Working Paper Series

Digital public financial management

An emerging paradigm

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Public finance in the digital era

Key messages

The prevailing approach to digitalisation is contributing to a public financial management system that is rigid and losing relevance.

Developing a public financial management system that is more flexible and responsive to the needs of users (policy-makers, civil servants and citizens) requires governments to embrace emerging approaches to digitalisation.

Data is the foundation for digital government. Improving data governance is fundamental for realising a *digital revolution in public finance*.

The finance ministry has a key role to play, not just in making public finance digital, but in making government digital.

Lower-income countries have the most to gain from digitalisation. Development partners need to adjust their funding models to be more supportive of emerging approaches to digitalisation.

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Glossary

Application programming interface (API)
A way for two or more computer programs to communicate with each other.

Budget execution
The set of processes through which governments deliver on the promises and proposals included in the budget.

Budget preparation
The production of the formal government budget proposal to be submitted to the legislature, as the output of the budget process.

Chart of accounts (CoA)
A hierarchical coding structure for the classification and recording of financial information.

Commercial off-the-shelf (COTS) solution
An information technology product or package designed to meet generic market needs.

Debt management system
Information technology for the automation of debt management processes including recording, monitoring and analysing debt information.

e-Procurement system
Internet-based information technologies for the automation of public procurement processes including tendering and contract management.

ERP system
A type of business management software – typically a suite of integrated applications – that an organisation can use to collect, store and manage data from various sources and business activities.

Financial management information system (FMIS)
Information technology that supports the automation and integration of public financial management (PFM) processes including budget formulation, execution, accounting and reporting.

Government service bus
A software tool that enables several IT applications to communicate and exchange information with each other.

Greenfield
An opportunity to create something new from scratch. In technology terms, a situation where a new service can be designed without needing to consider the transition from existing systems.

Interoperability
The ability of one information system to exchange information with other systems.

Legacy technology
Often used to simply refer to older technology. Here, we use legacy technology to refer to technology where the cost of maintenance is higher than the value delivered, because, for example, it is no longer widely supported, has diverged significantly from the way the organisation wants to work or does not fit into the wider architectural direction of an organisation.

Public investment management system (PIMS)
Information technology that supports the automation and integration of processes for managing capital expenditure over a project's life.

Technology architecture
How the different pieces of technology – hardware and software – that make up a system come together to perform its intended function, and the act of designing and managing those pieces, and of ensuring they are of the right quality. Architectures can be 'closed', meaning that the system is always considered as a whole and operates independently of others, or 'open', where effort is given to ensure the component parts can be managed independently and that the system is designed to connect into a wider ecosystem.

Treasury single account
A tool for consolidating and managing a government's cash resources and for minimising borrowing costs.

Executive summary

- While there is well-founded optimism surrounding a *digital revolution in public finance*, it is difficult to reconcile this enthusiasm with the current realities of public financial management (PFM).
- Despite significant investments in IT for PFM, the prevailing paradigm has struggled to deliver successful digital transformation.
- This prevailing paradigm is characterised by an unsuitable funding and delivery model, which contributes to a closed and siloed technology architecture. This is inseparable from a PFM system which is rigid and losing relevance.
- To be more flexible and responsive to users' needs (policy-makers, civil servants and citizens), PFM should embrace the new paradigm for *digital government*, its key principles – single source or truth, re-use and user-centricity – and ways of working.
- This emerging paradigm for *digital PFM* recognises PFM and digital as *means to an end*, and PFM processes (and the digital solutions that underpin them) as requiring ongoing iterative redesign to remain flexible and responsive to users' needs.
- This implies shifting to a much more open technology architecture in which digital solutions for PFM are part of a wider ecosystem of shared digital infrastructure, data and services. And to make this possible, governments need to reform their funding and delivery models to be more outcome-focused and problem-driven.
- Data is the foundation for *digital government*. Improving data governance is fundamental for realising a *digital revolution in public finance*. As a community of practice, PFM is both a provider and user of government data, and it should set standards for itself and what it expects from others.
- Finance ministries have a key role to play, not just in making public finance digital, but in making government digital. A *whole-of-government approach* requires its central institutions to act as standard bearers and as regulators for digitalisation.
- Lower-income countries have the most to benefit from this emerging *digital PFM* paradigm. Development partners need to adjust their funding models to be more supportive of emerging approaches to digitalisation.

1 Introduction

Digital transformation is everywhere. It is used to describe so many things that it risks losing its meaning, and with it, the potential for a common approach to supporting it in pursuit of equitable, sustainable development (Schoemaker, 2020).

