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What is 'public' about DPI?

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[The Institute for Innovation and Public Purpose \(IIPP\) at University College London \(UCL\)](#) aims to develop a new framework for creating, nurturing and evaluating public value in order to achieve economic growth that is more innovation-led, inclusive and sustainable.

This requires rethinking the underlying economics that has informed the education of global civil servants and the design of government policies. Our work feeds into innovation and industrial policy, financial reform, institutional change and sustainable development.

A key pillar of IIPP's research is its understanding of markets as outcomes of the interactions between different actors. In this context, public policy should not be seen as simply fixing market failures, but also as actively shaping and co-creating markets. Re-focusing and designing public organisations around mission-led, public purpose aims will help tackle the grand challenges facing the 21st century.

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C.

The earliest frameworks, measures and narratives – mainly originated in the policy space – have still been unable to capture the broader ‘public’ and ‘common’ value of DPI. Meanwhile, the scholarship on the digital transformation of the public sector has primarily focused on the digitisation of public services and efficiency gains enabled by technology (Meijer and Bekkers 2015; Mergel, Edelmann and Haug 2019), although there has been an increasing acknowledgement of the importance of embedding the notions of public value in technological solutions for the public sector (Bannister and Connolly 2014; Bonina and Cordella 2009 2012; Mazzucato, Entsminger and Kattel 2020).

It is embedded with values, assumptions and directions of impact created by the infrastructure. For example, Eaves and Sandman (2023) argue that publicness derives from guaranteeing the essential capabilities required to participate in a digital society. However, other definitions of publicness emphasise different attributes, such as openness or social value (Zuckerman 2020; Center for Digital Public Infrastructure 2023). Articulating a clear reference to identify how organisations frame the public value created by DPI is pressing. There has already been a marked increase among multinational funders and national governments in public policies, investments and attention directed at DPI as part of the policy agenda. The varied framings of publicness must be unpacked to understand how DPI creates value and to support the DPI ecosystemic players in designing and implementing more effective DPI.

This paper reviews the literature on traditional infrastructure to reflect on how debates on public value have shaped scholars’ understanding of public infrastructure more generally. Two high-level frames for value creation are identified and applied to the DPI context: attributes and functional perspectives. We argue that ‘publicness’ in DPI goes beyond a broad definition of publicness to encompass digital public infrastructure (DPI) that is *public*. We argue that ‘publicness’ in DPI goes beyond a broad definition of publicness to encompass digital public infrastructure (DPI) that is *public*.

2. B

2.1

G The etymology of 'infrastructure' derives from Latin, meaning 'underneath the structure'. French engineers began using the term in the 19th century to describe physical structures, such as excavations, earthworks, tunnels and bridges, that were supportive of or literally below railways, water tanks and other 'superstructures'⁸. The military adopted and popularised the term in the 1950s during the Cold War, albeit not without some controversy. Borrowing the term from his French counterparts, US President Eisenhower used it to justify building military installations (infrastructure) that could 'support' (the superstructure of) NATO's shared capabilities. Subtly, the notion of infrastructure was expanded beyond its literal meaning of 'underneath the structure' to incorporate a vaguer, but essential, idea of collective use.

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limited storage or processing power, then it is an impure public good⁹. The second criterion is associated with the notion of infrastructure being *shared*: i.e. in economic terms, capital goods or intermediate capital resources. Finally, the third emphasises the genericness of purpose, i.e. that infrastructures are used *for multiple purposes*, which can be services and other goods. In the rest of this paper, this definition of infrastructure is used.

2.2 Digital resources as infrastructure: a question of perspective?

Digital resources are seen as infrastructure when different societal actors can leverage them for several purposes, for example, for production, consumption, and distribution. In other words, digital resources

are seen as infrastructure when different societal actors can leverage them for several

Figure 1. The 'stack' and its layers



Source: Adapted from David Eaves' course materials¹²

Table 1. Examples of digital infrastructures

Category	Examples
Identity systems as infrastructures	<p>Google and Apple</p> <p>Google and Apple IDs can be used to authenticate individuals for several purposes. It is possible, for example, to use these IDs to sign up on a series of websites and to authenticate many services, such as Apple and Google Pay. New applications being created on Android and iOS also offer the option of authentication through Google email, Facebook account or Apple ID.</p> <p>Aadhaar (A . . .)</p> <p>Aadhaar is India's digital identity system</p> <p>Aarpia</p>

12 The stack image is adapted from David Eaves, Richard Pope and Ben McGuire (2019).

Data storage and exchange systems as infrastructures

A **(A)** **E**
AWS offers vast computing power, storage options and scalable services, allowing businesses and individuals to build and deploy applications, store data and manage various IT resources flexibly and cost-effectively.

