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Digital Public Goods: Guidance for Development, Governance, and Stewardship

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EXECUTIVE SUMMARY

The flourishing of a nation's residents depends in part on their ability to participate in social, economic, and political activities. That ability in turn increasingly depends on access to reliable technological systems, including digital systems that enable users to transfer money or verify their identity. While such systems have been designed and deployed in developed economies for some time, governments in emerging economies now also wish to implement them to connect residents to each other and to the wider global economy.

While developed economies have tended to build digital infrastructure by contracting with private companies, governments of emerging economies fear such an approach risks compromising data sovereignty, lead to technological dependency, and miss an opportunity to up-skill their own residents. As an alternative, governments might instead make use of digital public goods (DPGs). DPGs are openly available digital tools that are non-rival and non-excludable public goods. DPGs can be either foundational, i.e. systems which are the backbone of service delivery across many sectors, or functional, i.e. systems which perform a particular service in a few limited sectors. This report describes the ethical considerations involved in designing and deploying foundational DPGs in emerging economies.

In an increasingly complex world – in the scale and range of policy problems and the breadth of knowledge required to address them – ethical reasoning is both increasingly important and increasingly complicated. Reasoning of this kind includes learning about the various aspects of a decision-making context, assessing options and their likely effects, surfacing the diverse range of values at stake, and charting a course in light of a clear understanding of both. In complex contexts, that process rarely comes to a final stopping point. Even after setting out on a course, behaving ethically requires us to continually attend to the changing terrain and re-evaluate our decisions and the values they implicate.

Accordingly, in this report we describe a framework to guide organizations as they consider their responsibilities in designing and deploying foundational DPGs. The organizations range from technology designers who build DPGs, international development agencies and national governments who support their implementation, and funders who resource the whole process. The responsibilities we explore include how to structure decisions about when and how to support the development and use of DPGs, how to take steps to ensure ethical responsibilities are met, and how to monitor whether risks have been successfully mitigated over time. In offering this guidance, we do not mean to directly endorse the use of population-scale technologies to solve social problems. But such uses are already underway, and in the future seem almost inevitable. If governments and associated actors are committed to using technology to solve social problems, we are committed to helping see to it that it is done responsibly.

Our goal is not to provide a definitive or settled list of ethical considerations when designing and deploying foundational DPGs. Rather, we intend to describe how organizations themselves should evaluate those ethical considerations over time by developing inclusive structures of decision-making, making sure they build DPGs to be revisable to adapt to changing demands and technological possibilities, and how they should monitor the impact of their decision-making and technology over time, and hold themselves accountable to those whose lives they seek to improve. This is fundamental to our understanding of ethics. This report is not merely a checklist of ethical considerations or a list of risks and opportunities. It is a roadmap for organizational structures that we hope will be made more precise through future collaboration among relevant stakeholders.

The report proceeds in five stages. The first two lay the foundations of the report's argument about the need for deliberative structures of governance and revisable technology design. The final three explore the ethical responsibilities in designing foundational DPGs, establishing ongoing decision-making processes for monitoring and evaluation, and for funders who support the design and deployment of DPGs.

We argue that foundational DPGs should be thought of as a kind of digital public infrastructure. Like a national air traffic control or highway system, digital public infrastructure can be used by many people without decreasing its value for others, supports a wide range of downstream activities and actors, and is a bottleneck that shapes users' social, economic, and political lives. As a result, those who design and control that infrastructure wield a form of power over those who rely on it, a power that must not only be wielded beneficently, but also be intentionally structured to include the voices and interests of those whose lives it shapes. Whoever designs and controls digital public infrastructure must be held accountable to those who use and depend on it.

Thinking of foundational DPGs as digital public infrastructure illuminates how to approach the ethical considerations bearing on designing and deploying foundational DPGs. We argue those ethical considerations depend on two crucial factors: deep uncertainties that limit the possibility of identifying in advance the possible benefits and risks of design decisions, and an inherent and desirable dynamism in how and by whom digital public infrastructure will be used. We believe the risk-benefit framework – in which organizations seek to maximize benefits and minimize risks – is an unhelpful way to approach the ethical considerations involved in designing and deploying DPGs. It risks supporting a framework that offers a false sense of certainty about the future that may fail in practice to advance the salient values it identifies. Any approach to the ethics of DPGs must be robust to the inherent uncertainty involved in designing and deploying digital infrastructure.

We articulate a framework that builds in active and ongoing consideration of underlying values and interests in the design and deployment of DPGs. We focus on three key decisions: how the technologies are designed, how their implementation is governed within particular states and organizations, and how funders should use their leverage to influence the full range of DPG lifecycles. Many of the recommendations we offer focus on governance. Because they apply broadly to the design of digital infrastructure, governance recommendations are both actionable in the near term and likely to have lasting effects for responsible decision-making. We believe further engagement with representatives from government, national civil society groups, and international development agencies is necessary to make meaningful progress on how to develop and enact these governance recommendations.

In technology design, we argue that a key guiding principle is revisability. Digital public infrastructure should be designed to be adaptable to emerging needs and concerns and technological developments. Digital public infrastructure should be built to ensure that governments are not dependent on external actors for necessary changes, and where such dependence is inevitable, those who design that infrastructure should approach it as part of the obligations of engagement to continuously update and develop it. Technology design processes should be integrated with other mechanisms of external governance to ensure feedback from users and other stakeholders informs the revision of technology. Where possible, defined points at which feedback will be sought from users and other stakeholders in a deliberative way should be established and clear commitments should be made from relevant actors to participate in that process.

We further consider both external governance, in which those designing and deploying digital public infrastructure engage with other civil society, political, economic, and legal actors, and internal governance, which concerns the internal structure of organizations that build and fund digital public infrastructure. With respect to external governance, we argue for an explicit commitment to structured processes of deliberation that include not only residents themselves, but also advocates for their interests like digital rights charities, groups who represent marginalised or excluded residents, or international human rights charities. Because digital public infrastructure is both experimental and fundamental to the lives of residents, deliberative governance should be integrated as deeply as is possible at all stages of the design, deployment, and stewardship of DPGs. Deliberation should be a permanent, rather than temporary, feature of the design and deployment of all digital public infrastructure.

With respect to funders, we argue that for powerful philanthropic actors to respect their responsibilities to the residents of countries in which they help build and support digital public infrastructure, they should build in structures to hold themselves accountable to those whose lives they seek to improve. Stakeholders involved in the financial support, design, and deployment of foundational DPGs should therefore assemble teams that are prepared to address the interdisciplinary, sociotechnical, and ethical dimensions of the technology. The team's collective expertise must position them to make well-informed decisions that respect the requirements for external governance and engagement with the ultimate stakeholders in the design of public infrastructure, and for possible revision to the technology and corresponding implementation plans.

