectively, the stakeholder groups will consider engaging with partners working on the development of DPI building blocks to further elaborate a set of recommended foundational DPIs that can support DPI approaches to the agricultural sectoral such as NAgDI and connect them to providers of data-driven services to the community.
3. **Capacity building.** Engage countries beyond advocacy and awareness and provide capacity-building and technical assistance to countries interested in developing their own implementation strategies for NAgDI to inform the development of the infrastructure.
4. **An industry report on the cost of inaction.** Collaborate with interested technical and funding partners to produce an industry report to highlight what countries are losing annually by not investing in such a foundational infrastructure for their data.
5. **Proof of concept.** Begin low-cost proof of concept cases in at least three countries, with three partners in each country that have complementary datasets and are willing to follow the NAgDI principles to support data exchange between them.

5.2 Recommendations

5.2.1 Guiding Recommendations for Investment in Policies and Principles

The work under this investment area is *not* about developing new data policies and principles, especially if the country has existing policies. It is about building on the investments that have already been done globally, regional and national on data governance, data protection, etc. Countries should begin by taking stock of the existing generic data principles globally and then specific policies relating to the agricultural sector. The work should involve consultative agreement on policies and principles that will guide the data infrastructure. This should involve collating, reviewing and analysing the existing data policies to identify and determine potential policy gaps. The updating process should ensure that the policies are agile and evolve with technological advancements to maintain the sanctity of data. They should ensure that the policies and principles align with national laws and international best practices and foster a legal environment to support responsible data management.

The policies and principles are expected to guide users on how the backbone technologies are used and the operations around the business model, as well as the enforcement of the rules by the independent oversight mechanism for the technical and operational running of the infrastructure. This investment area could more appropriately be initiated by a government agency in collaboration with other stakeholder groups.

A lived example from Malawi is that at the time of the multi-stakeholder national dialogue in 2023, stakeholders mentioned a national bill on data protection that had been revised and was being considered in the parliament of Malawi. The intentions were that following the enactment of the law (as of June 2024), there would be a

34 https://dgroups.io/g/NAgDI

development of the corresponding regulations in each sector. This opportunity could provide the foundation to guide the agricultural sector to collate and develop the policies and strategies for the design, development and use of the infrastructure.

5.2.2 Guiding Recommendations for Investment in Governance and Administration

The work under this investment area would logically come after the policies and principles are developed. Nevertheless, the work under this component should already be started while the policies are being developed or adapted. The need for an agreeable home and a custodian to enforce and keep the policies updated should have been discussed.

The key action in this investment area is to establish an oversight model that is independent of the data contributors and ensures neutrality and confidence in the infrastructure for users. Operationally, this could be led by a government agency in collaboration with other stakeholder groups, with the provision that the neutral entity is established in the process. The eventual oversight mechanism should have the mandate from the national government to perform the task with a possibility of different entities overseeing the different units of the infrastructure, just as we may find with road infrastructure. Ideally, this oversight model should take a multi-stakeholder approach, with representation from key stakeholders/shareholders whereby capacity should be built for existing agencies or institutions to carry out these roles.

A lived example of an administration to be explored is the model of Credit Bureaus in certain countries. For example, in the United Kingdom, credit reference agencies are bound by the Data Protection Act 2018, which requires that data relating to identifiable individuals must be accurate, relevant, held for a proper purpose and not out of date, and gives individuals the legal right to access data held on them.

5.2.3 Guiding Recommendations for Investment in Technologies and Systems

The work to be carried out under this investment area is to frame the technical backbone for the entire infrastructure. It is *not* about building yet another digital platform for digital service provision or for data collection from farmers and other end users, but rather the focus is on providing the infrastructure that will support such platforms.

It should be noted that this investment is just a technical component of the entire infrastructure and should be considered as NAgDI. The investment should be aimed at building on other investments that have already been made globally, regionally and nationally on data management technologies and systems. It should aim at supporting the use of standardised data collection approaches by multiple users, harmonisation from different data sources and exchanging of data with others.

This component must pay particular attention to regional perspectives, whereby key issues will have to be considered, such as the issue of interoperability of the national technologies or data systems and consideration of the hosting infrastructure locally or in the region, as well as the viability of technological or data systems for interoperability across existing data systems within the countries. Leveraging any existing technologies in a country, the use of open-source systems and DPGs can avoid vendors becoming locked in and allow countries to have control over their infrastructure. In principle, this investment area can be led and coordinated by a private sector entity in collaboration with other stakeholder groups.

5.2.4 Guiding Recommendations for Investment in Marketing and Business

The work carried out under this investment area sets the scene for the national ownership of the infrastructure, starting with buy-in from policy-makers to commitment from the different categories of stakeholders. The resources for such design and development should be mobilised by involving key national stakeholders, such that they identify with the infrastructure. The work supported by this investment will consist of developing a clear value proposition of the infrastructure to society – the economics, policy and environmental benefits should be mapped out.

There should be a need for initial seed funds through a blended financing instrument to help derisk the infrastructure to attract private capital. A key recommendation on this is for governments to consider instituting a levy to be paid by all development organisations from their annual agricultural budget in the country for a specific duration. There should be an open and free access component in addition to the monetised component. Incentives for participation and revenue streams to maintain the infrastructure are critical. This investment area could be led by a private sector entity in collaboration with other stakeholder groups.

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