C **(C)** **G**
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A growing body of research has attempted to use the public value theory to analyse the benefits of ICT transformations (see, for example, Bannister and Connolly 2014; and Bonina and Cordella 2009, 2012). Cordella and Paletti (2019) were among the first to articulate clearly how the GaaP architecture can help public administration deliver public value better. Analysing the Italian case, they suggest that public value creation requires a stronger GaaP orchestration, pointing to a potential role for the state to play.

Building public-governed digital infrastructure might allow states to develop capabilities (Cingolani 2022) essential to running a 21st-century society (e.g. managing identity, payments and data exchange). Digital infrastructures create opportunities for new regulatory and operational mechanisms to fight structural inequalities and offer an alternative to value extraction by corporate or foreign actors (O'Reilly et al. 2023). Nevertheless, if the direction for change is not set with purpose or, worse, set with the wrong one, DPI – and other digital transformations at the population scale – can facilitate structural exclusion and other types of problems at scale across a society. Several examples depict the potential harms. India's Aadhaar has had several documented examples of exclusion, highlighting the risk of pairing IDs with access to welfare services (Totapally et al. 2019). Likewise, in Kenya, misrecognised IDs have barred migrants and refugees from essential social security programmes (Weitzberg 2020).

As more countries embark on strategies to build DPI, it is fundamental to understand what 'public' means in DPI and how a theory of the 'common good' (e)5.6 (v)9. (l)0.5 (d0. (e)-0 (zb)-4 ()-6trae410.4h (

H... D I... For Bozeman (2007), whereas the... is an ideal to be pursued but not tied to any specific content, ... have content and, in many cases, can be easily identified, measured and evaluated. He adds that 'public values' provide a ... about '(a) the rights, benefits and prerogatives to which citizens should (and should not) be entitled; (b) the obligations of citizens to society, the state and one another; and (c) the principles on which governments and policies should be based.'⁷

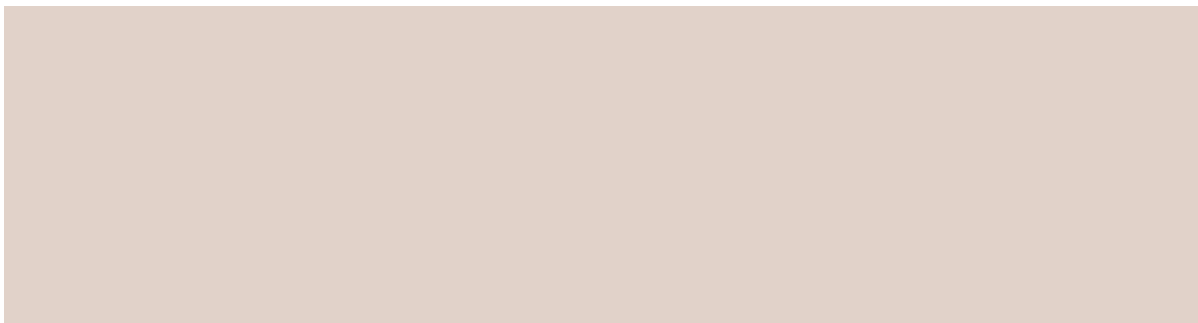
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Table 2. Different ways of framing 'publicness' in DPI