While this report identifies some considerations of special importance in the use of large-scale, foundational DPGs, and provides some actionable guidance to actors responsible for designing, implementing, and overseeing them, we do not attempt to identify the full range of ethical considerations relevant to foundational DPGs. Fundamental to our approach is the need to establish ongoing structures of governance, evaluation, and monitoring that will surface ethical considerations over time. We believe that

an important next step is to convene discussions among philanthropic organizations, international development agencies, civil society groups, and governmental representatives to assess the merits, feasibility, and limitations of these recommendations.

INTRODUCTION: THE PROMISE OF DIGITAL PUBLIC GOODS

An individual's ability to participate fully in social, financial, and political life increasingly depends on access to and facility with reliable technological systems. For residents of developed economies, digital systems facilitate critical interactions like transferring money from one bank to another or verifying their identity with a governmental office. National governments with emerging economies are increasingly seeking to realize such capabilities in their own countries, to connect residents to each other and to the wider global economy, and because digitizing services may offer significant gains with respect to the cost and efficiency of implementing and maintaining them. But as we will discuss in what follows, doing so is not without risks, and any digital development projects in emerging economies must be carried out with thoughtful attention paid to the opportunities, risks, and trade-offs involved.

There are a variety of ways to develop a population-scale piece of digital infrastructure, including by partnering with a private technology vendor on a contractual basis – unsurprisingly, a common model in developed economies in which technology firms have flourished for decades. Replicating such a model in emerging economies, though, introduces apparently serious difficulties:[1]

1. As the digital collection, use, and storage of personalized data for a variety of services becomes more important, nations may fear compromising their data sovereignty by involving a private, probably foreign-based vendor.
2. Relying largely or solely on technical capabilities from other countries may deprive nations of an opportunity to develop relevant skills among their own residents, and to develop their own governmental technological capacities.
3. Contractual obligations to vendors may limit a nation's ability to customize technological solutions to its unique and evolving social environment, meaningfully include residents in decision-making and governance, adapt nimbly to changing needs over time, and avoid becoming "locked in" to a suboptimal piece of digital infrastructure.
4. Increased reliance on major tech firms to provide national infrastructure may contribute to their monopolistic or oligopolistic control of certain sectors of the technology market at the global scale.

There has been a recent focus on alternative approaches to technology provision that may help address at least some of these challenges. Rather than relying on proprietary, market-based solutions, governments might instead look to secure economic and social digital inclusion for their residents by relying on digital public goods (DPGs). In broad terms, a DPG is an openly available digital tool that is a "public good" in the economic sense: in principle no one is excluded from making use of it, and the use by some does not diminish the value of future use by others.[2] More precisely, a 2020 United Nations report defines DPGs as "open-source software, open data, open artificial intelligence models, open standards and open content that adhere to privacy and other applicable international and domestic laws, standards and best practices and do no harm."[3] Created in response to the work of that report, the Digital Public Goods Alliance (DPGA) now accepts and reviews nominations for relevant digital entities to be included in their registry of DPGs.[4] That registry includes, for example, an app for "confidential case management and incident monitoring" in the provision of social services (Primero), and a platform for implementing a digital identification system (MOSIP).

Given our focus in this report on population-scale attempts to provide core services to residents, DPGs are most relevant to our analysis when conceived in their foundational rather than functional manifestations. Functional DPGs are so-called because they enable delivery of some particular service in one or a few limited sectors, like Primero's use for handling child protection cases. Foundational DPGs instead act as the "backbones" of service delivery across potentially many sectors, as in the case of MOSIP, which establishes a foundational ID system that could in principle be used to authenticate users' identities in a very wide range of contexts.

Foundational DPGs may be especially attractive to national governments without pre-existing digital infrastructure to support the core functions of their financial and governmental sectors. Consider, for example, the case of financial transfers across institutions. Rather than contract with a major banking or credit entity to enable

1 Some of these difficulties are not specific to emerging economies. They may be especially challenging in such contexts, though, even if also present elsewhere.
2 Digital Public Goods Alliance, "Accelerating Financial Inclusion During COVID-19 and Beyond."
3 United Nations, "Report of the Secretary-General: Roadmap for Digital Cooperation."
4 https://digitalpublicgoods.net/registry/

such transfers for its residents, a government may prefer an open-source solution like Mojaloop, a foundational DPG that provides the means for full interoperability across a diverse range of financial actors.[5] DPGs offer the promise of avoiding the challenges of private, proprietary technology-provision we considered:

1. Relying on DPGs offers nations the opportunity to retain significant control over both the technology itself and its associated data management.
2. Implementing DPGs offers an opportunity to augment existing technical capabilities locally, especially if such an effort were supported through the development or philanthropic efforts that sometimes fund DPGs themselves.
3. DPGs are in principle available for use independently of any contractual obligations.
4. Relying on DPGs seemingly contributes less to increased market dominance from major technology firms than standard approaches.

For these reasons, building out digital infrastructural solutions in developing economies via DPGs is a particularly attractive idea. However, doing so requires careful attention to a wide range of considerations across the full lifecycle of DPGs, including their development, implementation, governance, and ongoing maintenance and oversight. As in all high-stakes decisions, the options for funders, developers, and users present decision-makers with a series of trade-offs; a short-term gain in efficiency may result in a long-term loss in robustness, for example. To realize the benefits of foundational DPGs we have briefly considered, and avoid trading too much to secure those benefits, we require a set of governing ideas for identifying and managing the risks and benefits of foundational DPGs.

This report describes an overview of what those governing ideas ought to be. We not only explore the possible benefits and risks of relying on foundational DPGs, but also take a step back to consider how organizations that fund and otherwise enable such systems should understand their responsibilities. These responsibilities range from making decisions about when and how to support the development and use of DPGs, how to take steps to ensure that their responsibilities are met, and how to monitor whether risks have been successfully mitigated over time. We consider this a first attempt at laying foundations that, while providing actionable guidance in some arenas, will also support future attempts to articulate further recommendations in greater detail.

We situate DPGs in a broader conceptual space that we believe is essential for reasoning about the relevant responsibilities in the contexts we examine: that of public infrastructure and digital public infrastructure. We explore what it means to conceptualize technology as infrastructure, what responsibilities organizations that build and implement infrastructure have to those who use it, and how thinking of the activity of building DPGs as infrastructure-building illuminates those responsibilities.

We argue that the peculiarities of foundational DPG technology give rise to important considerations in at least three areas: the construction of the technologies, their governance within particular states, and the important leverage point of funding their development and deployment. Many of the recommendations we offer focus on governance. Because they apply broadly to the design of digital infrastructure, governance recommendations are both actionable in the near term and likely to have lasting effects for responsible decision-making over long periods of time. We believe that further engagement with representatives from government, national civil society groups, and international development agencies is necessary to make meaningful progress on how to develop and enact these governance recommendations.

FOUNDATIONAL DPGS AS PUBLIC INFRASTRUCTURE

Our analysis of foundational DPGs rests on wider considerations about what public infrastructure is, how and by whom it is built, and what kind of power relations it facilitates among users, builders, and stewards. Our view is that thinking of technology as public infrastructure illuminates many of the most important ethical considerations that bear on choices about building population-scale technologies.[6]

Consider two paradigmatic instances of physical public infrastructure: a road system and an air traffic control system. Both exhibit at least six important features of infrastructure:

1. Infrastructure is typically partially non-rival, which means multiple actors can make use of it up to some point of congestion, after which it becomes effectively unusable for everyone. It may make no difference whether there are a hundred or a thousand cars on a highway at any given moment, but once the number of cars crosses some threshold, the resulting gridlock makes the highway useless for everyone.
2. Infrastructure is essential for performing a wide range

5 Another entry in the DPGA registry. See fn. 4.
6 For further discussion of the relationship between DPGs and public infrastructure, see Digital Public Goods Alliance, "Accelerating Financial Inclusion During COVID-19 and Beyond."

of downstream activities, social and political as well as economic. Air travel is a useful means to a wide variety of ends: to transport goods, to conduct in-person business, to protect national security, to visit family and friends, or just to see the world. Each of these activities is served by an effective and safe air traffic control system.

3. Infrastructure constitutes a bottleneck, such that control over it confers a critical kind of power over its users and the social, economic, and political activities for which they make utilize it.[7]
4. Infrastructure that is designed with auditability and revision in mind is often especially desirable, as there is an advantage to being able to continuously respond to changes in public need and stakeholder demands, instead of being wedded to systems that become less reliable but that users nonetheless become increasingly dependent on. A complex road system built without space for parking maintenance vehicles while workers tend to ongoing repairs, for example, would degrade faster than a better designed system.
5. The design of infrastructure involves choices that inevitably benefit some and burden others. If the placement of entrances and exits on a freeway system smooths travel for residents of wealthy neighborhoods but does not serve the commuting needs of those who are worse off, the roadway will compound existing disadvantage. This feature of differential impact via design necessarily entails ethical and political choices in determining who should benefit and who should not.
6. Infrastructure, like all technology, is more than a tool that humans manipulate; it shapes the very humans who use it, and their societies. Thus, the stakes involved in choices about the design of infrastructure are high. Widespread commercial air travel was not a mere addition to human activity that otherwise left life as it was, but instead profoundly altered the way individuals arrange their lives and what they chose to value.

The interactions that infrastructure enable may be commercial, educational, social, and/or political, and those who use infrastructure may be corporations, governments, civil society actors, or individuals.[8] Air traffic control systems support global commerce, diplomatic activity, international security, as well as tourism and other personal travel. Because of the wide range of activities that infrastructure is designed to support, its benefits are primarily realized by its end users. Correspondingly, those that infrastructure makes vulnerable are the same: those who depend on infrastructure to engage in everyday social, economic, and political activities. Users are the ultimate stakeholders of infrastructure. They benefit from the multiple kinds of activities that infrastructure supports and they are made vulnerable by the possibilities of exclusion and oversight created by the design of infrastructure.

Those who design, build, and steward infrastructure have a high degree of control and influence over those who use it. They are gatekeepers of the activities that infrastructure supports.[9] Because of the enormous power they wield over central elements of people's lives, infrastructure's gatekeepers have strong responsibilities to ensure they respect ethical obligations, rules, and laws in the exercise of that power, such as non-discrimination rules that ensure infrastructure serves different communities equitably and with due respect and concern.

Digital infrastructure is required to support our rapidly digitizing lives. The vast majority of digital infrastructures are currently built and governed by large corporations that control and influence how this infrastructure is designed, used, and modified.[10] These private entities have the ability to discontinue or modify their infrastructural products unilaterally. Consider the ongoing, consequential case of Facebook's advertising infrastructure, which now channels a significant portion of the United States' political campaign advertisements.[11] Facebook Ads came under scrutiny for its role in spreading misinformation during the 2016 US election,[12] and has since responded with several changes to how political advertisements can be added to the platform: they've instituted additional disclosure and verification norms,[13] and blocked the publishing of new political advertisements in the week before the 2020 US presidential election.[14] The execution of these modifications was not without controversy,[15] but there are no clear mechanisms via which stakeholders can directly influence Facebook's management of its systems. Facebook decides how Facebook's ad system is designed, with little oversight or input from users, regulators, or legislators. The development of public digital infrastructures, if executed responsibly and wisely, may mark progress from the status quo of private dominance over digital spaces.

7 Frischmann, Infrastructure: The Social Value of Shared Resources.
8 Frischmann. 334.
9 Furman et al., "Unlocking Digital Competition." 41.
10 Zuckerman, "What Is Digital Public Infrastructure?"; Parser and Allen, "To Thrive, Our Democracy Needs Digital Public Infrastructure."
11 Levy, Rodriguez, and Graham, "Why Political Campaigns Are Flooding Facebook with Ad Dollars."
12 Ghosh and Scott, "New Facebook Scandal Shows How Political Ads Manipulate You."
13 Gold and Fung, "Facebook Rolls out Stricter Political Ad Rules Ahead of 2020."
14 Isaac, "Facebook Moves to Limit Election Chaos in November."
15 Graham, "As Facebook Cracks down on Fake Political Ads, Businesses Are Getting Caught in the Crossfire"; Sonnemaker, "Facebook Admits It 'improperly' Blocked Some Political Ads Due to 'Technical Issues' as Joe Biden's Campaign Slams It for Being 'Wholly Unprepared.'"

Digital infrastructure shares many of the same properties of traditional infrastructure: it is essential for downstream activities, its long-term viability is integrally connected with its ability to serve the public good, and the parties responsible for its stewardship hold enormous power. Because foundational DPGs like MOSIP and Mojaloop, for example, will be the first of their kind deployed at the scale of large, national populations, the stakes for the success of any given offering are that much higher.[16] Infrastructures that unintentionally restrict participation in ecosystems of exchange, or that unjustifiably advantage certain actors over others, have much more drastic implications when there are no other offerings available, and therefore have tremendous potential to steer us on a course that will later be difficult to adjust.