	Formal publicness	Informal publicness	Publicness as a goal
A . . .	Be interoperable through open standards	Dynamic efficiency and scale	Open and interoperable standards prevent lock-in, and thus improve and increase and shape competition
	Be built using reusable building blocks	Dynamic efficiency and scale	The more digital infrastructure can be reusable, the higher network effects and combinatorial innovation
	Be built using open-source licenses (or be unlicensed and in the public domain)	Efficiency and scale	Digital infrastructure with open-source licenses or in the public domain generates positive externalities through adoptability, adaptability and prevention of lock-in
F . . .	Foster community and social relationships	Social value	DPI resources in the context of social infrastructure can foster inter- and intra-communal relationships
	Foster economic activity	Economic value	DPI can improve financial inclusion and mobilise the potentialities of economic agents
	Guarantee essential capabilities	Capabilities and human rights	DPI can create the capabilities for individuals, businesses and agents of society to participate

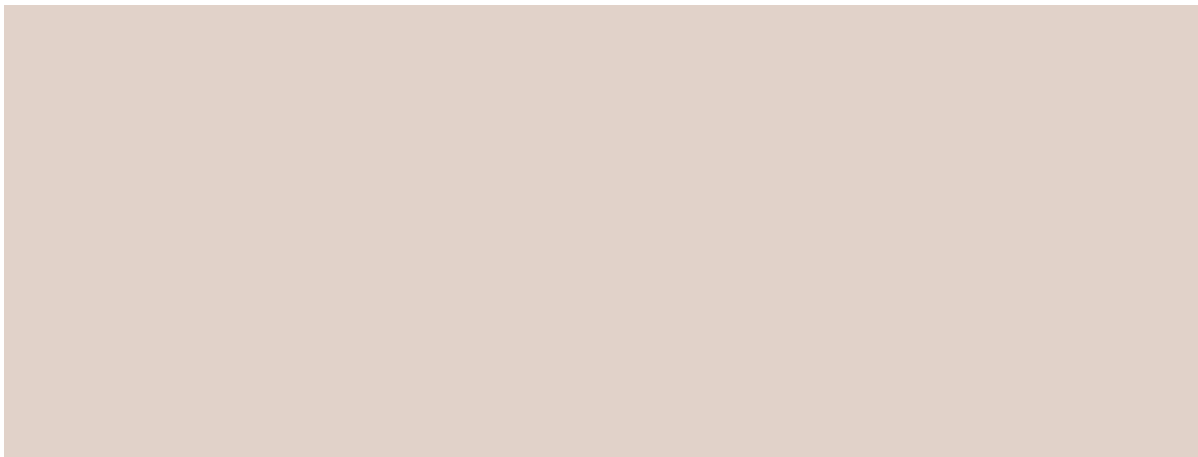
4.1.1 **D** I

One of the ways in which traditional infrastructure generates... is by fostering... Interoperability ensures seamless interaction and collaboration among various entities within shared systems, facilitating competition in diverse sectors. The standardisation of electrical grid protocols is one example. Common technical norms across the diverse elements of the electrical grid — transformers, meters, control systems, and even socket ports — enabled a high level of interoperability. This



even more powerful modular subcomponents. Analogue infrastructures do not have this feature, as they are technically indivisible⁹. A helpful analogy might be to think of reusable building blocks such as Lego bricks. Digital 'Lego bricks' are associated with a [digital public good](#) since the building blocks, like Lego bricks, can be used to build many other goods, services and infrastructures. McAfee and Brynjolfsson (2017) describe the [benefits](#) of reusable building blocks as 'coming up with something new and valuable not by starting from scratch, but instead by putting together in new ways things that were already there (perhaps with a few generally novel ingredients)' (McAfee and Brynjolfsson 2017).

The Digital Public Goods Alliance's GovStack Community of Practice (2022) has conceptualised reusable building blocks as part of 'DPI ecosystems'. According to them, digital public goods (DPGs)¹⁰ and building blocks constitute a country's DPI. In their definition, building



from using it. One example is the Centers for Disease Control and Prevention (CDC) Covid Data Tracker, freely available to anyone worldwide who wants to visualise, compare or analyse the standardised Covid data (CDC 2023). A good is **non-rivalrous** when its consumption by one person does not reduce the amount available for others. Data, for example, is non-rivalrous because there are no scarcity constraints to its consumption. The differentiation between market-based private goods and non-profit public goods based on the attributes of excludability and rivalry originates from neoclassical microeconomic theory and welfare economics. It is based on the assumption that individuals pursuing their self-interest in competitive markets lead to the most efficient results (Mas-Colell et al., 1995; Samuelson 1947). However, in practice, very few are 'pure' public goods, as many are partially rivalrous or partially excludable (toll roads, for example). Thus, the typical examples of infrastructure fall under the 'impure' public good category.