Digital infrastructure also offers rich possibilities for realizing the promises of public infrastructure, particularly in the arenas of governance, distributed control, auditability and scalability. Digital technologies are more flexible in their ability to bring participants and users into the governance fold: Wikipedia's army of volunteer authors and editors[17] and Taiwan's digital democracy platform[18] are two successful examples of digital technologies that open possibilities for deliberative, decentralized, and participatory governance models. Digital technologies also allow for greater transparency and government auditability. To increase trust in governmental systems, many governments are now moving towards publishing government data in machine-readable formats so that it can be scrutinized by the public.[19] Digitization also creates possibilities for more nimble changes to public infrastructure, reducing the friction and transactional overheads inherent to responsive governance. Entire volumes are emerging on practices and approaches to leveraging digitization as a way to deepen the promise of public goods.[20]

This new era of infrastructure-building favors a departure from the standard approach that government agencies take to software development. Most governments rely on third-party contractors to build software tools; the need is defined in a requirements document, outsourced to external developers, and then received as a near-complete product with little iterative development and design.[21] This is a relic from an era when this approach was perhaps more appropriate – when software provided *tools* to supplement and optimize primarily non-digital processes: software to scan and maintain documents, to automatically process tax filings, or to allow users to pre-register for appointments at the DMV. *Infrastructural* software, on the other hand, is a core pillar of, rather than an addition to, public services that are changing and adapting as societies evolve. A nimbler approach to software development, deployment, and oversight is thus necessary for software projects of this scope and breadth.

UNCERTAINTY AND EXPERIMENTATION

A natural way to evaluate pieces of infrastructure generally, including foundational DPGs, is to attempt to understand their benefits, identify risks, and explore the most effective ways to mitigate those risks while still realizing enough of the benefits. The degree to which such an approach will succeed depends in large part on our ability to recognize ex ante important details about the pros and cons of pieces of digital infrastructure and the efficacy of various policy interventions we might enact to integrate them into particular socio-technical environments.

Plausibly, we can identify some of the benefits and risks of national, foundational DPGs prior to their being implemented, including some that we have canvassed above:

BENEFITS

- Affording countries autonomy over the kind of technology used, and the manner of its deployment, in their local environments
- Connecting residents with state social programs, especially the traditionally underserved
- Connecting residents to an increasingly digitized economy, especially the traditionally financially disadvantaged
- Possibly protecting residents against digital intrusion into their lives, either as a result of malicious digital attacks or negligent supervision of data
- Affording residents increased degrees of transparency and control with respect to their digital identities
- Incentivizing entrepreneurship and collaboration by smoothing interactions among previously siloed systems
- Avoiding monopolistic control of digital infrastructure and its resultant data by private firms

16 We will occasionally return to these examples below. In each case, we mean for discussion to be illustrative of ideas that also apply to other pieces of technology. MOSIP and Mojaloop function as useful examples in part because they are straightforwardly foundational and already recognized by the DPGA as DPGs.
17 Zuckerman, "The Case for Digital Public Infrastructure." 17.
18 Leonard, "How Taiwan's Unlikely Digital Minister Hacked the Pandemic"; Lanier and Weyl, "How Civic Technology Can Help Stop a Pandemic."
19 Obama, "Executive Order–Making Open and Machine Readable the New Default for Government Information."
20 Lathrop, *Open Government: Collaboration, Transparency, and Participation in Practice.*
21 Burton, "Peace Corps for Programmers."

RISKS

- Centralizing sensitive personal information, including biometric data, may ultimately increase its exposure to bad actors
- Centralizing sensitive personal information, including biometric data, may enable state surveillance, oppression, and worse
- Digitizing access to core state services may inadvertently set back the already disadvantaged yet further
- Disadvantaging certain residents who, for reasons of disability, would be excluded by enforcing biometric authentication

Despite the above lists, which could no doubt be populated further, we believe there are fundamental limits to how effectively the future benefits and risks of DPGs can be identified, not just by ethicists but by those tasked with designing DPGs themselves. We therefore believe that devising ethical frameworks by relying on the identification of risks and benefits alone is insufficient and may encourage a false sense of certainty about what risks there are and what their possible scale and scope might be. Such an approach underestimates the dynamism of digital infrastructure, the ways in which it is changed by those who update and reform it, and as a result of the changing expectations of those who use it. We believe that uncertainty and dynamism are key features of the ethical challenges facing designers and implementers of DPG technologies.

First, consider the high level of initial uncertainty in large-scale DPG projects. Many of the technologies under consideration have never been deployed at the scale of a large country, and how those technologies will operate in practice will vary across countries with different cultures, norms, and institutions. Social frictions and technical challenges are certain to emerge in any such large-scale, novel undertaking that would be impossible to anticipate with precision. Even some of the risks that can be anticipated—like sudden political changes—are nevertheless nearly impossible to predict – what the political change will be, when it will happen, what implications it will have. Thus, simply enumerating risks, ranking them by probability and magnitude, and devising a strategy to pre-emptively address them risks supporting an ethical framework that offers a false sense of certainty and which would in practice fail to advance the salient values it identifies. Any approach to the ethics of DPG technologies must be designed to be robust to the inherent uncertainty involved in designing and deploying digital infrastructure.

Second, the dynamic nature of building and integrating public infrastructure, a process that plays out over time, subject to the influence of multiple stakeholders and changing expectations, is also critical to the ethical dimensions of DPGs. For example, an otherwise well-intentioned and well-designed identity technology could become the source of significant injustice if usage requirements were to outpace distribution. As another example, consider the possibility of criminals targeting infrastructure technologies. Cyber vulnerabilities are not static, and they depend on the interface between DPG technologies and other platforms as well as the creativity and determination of malicious actors. The concerns raised by dynamism suggest the need for flexibility and robustness in the structure of an ethical framework for guiding decision-making regarding deploying population-scale technology solutions, and especially where foundational DPG technologies are concerned.

One domain in which ethical considerations also depend on uncertainty and dynamism is bioethics. Some bioethicists have responded by conceiving of the evaluation of such technologies in terms of social experiments.[22] Just as medical experiments require the integration of ethical considerations from the outset, approval by an institutional review board, informed consent of subjects, and procedures for monitoring and reporting emergent concerns with an experiment, so too should social experiments be carried out only with analogous safeguards and feedback loops. The details of how to ensure that these safeguards are present vary from project to project, but we believe this framework is highly relevant to the ethics of DPGs. The design and deployment of digital public infrastructure should therefore be structured according to the guidelines suggested in the remainder of this section and specified further in the following sections.

We have emphasised two challenges: First, the full range of risks and benefits of implementing national digital infrastructure are probably not fully knowable ex ante, and, second, responding appropriately to them is a complex sociotechnical task. The processes used for design and implementation of foundational DPG technologies must consistently meet these twin challenges of interdisciplinarity and uncertainty. We describe a potential framework for addressing those challenges by focusing on three key decision areas: how the technologies themselves are designed; how they are implemented, maintained, and governed over time; and how funders influence the full range of DPG lifecycles.

To illustrate how these key decision points intersect, consider the case of a digital payment system like Mojaloop. The Mojaloop Foundation's list of actors concerned with

22 van de Poel, "An Ethical Framework for Evaluating Experimental Technology."

its technology is a good starting point for thinking about the stakeholders who should be involved in structuring the governance of the design and deployment of Mojaloop: "individual users, banks, government entities, merchants, mobile network operators, providers, and technology companies."[23] At the outset of a decision to implement Mojaloop or any similar system in a country, all these stakeholders should be brought together to consider the functional requirements for the designers and engineers adapting open source modules to a particular local context. Critically, this initial stage of deliberation should take place as early as possible and should establish a clear structure for ongoing accountability, in which decision-makers within organizations are required to articulate clear, justified, and well-documented decisions. These decisions should then inform the technical work of crafting a national platform around the payment system's framework. This is the first step in what we call ongoing *external governance*. As will become apparent, however, establishing credible external governance is much more than a one-off exercise, and instead requires ongoing, iterative deliberation.

Technology design of digital public infrastructure should take into account at least two factors: the importance of intentionally designing for revisability to respond to emerging needs and concerns and the need to facilitate external governance in order to capture the feedback that will inform technology revision. The fundamental idea is that those who are best suited to represent the interests of users - again, the primary stakeholders of national infrastructure - should be presented with systems that facilitate their input. For example, in some contexts those who are best suited to play this role will be residents themselves. Users who identify issues could have the ability to opt-in to being connected to other users with similar concerns. Additionally, the technology itself could be used to randomly sample stakeholders and invite them to (compensated) deliberation sessions for evaluating the rollout of the platform. Doing so would create the mechanism by which deviation from iterated external governance would be automatically noted. Digital infrastructure should be designed with temporal modularity in mind, so that features can be easily revised, added, or removed as the deployment process clarifies the needs of users.

External governance and revisable technology design must be accompanied by clear structures for *internal governance* too. Stakeholders involved in the financial support, design, and deployment of foundational DPGs should therefore assemble teams that are prepared to address the interdisciplinary, sociotechnical, and ethical dimensions of the technology. The team's collective expertise must position them to make well-informed decisions that respect the requirements for external governance and engagement with the ultimate stakeholders in the design of public infrastructure, and for possible revision to the technology and corresponding implementation plans.

Consider the preliminary issue of a technology stakeholder deciding whether or not to engage with a country that wants a digital payment system. If the country is willing to work with funders and other project organizations to establish ongoing structures of accountability and participation that begin in the scoping phase and continue well after a project has been implemented, then cooperation with that country should be strongly considered. Otherwise, there should be significant reservations. Notice that this does not place stringent requirements on the overall political system of the country to be engaged. But by ensuring that—at least within the space of payment systems—room is made for democratic deliberation, substantive ethical principles like those identified in the UN Universal Declaration of Human Rights are more likely to be respected. At the same time, avoiding systemic political litmus tests limits (but does not eliminate) the opportunity costs of non-provision or malicious provision. In considering the practicality of how to secure such an agreement, one approach might be to assure the host government that the deliberation sessions themselves would come at no cost to the state but would instead be covered by philanthropic or development funding.

What kind of team should be in place to make decisions of the kind just described? We suggest that, as a matter of internal governance, building a decision-making team that comprises a wide range of expertise (technical, legal, sociological, ethical, etc.) will best position stakeholder organizations to address the challenging questions that arise not only at the early stages of a potential engagement, but also at all future stages at which the relevant actor is able to influence how the engagement unfolds.

Now consider the significance for the implementation stage of building diverse internal capacity and establishing processes that reflect the need for revisability and external deliberation. Digital infrastructure introduces digital vulnerability, and a dedicated 'red team' should iteratively search for technical vulnerabilities as DPGs are fused with national systems and released into the world. However, the work of such a 'red team' should not be confined to technical experts. Instead, the framework used for deliberation about design and implementation should be leveraged for ongoing monitoring about security. Technical experts should ensure that discovered threats are explainable to non-expert users and that these threats are in fact explained, as doing so is necessary for securing ongoing

23 Mojaloop Foundation, "Mojaloop Foundation - Open Source Software for Payment Interoperability." We use Mojaloop for illustrative purposes here, and note that it has not yet been implemented nationally anywhere.

informed consent. This task will be substantially easier if the same kind of diverse team needed for the preliminary engagement decision is available to the technical red team. Ideally, users and other stakeholders would play a key role in prioritizing the work of the technical teams assigned to patch vulnerabilities. Only through iterated governance can people be assured that technological lock-in does not lead the risk/reward ratio of digital payments to become skewed and unfair.

Although identified with foundational DPGs in mind, the considerations just discussed should bear in a similar way on any technology that shares some of the essential features of infrastructural DPGs, particularly the uncertainty and dynamism due to technical novelty and large-scale application. This potential for broader application does not come from sweeping prescriptions or prohibitions grounded in broad ethical principles. Rather, it arises from the modest recognition that, as we invent our sociotechnical future, ethically grounded processes of governance are best equipped to grapple with that which we cannot yet know.

We now describe more detailed guidelines for building DPGs, implementing and governing them, and funding their full lifecycle, before closing the report with suggestions for further advancing our shared understanding of the ethics of foundational DPGs.