The public good is well embedded in market failp.cil.cilicucOmp1s publiinteventi, verlentintevete marketef i15.(v)9.5 (e)-10.1 (s)-6.2 (t)-2.3 (i)6.1 ((d i)6.1 7 a)-6.6 (r)7.1(de)-4.7 a,



and accountability, collaboration with other implementers and potentially more trust in the technology. However, open-sourcing DPI is no silver bullet, as there are also many other aspects needed if the goal is adoption by other countries. First and foremost is relevance, but code quality, documentation, governance and support also matter.

One example of open-licensed DPI is Estonia's X-Road, a free and open-source data exchange solution. As of November 2023, at least 22 countries had implemented some version of X-Road and benefited from the positive externalities of data exchange and not having to

Stack.¹² The second is DPI's potential for fast-tracking economic development (Mukherjee and Maruwada 2021), usually focusing on the most vulnerable. For example, the World Bank's Identity for Development (ID4D) prograD

4.2 A.

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While, in practice, organisations rarely rely on a single perspective, looking at the different narratives in isolation makes explicit the assumptions about value creation embedded in how DPI potential is justified. But should one care which narrative is used? Moreover, are these categorisations satisfactory for defining the 'P' of DPI?

C. DPI

For example, designing DPI to have open standards, being built with reusable components and open-source software, contributes to many dynamic efficiency gains (such as increased and improved competition, network effects, and the circulation and dissemination of knowledge in the economy).¹⁴ These features also foster the system's scalability and access. However, it assumes that innovation emerging from the infrastructures will create positive spillovers in different markets and formats, and those should not be restrained or pre-defined. While this is undoubtedly a positive consequence of the attributes outlined in this paper, its downside is to possibly waste DPI investment and implementation efforts in areas that are not policy-relevant or priority.

H. DPI

For example, a needs-based discourse would justify building DPI for essential goods enabling human existence, which is a restrained scope for DPI's impact. However, suppose DPI is built with a specific function in mind, but does not comply with attributes. In that case, it might waste an opportunity for societal impact and be less resilient to political shifts. For example, building digital identities that are not reusable, interoperable and open does not maximise the impact that takes place when the digital ID is designed for multiple use cases and at scale. Features are also complicated to change over time, whereas an ill-intended leader can reshuffle governance more easily. They are thus critical to the sustainability and endurance of public values.

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because it expands the potential for creating public benefits. However, at least two arguments can be made. The first is about attributes and functional perspectives. Although both attributes and functional perspectives alone create some form of value, as described above, none account for the processes surrounding value creation and maximisation, and the political economy implications. For example, nothing intrinsic about the attributes or functions of DPI creates inclusion, transparency and trust. These are achieved not only through features, but also through processes, i.e. governance. Second, both discourses are broadly silent on the political economy. In the policy discourse, it is expected to find economic perspectives which see the state's role as fixing market failures or being unable to deliver more quality than the private sector. This framing is not helpful. Achieving ambitious goals aligned with public values requires proactive governments who set the direction for the required collective action (Mazzucato and Ryan-Collins, 2022).

14 This architecture provides a minimum, standardised set of shareable components that allow for further decentralisation of the ecosystem's capacities and organisational structure. It thus creates the conditions for a dynamic system of innovation (Lundvall 1992), which builds horizontal and vertical linkages between actors and breaks organisational monoliths. These dynamic systems allow organisations to share data, knowledge and potentially work together on different societal challenges.

In the next section, the discussion centres on how a 'common good' framework, when applied to governance, has the potential to enhance the public value creation of DPI.

5. Public value creation of DPI

The different lenses on the publicness of DPI, which can be pronounced in isolation or recombined to justify DPI's potential, illustrate that DPI's publicness is significant. As argued, one possible implication for the DPI ecosystem is to consider the value creation of DPI from both technical attributes and a functional perspective. However, defining normative values is not enough for public value creation. As discussed in section 4.2, the different notions of publicness are limiting, because they are broadly silent on governance and the state's role. In this section, we argue that these two elements are essential for public value creation and we propose a framework for public value creation, as developed in Mazzucato (2023), to strengthen the public value creation of DPI.