TECHNOLOGY DESIGN

Iterative feedback loops and stakeholder governance are meaningless in practice if the technical structures of DPGs make them resistant to change. The technical systems that codify the functionalities, limitations, and rules of foundational DPGs must be developed with deliberation and modification in mind. Technical design processes should strive for infrastructural solutions that will be resilient to modifications 2, 5, 10, and even 15 years into the future. Technologies like MOSIP are already designed with some of these principles in mind: MOSIP was developed to be vendor-agnostic, for example, so that the system can be deployed with any cloud provider.[24]

The dominant government model of contract-based software development discussed earlier has established a norm of "waterfall" design: system requirements and specifications are designed and finalized in the abstract, sent off for development, and received in a final, complete form, ready to use. Governments will sign a contract with vendors to build the software and maintain it for a period of time ranging anywhere from one year to multiple decades.[25] These third-party contractors often have an incentive to design systems that are brittle and not friendly to changing requirements so governments have to return to them to commission new systems. In effect, they are incentivized to build products that create ongoing dependency. This has resulted in a poor reputation for government software in many countries as outdated, difficult to use, and resource-intensive to maintain.[26] Notably, one of the stated goals behind MOSIP is to address this problem directly: to reduce the extent to which governments are bound to the contractors or vendors who first built their software.[27]

The efforts to establish foundational DPGs discussed in this report must also anticipate the limitations of free and open-source software (FOSS) offerings. The FOSS ethos is rightly concerned with how difficult it can be to implement something from scratch. FOSS offerings aim to reduce "start-up cost" by making a public offering for others to benefit from. FOSS projects typically intend for each instance of the system to take on a life of its own once the technology is customized and deployed in a given setting; their design process is therefore less concerned with long-term viability from the outset. MOSIP's documentation and guiding principles reflect this: the documentation's guidance ends with the "deployment" stage and includes no reflections on approaches to upgrading an already-deployed system as MOSIP's own FOSS offering is upgraded.

In the case of foundational DPGs, some responsibility for ensuring long-term viability rests with the development agencies or philanthropic entities encouraging governments to make a long-term investment in adopting these technologies. A core public infrastructure system like Foundational ID cannot be so resource-intensive to modify that it must either remain static post-deployment, or be replaced by another system entirely. Consider the example of driver's licenses in the United States and the recently enacted REAL ID requirements for domestic flights. The fact that driver's licenses expire at a predetermined date allows the entire physical ID system to be gracefully revisable. When the intent to impose REAL ID requirements was confirmed, states began to issue updated IDs to individuals renewing their licenses. Residents thus received REAL ID-compliant licenses in a staggered way based on the natural dispersion of issue/expiry dates. Only now, as we approach the enforcement date for the REAL ID requirement on domestic flights, are a relatively small number of users forced to make a hasty change.

24 MOSIP Foundation, "Guiding Principles."
25 Burton, "Peace Corps for Programmers."
26 Trujillo, "Five of the Most Outdated IT Systems in the Government."
27 MOSIP Foundation, "Guiding Principles."

Similarly, if all of a nation's ID records were to end up building on MOSIP, a successful MOSIP deployment would handle modifications gracefully. Consider a new feature in the latest release of MOSIP's FOSS offering that allows users to control personal information access on a per-partner basis, giving them greater control over who sees their data under what circumstances. If a country had already deployed MOSIP a year or two ago, a staggered and gradual process would ideally modify the underlying data model and resident portal to reflect this updated functionality without major system outages or the re-building of entire modules. MOSIP may indeed be able to accommodate these kinds of changes, but its current technical design documentation does not directly address this aim.

One of the major strengths of many DPG projects is they explicitly articulate their design goals and principles going into the development process. Including revisability and responsiveness to deliberative governance in these principles would ensure that MOSIP's systems are designed with temporal modularity in mind. Dedicating more engineering resources towards post-deployment responsiveness will result in solutions that are more viable in the long-term. Influential actors in the development sector should work with DPG technology partners to prioritize long-term infrastructural durability and revisability by updating their guiding principles to include these aims, and building whatever internal structures are necessary for adhering to them.

Each technology partner will need to assess the extent to which their current designs are friendly to graceful post-deployment modifications and system changes. For example, resident stakeholders could consider various ideas for hypothetical feature changes as a way of identifying which modules and sub-components of the system are more or less brittle.

This process should also address how a given nation's customized DPG implementations can be made more transparent and auditable. Government systems gain trust among residents through institutionalized audit mechanisms; many historical systems pre-plan audit cycles as in the case of redistricting congressional maps. The governance mechanisms we discuss in other sections of this report can be supplemented through careful thought to technical auditability: one approach may be to make country-specific implementations of foundational DPG technologies themselves open-sourced. Recent work in Development Operations (colloquially known as DevOps), specifically in Continuous Deployment and Continuous Delivery, should also be taken into account to determine the extent to which DPG system deployment can be initiated directly from these open-source repositories to increase public trust. This is one of the many ways in which the flexibility that digitization offers can strengthen governance mechanisms and public trust in governments.

Influential actors in the philanthropic and development sectors can encourage their technology partners to expand their FOSS offerings to also include tools, frameworks, and scripts that can support common lifecycle scenarios for foundational DPG technologies, like opening new data center regions, changing the underlying specification of identifying user data stored, and incorporating and deploying upgrades made to the original FOSS offering.

These technology partners should also add documentation, with a similar level of granularity and detail as the existing documentation, that discusses scenarios for various necessary post-deployment changes. This documentation would detail how the system is designed to gradually and gracefully handle such changes while:

- minimizing service outage for those relying on this infrastructure (the equivalent of repairing potholes lane by lane, rather than shutting down a road entirely)
- avoiding unnecessary resource-intensive technical work that requires "reinventing the wheel"
- minimizing the accrual of technical debt through poorly executed changes that future maintenance or modification cycles will need to repay

This supplementary documentation may also include discussions on which modules of the system are more or less revision-friendly: Which features are static or would be most difficult to change? Where are there dependencies in functionality, e.g.: in which cases would revisions require significant changes elsewhere, and in which cases not?