5.1 Framework for public value creation

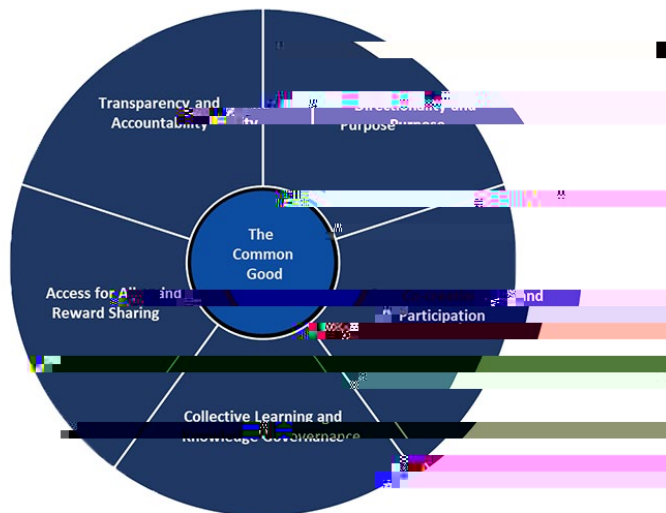
Consider the Mastercard, Visa and American Express examples in section 4. One can argue that these companies create public value because they contribute to financial inclusion by providing payment solutions, allowing individuals to participate in the global economy. It can also be argued that the widespread use of Mastercard and Visa facilitates efficient and convenient transactions, reducing the reliance on cash and streamlining economic activities. This efficiency benefits individuals, businesses and governments, contributing to economic development. Yet, because merchants transfer their fees to retail prices, the indirect 'credit card tax' is estimated to reduce annual consumer and total welfare by \$7 billion and \$10 billion, respectively (Wang 2023). **A** framework for public value creation is needed to address these questions.

Framework for public value creation. **public values** **B**enefits to society. The value creation process (i.e. its direction, how it happens, who is involved and who guarantees it – more than who runs it) matters. Typically, the details of a collective value creation process are not debated. One of the reasons is that this discussion foregrounds a state versus market dichotomy; a reflection of a market failure policy narrative that has yet to move past the idea of which player has more capacity to deliver results efficiently. However, Bozeman's (2002) work on public values, which builds on Moore's (1995) seminal work on public value management (PVM) theory, calls for efficiency not to be the leading argument for policy delivery just 'by force of available analytical tools'. Bozeman argues that efficiency is one of many 'public values' (see definition in section 4) that the public could hold at any time.

Implications for public value creation. **B**enefits to society. **A** framework for public value creation? The key is to understand public value creation as a process created by the public and private sectors, not only created by one and fixed by the other (Mazzucato and Ryan-Collins 2022). In practice, this conception of public value creation means

capabilities and has made it more vulnerable to being captured by vested interests.

A When the state outsources some of its functions, it loses institutional memory and overall implementation capacity in the long run. Unless the state engages in building DPI, essential societal functions will be the exclusive (knowledge) property of private corporations, usually even foreign ones. This results in most states losing sovereignty and affects public institutions' ability to guarantee the common good pillars. This vision does not imply that governments should be running and operationalising all the DPI components, but that there needs to be a minimum mass of implementation capacity to ensure meaningful regulative



can be embedded in technical attributes and well-defined functional purposes (see section 4). Second, the five pillars of the common good can be translated into governance practices and processes. Finally, governance and values need to be aligned with clearly articulated and aspirational societal goals. Below, we further explore the five pillars outlined above and suggest directions for application in the DPI context.

Figure 3b: Governing DPI for the Common Good

Source: Author's elaboration based on Mazzucato (2023)

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5.4 A (Eaves and Goldberg 2018). To the Indian government, the main reason for establishing residents' identity was to simplify the distribution of welfare benefits (including direct cash transfers, subsidised food, cooking gas and other benefits). The government feared that a substantial portion of those benefits was being wasted due to fraud and corruption. Building a system to identify an individual uniquely was paramount to prevent fraud and improve the targeting of social benefits. This directionality also made additional scaling easier. It turned out that a scaled identity solution was not only helpful for welfare benefit leakage, but streamlined 'know your customer' (KYC) compliance for all sorts of critical services, from banking to telecommunications.

5.4 B (Eaves et al., forthcoming). Initially, the Jamaican government declared an interest in building an ID system, but did not link it to a primary policy purpose. This allowed others to imagine the ID's purpose, fostering the distrust of civil society actors, who were suspicious of the government's intentions. It was also a wasted opportunity, as the government did not focus on developing a programme or application that would benefit its citizens.

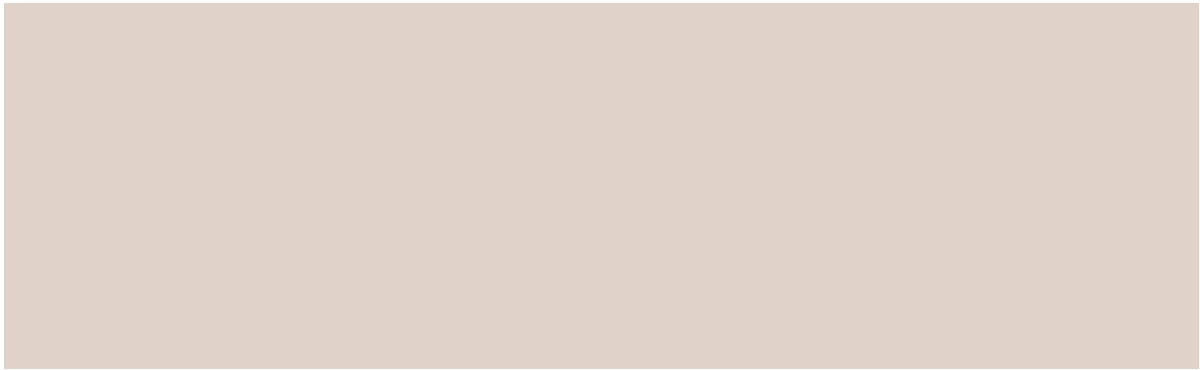
- What normative public values support the DPI creation?
- Is the DPI built considering priority use cases (without losing sight of broader applicability)?
- Are civil society organisations and other societal representatives involved in defining purpose?
- Is the government responsible for orchestrating the DPI design and implementation process?

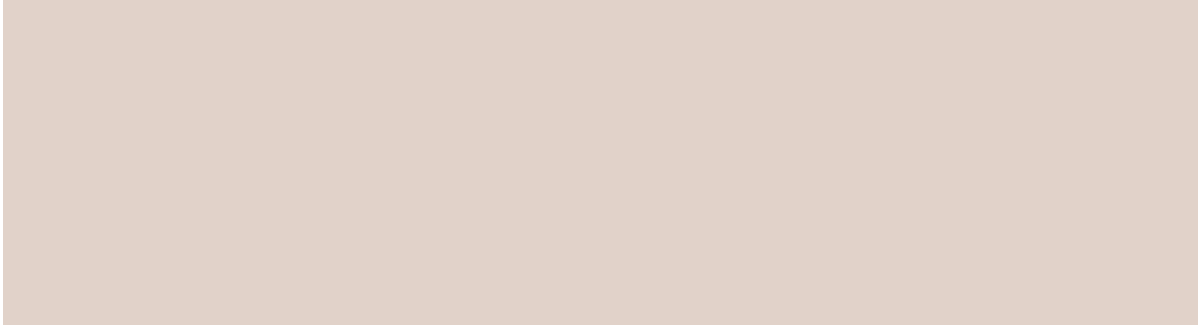
5.4 C *Designing a Digital Public Identity*