KEY GUIDELINES FOR TECHNOLOGY DEVELOPERS

- Avoid creating systems that are brittle and resistant to modification by incorporating the principle of revisability into the design of all infrastructural DPGs
- Dedicate resources to supporting revision and maintenance of infrastructural DPGs well past initial deployment and consider this revision and maintenance as a necessary part of the initial commitment to engage
- Collect and process sensitive personal information about users only when strictly necessary for the performance of specific functions. Such data storage and processing should be confined only to those uses and should be separated from other use cases
- Avoid exclusion by enabling access for users who vary across multiple dimensions, including technical literacy, physical traits, identities, and backgrounds
- Aspire to consult directly with end users or their organized advocates – at all stages of the technology life cycle
- Aspire to enable ongoing consultation with users or their organized advocates through system design choices

- Ensure systems do not interfere with or otherwise undermine the practical force of the rights of end users, for instance by performing human rights due diligence with respect to anticipated implementations

GOVERNANCE

How should we design policy to govern the use of foundational DPGs? To answer, we might benefit from considering how the question has been answered in another context in which scientific and ethical considerations closely interact: bioethics. The former Presidential Commission for the Study of Bioethical Issues made a strong case for the centrality importance of democratic deliberation in resolving legal and policy questions about bioethical issues, defining democratic deliberation as "a method of decision making in which participants discuss and debate a question of common concern, justifying their arguments with reasons and treating one another with mutual respect, with the goal of reaching an actionable decision for policy or law, open to future challenge or revision."[28] In view of the great opportunity and uncertainty presented by foundational DPGs, we suggest deliberation should be central to their architecture and implementation —that digital infrastructure should be *deliberative by design*. This need not require a government to be democratic to engage; it simply requires a representative set of stakeholders or their advocates to be brought into a meaningful and iterative process that includes those affected by DPGs in decisions about how they are designed.

Deliberation accomplishes two key goals: first, it embodies respect for the welfare of those involved by establishing a fair procedure; second, it embeds responsiveness to the uncertainty and dynamism inherent in the unprecedented rollout of infrastructural technologies like DPGs. By bringing in the voices of those who use new technologies, democratic deliberation provides a better chance for beneficence and non-maleficence to prevail compared to a decision-making process that does not mandate the inclusion of these users. Similarly, deliberation recognizes the autonomy of multiple stakeholders in the process of technology development and implementation. Although no process can guarantee just outcomes, democratic deliberation places the concerns of residents at the center of the conversation.

Further, because deliberation is inherently "open to future challenge or revision"[29] it embeds robustness to uncertainty. By making the deliberative process iterative, problems with DPG technologies can be identified early, discussed, and addressed. These feedback loops are key to accommodating the uncertainty inherent in an essentially experimental suite of technologies. Similarly, iteration and the opportunity for revision can provide for flexibility in the sequencing and security measures.

The mechanisms for deliberation must be incorporated in the design of foundational DPGs and the plan for their implementation. Securing stakeholder representation as early in the process as possible ensures initial buy-in as well as creating the infrastructure for feedback loops to adapt to unforeseen challenges. That representation need not be *direct*. In fact, organized advocates may be well-suited to protecting the interests of groups of residents during deliberation, and especially in cases in which such advocacy structures already exist, relying on them may be more efficient than attempting to develop a system for direct representation. These might include digital rights charities, groups who represent marginalised or excluded residents of a country, or international human rights charities. Whatever form it takes, by making an explicit commitment to deliberation, any deviation from a structured process of deliberation becomes cause for concern in and of itself—rather than users needing to advocate for their inclusion in discussion and decision-making after the fact.

Acknowledging the advantages of a democratic, deliberative approach to the use of DPGs is not in and of itself sufficient. The deliberative process as formulated by the Presidential Commission works for well-posed questions of bioethics and biomedical policy, that could, at least to a significant degree, be answered ahead of future direct confrontations with them. The case presented by foundational DPGs is, we have argued, importantly different. Because of their experimental nature, and because of their infrastructural role of providing essential, ongoing support in the lives of individual users, deliberative democratic governance should be integrated as deeply as is possible at all stages of the design, deployment, and stewardship of DPGs. Deliberation should be a permanent, rather than temporary, feature of the design and implementation of DPGs. Naturally, what form this takes will be shaped by existing local governance procedures and feasibility constraints. Close attention should be paid in each case to how the values we have identified here can best be realized in particular localities.

KEY TAKEAWAYS FOR POLICYMAKERS

- Establish ongoing structures of deliberation about how to design and implement DPGs that include those who will use them or organized advocates who represent their interests

28 Presidential Commission for the Study of Bioethical Issues, "Bioethics for Every Generation: Deliberation and Education in Health, Science, and Technology." 3.
29 Presidential Commission for the Study of Bioethical Issues. 3.

- Ensure those structures are continuous rather than temporary, incorporated within regular reviews of the operation and deployment of the DPGs
- Conduct rigorous impact evaluations of the human rights implications of implementing DPGs at a population scale and of the different ways of designing DPGs
- Establish clear legal reform where necessary to protect user rights, transparency, and ongoing structures of accountability over those who design and control DPGs

FUNDING

Because they have a role to play in directly funding technology development, in financially and otherwise supporting partnerships between nations and technology creators, and in financially and otherwise supporting nations in related development aims, major philanthropic and development agencies are well positioned to exert influence at multiple stages of the DPG lifecycle, particularly as DPGs are rolled out in developing economies.

This is especially acute because powerful philanthropic actors have no clear source of legitimacy for themselves designing DPGs for other nations. They are not elected governments whose authority flows from the people, nor are they businesses started and taxed in the countries in which they operate. While they are external actors with beneficent aims, it is critical for philanthropic actors to accept the heightened levels of responsibility they have to the residents of countries in which they aspire to build infrastructural technologies, and ensure they build in structures to hold themselves accountable to those whose lives they seek to improve.

First, funding agencies have the power and responsibility to encourage good behavior on the part of their technology and governmental partners. Ideally, this would be accomplished by reaching a shared understanding of the nature of the ethical challenge of foundational DPGs and a shared vision for resolving them. With a common understanding of that kind, funders could leverage their convening and financial power to influence behavior at multiple points.[30]

Second, funders can attempt to induce new *kinds* of behavior from both technologists and policymakers, as opposed to merely working toward guidelines for standard activities. For example, where we have recommended technology firms step outside of their usual practices by including end users in design processes, philanthropists may deliberately help and encourage firms to accomplish this. Similarly, if states are not presently capable of deviating from standard technology acquisition practices to pay for expert, ongoing maintenance of and revision to a DPG, development money might be targeted for that purpose.

Lastly, funding entities may be especially appropriate sites to develop relevant internal governance mechanisms to monitor their own behavior, and possibly to serve as a deliberative resource for their partners.

We argued above that because foundational DPGs are a kind of experimental public infrastructure, we should build and implement them to enable key stakeholders to exercise agency in decisions about how they will be used, and that allows them to be easily modified in response to a range of dynamic, unpredictable considerations as they become known. We appreciate that knowing how to execute those recommendations about development and deployment may seem daunting. Indeed, the task is probably even more difficult than our report to this point suggests. Because the analysis we undertake represents only a subset—though, we think an important and underappreciated subset—of the key ethical considerations that bear on the use of DPGs, the deliberative challenge confronting the various actors in this space is especially thorny.