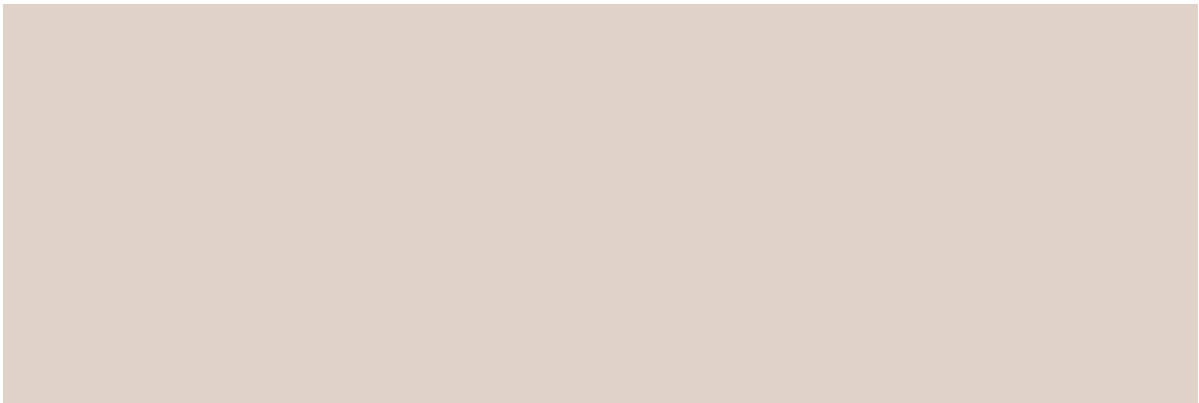
Designing a Digital Public Identity (Eaves and Goldberg 2018)

technology, is more challenging than an open-source or digital public good option.

B **D I.** Launched in November 2020 by Brazil's Central Bank (BCB),







Transparency also potentially enhances access by making initiatives more well-known and creating a stronger value proposition for citizens. However, transparency by itself does not guarantee accountability and trust. For example, if interactions with citizens through making data available are not operationalised in a user-friendly way, then the effect on trust can be neutral or possibly negative.

- Can citizens and companies consent or audit how and when their data is being used?
- Are key decisions (technical and management) about the infrastructure available in an accessible language and format?
- Is the DPI governed by a public-interest entity?

6. Digital Public Infrastructure (DPI) and Public Value Creation

6.1. Introduction

In the context of a growing interest in the DPI approach for achieving sustainable development goals and other societal impacts, major investments and decisions about the design and governance of DPI are taking place. This is a crucial moment for further reflection on the choices that can increase or harm the potential for public value creation.

In this paper, we outlined one central question for analysis: what does 'public' mean in digital public infrastructure? To answer this question, we argued that no infrastructure is neutral in directionality and demonstrated that DPI is no exception. We argued that the current narratives through which different groups understand the publicness of DPI, although vested under the broad concept of public interest, already embed a directionality through values generated by attributes or led by functions. We hope to have contributed to the literature and the policy world by making these values explicit (see Figure 3).

However, making values explicit is an important and necessary step for public value maximisation, it is insufficient. If one understands public value creation as a process co-created by the public and private sectors, not only created by one but fixed by the other (Mazzucato and Ryan-Collins 2022), then functions, attributes and even public provision are limiting. We suggest that the debate on DPI starts by making public values explicit, but that it goes beyond it. Public value maximisation must be a collective effort focusing on outcomes and processes towards the common good. In this process, the state has a renewed role in guaranteeing and orchestrating DPI. The 'common good' framework (Mazzucato 2023) and its five principles emerge as useful perspectives to strengthen DPI's value generation process with a focus on governance.

Figure 4. A summary of the paper's arguments

What is 'public' about DPI?		
Current Interpretation	In practice	Proposed Interpretation
P as Public Interest	P as Public Values	P as Public Value Maximization
<ul style="list-style-type: none"> An ideal to be pursued, but yet (Bozinger) Leads to confusing definitions of DPI due to implicit interpretations or publicness 	<ul style="list-style-type: none"> DPI is not neutral already at play, associated and attributes of DPI (e.g.: social value, essential capabilities, dynamic efficiency, and scalability) 	<ul style="list-style-type: none"> Five pillars of public values and functions) five pillars of the German Good Proactive relationship (market shaping perspective)

Source: Authors' elaboration

D I We leave a call for researchers in the public administration and digital government field to consider more robust investigations on the specific policy tools and management mechanisms required to apply a common good governance framework to DPI for creating even more public value. After all, as Star and Ruhleder (1996) remind us, infrastructure is only such when or while it facilitates value.

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