Consider, for example, the importance of respecting human rights in the use of digital infrastructure. As we have argued, it is practically impossible to anticipate in advance all the ways foundational DPGs will affect primary stakeholders, it is also likely impossible to know *ex ante* how population-scale systems are likely to interact with ethical considerations arising from standardly recognized human rights. What's more, the particular ways in which those interactions develop will be highly context-dependent, especially when considering engagements carried out in collaboration with national governments. Because countries vary greatly in the *degree* to which they conform with human rights requirements, and with respect to *how* they deviate from them, we should expect that the effect on human rights for any given foundational DPG engagement

30 A potentially useful touchstone is John Ruggie's understanding of the role that the United Nations Guiding Principles on Business and Human Rights can play in a global environment marked by complexity, disagreement, and the lack of a top-down governance structure to impose order: "Creating a more just business in relation to human rights involves finding ways to make respecting rights an integral part of business - that is, just making it standard business practice. However, there is no single Archimedean leverage point from which this can be achieved; success depends on identifying and leveraging a multiplicity of such points, but within the same normative and strategic framing." Ruggie, *Just Business*.

will also vary in these ways.[31]

While the challenge of behaving responsibly as the architect and overseer of DPGs is difficult, it is still critical to meet it. Indeed, because of the tremendous influence of infrastructure of the kind and scale under discussion, these actors are obligated to take significant steps to bind themselves to well-structured deliberative processes that can enable them to discharge their substantive obligations as discussed above. Individual organizations must structure themselves internally so as to be reasonably capable of navigating the difficult ethical terrain confronting them, including by building mechanisms to hold themselves accountable for their shortcomings.

Suppose that a previously partnered global development agency and technology developer has the opportunity to engage with several nations to assist them in implementing infrastructural technology. The partnership faces several difficult questions, such as *which*, if any, of the possible engagements it ought to pursue, and *how* that engagement should take shape. Given the diverse considerations we have argued must be taken into account, some mechanism is required for gathering information about existing attitudes among residents about the kind of technology to be deployed; governmental successes and failures with respect to human rights standards; the likely effect of introducing DPG technology with respect to the same; stakeholder interests in participating in democratic deliberation about the kindof technology in question; and governmental willingness to enable democratic deliberation of that kind. Further, some mechanism is required for integrating and reasoning about that information.

A natural mechanism to consider for these legal, sociological, technical, and ethical tasks is a multidisciplinary ethics committee. While we do not mean to insist that a committee arrangement will be ideal in every case, we are encouraged by recent work identifying the benefits of deliberative bodies of this kind and offering recommendations for how they ought to be structured.[32] In addition to collecting the relevant kind of expertise needed to assess the permissibility of any particular engagement under consideration, integrating ethics committees into the internal governance structure of an organization advances at least two additional and crucial ends. First, a formalized structure that offers ethics committees either a high degree of executive decision-making power or the opportunity to directly advise those so empowered is one way for those organizations to hold themselves accountable to their own principles. Second, a standing committee can support well-reasoned decision-making across time and diverse cases, by maintaining a record not only of its judgments, but also the rationale for them, and to update its assessment of its own past decisions by continually reflecting on past and ongoing engagements as they unfold.

Correctly identifying the particular substantive principles that should guide our choices about how to build and use digital infrastructure is a difficult undertaking that we have attempted to make progress on in this report. But whatever the content of those principles, we think it unlikely that it will be easy in most cases to know precisely how to respect them in practice. Whether through the implementation of ethics oversight committees or other decision-making mechanisms, philanthropic and development agencies must be prepared to exercise informed judgments about the application of general principles to particular cases. We expect this will require some investment in a standing, diverse team of descriptive and normative experts, to be supplemented as needed by specialists on a case-by-case basis.

KEY TAKEAWAYS FOR FUNDERS

- Because funders have the power to influence both the development and governance of foundational DPGs, they bear considerable responsibility for ensuring that each is done responsibly and building in due consideration of ethical frameworks
- Some funders may be well positioned to encourage technology and policy decisions to be made synergistically, which we have suggested above is sometimes desirable, when combined with governance structures in which funders hold themselves accountable to those whose lives they seek to improve
- Realizing the promise of foundational DPGs requires attending to the upstream technological process of enabling the creation of systems that are open, interoperable, and sustainable
- Major funding entities will be better positioned to induce good behavior among their partners to the extent that they can reach a shared vision of what responsible conduct with respect to digital infrastructure looks like and build in accountability structures for surfacing the concerns of those who will use that infrastructure

31 Ruggie, "Guiding Principles on Business and Human Rights: Implementing the United Nations 'Protect, Respect and Remedy' Framework." We wish to highlight the work has already been done in the United Nations Guiding Principles on Business and Human Rights concerning the nexus of considerations that bear on the obligations of both governments and non-state actors when their shared or otherwise interacting undertakings implicate human rights. The conditions detailed in that report under which heightened attention to human rights concerns, including in the form of executing human rights due diligence, is warranted are likely directly relevant for the implementation of foundational DPGs, even if they do not necessarily involve corporate entities of the sort targeted in the UN report. We are also encouraged by the attention paid by the DPGA to the UN Sustainable Development Goals.

32 Sandler and Basl, "Building Data and AI Ethics Committees."

- That vision must include at least a detailed understanding of how the implementation of nation-scale DPGs could interfere with respect for universal human rights as recognized by the United Nations
- Technologists and policymakers will sometimes lack the means necessary for doing what is required of them, in which case this deficit could be met either through direct provision or financial support from funders
- The funding community should be prepared to navigate an uncertain and changing ethical terrain by developing ethical expertise either within or among its most influential individual members
- That expertise might be secured by supporting multidisciplinary ethics committees for ongoing oversight, and we recommend that serious attention be paid to this possibility

NEXT STEPS

This report attempts to identify some of the considerations that are of special importance in the use of large-scale, foundational DPGs. We have also attempted to provide some actionable guidance to the variety of actors responsible for designing, implementing, and overseeing them. Those attempts led to the development of the above recommendations on technology design, external and internal governance, and for funders, which we hope provide a useful foundation for further work in this area. We explicitly acknowledge that we have not identified the full range of ethical considerations relevant to foundational DPGs, or even approximated an exhaustive set of recommendations.

We believe an important next step is to convene discussions among philanthropic organizations, international development agencies, civil society groups, technology providers, and governmental representatives to assess the merits, feasibility, and limitations of these recommendations. This could include piloting in practice some of the governance mechanisms we have sought to describe in the design and deployment of infrastructural DPGs.[33]

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