There is currently a great deal of optimism around the potential of digitalisation to reshape PFM to be more responsive to contemporary challenges and expectations (Gupta et al., 2017a; AlphaBeta, 2018a). Much of this optimism is well-founded. Digitalisation is already changing how governments administer taxation and spending and deliver public services. During the Covid-19 pandemic, governments with good digital capabilities were better positioned to design and implement timely fiscal policy responses, from the United Kingdom's furlough scheme to Colombia's *ingreso solidario* cash transfer programme.

However, digital solutions for PFM often fall short of expectations. 'Big bang' approaches take a long time to implement, are expensive and often produce disappointing results. Governments can find themselves locked into legacy technologies and closed architectures, making them less responsive to the changing needs and expectations of users – including civil servants, policy-makers and citizens. In sharp contrast, emerging approaches to digital government emphasise a more flexible architecture and agile delivery models that promise greater value for money.

The underwhelming impacts of digitalisation in strengthening PFM systems, as well as how they support service delivery, necessitates a rethink of how digital and PFM intersect. This paper considers the question: what does it mean for PFM to be digital? We do this by contrasting the prevailing paradigm with wider developments in digital government, in order to construct an emerging paradigm. We refer to this emerging paradigm as *digital PFM*.

In discussing PFM, we rely on definitions that reflect its expanding role, evolving nature and relationship to service delivery (or results) (see Box 1). However, we limit much of the discussion to the traditional expenditure management role of PFM.[1] We also take an expansive view of what digital means, recognising it as distinct from

[1] This is mainly because, on the revenue management (or tax administration) side of PFM, the emerging paradigm appears to be further along. Such a discussion would also be beyond the scope of one paper.

digitisation, but related to digitalisation and digital transformation. As a result, we sometimes use digital, digitalisation and digital transformation interchangeably.

Box 1 Definitions

Public financial management (PFM)

'The way governments manage public resources (both revenue and expenditure) and the immediate and medium-to-long-term impact of such resources on the economy or society. As such, PFM has to do with both process (how governments manage) and results (short-, medium-, and long-term implications of financial flows)' (Andrews et al., 2014).

'PFM is now seen as an "umbrella" definition, covering a set of systems aimed at producing information, processes, and rules that can help support fiscal policymaking as well as provide instruments for its implementation' (Cangiano et al., 2013).

'An "open" system that learns and interacts with the broader policy domain' (Manning et al., 2020).

Digitisation

'The transition from analog to digital services with a 1:1 change in the delivery mode and the addition of a technological channel of delivery' (Mergel et al., 2019).

Digitalisation

'Changes in the processes beyond mere digitizing of existing processes and forms' (ibid.).

Digital transformation

'A holistic effort to revise core processes and services of government beyond the traditional digitization efforts. It evolves along a continuum of transition from analog to digital to a full stack review of policies, current processes, and user needs and results in a complete revision of the existing and the creation of new digital services. The outcome of digital transformation efforts focuses among others on the satisfaction of user needs, new forms of service delivery, and the expansion of the user base' (ibid.).

Digital

'Applying the culture, processes, business models and technologies of the internet era to respond to people's raised expectations' (Loosemore, 2017).

Our objective is to encourage further discussion, research and experimentation on the concept of *digital PFM*, with a particular focus on its application in lower-income countries. To that end, this paper is written with three audiences in mind:

- members of the PFM community[2] who are increasingly frustrated with the prevailing paradigm;
- members of the digital community who recognise PFM as an important domain to engage with, but are unsure how to do so;
- members of service delivery communities who want to get more from the first two communities to solve the problems they are working on.

We recognise that the international development community straddles all three of these communities and hope the paper is also useful for those working in international organisations, particularly those with influence over how digital projects for PFM are designed and funded.

This paper also recognises recent efforts to clarify the role of PFM and its objectives vis-à-vis public finance (or fiscal policy) objectives which have been the source of some confusion (Cangiano, 2019; Manning et al., 2020). Building on these efforts, we view PFM and digital as *means to an end*, or part of the 'how' that governments use to deliver their policies (the 'what'). Nevertheless, by bringing PFM and digital together in a more holistic manner we believe there is an opportunity for *digital PFM* to inform not just how governments do things, but also what they do. The central concern of this paper is therefore how *digital PFM* can support a *digital revolution in public finance* (Gupta et al., 2017a).

The rest of the paper proceeds as follows. Chapter 2 outlines the problem with the prevailing paradigm. Specifically, we discuss the problem with the current approach to funding and delivering IT projects for PFM, how this contributes to a closed and siloed PFM technology architecture, and how these problems are inseparable from a rigid approach to PFM that is losing its relevance for policy-makers.

Chapter 3 considers the application of wider developments in digital government to PFM. We begin with a discussion of what a more flexible and responsive PFM system might look like, before discussing the technology architecture and funding and delivery approaches that could help realise this.

[2] We use the term community here and elsewhere to refer to government officials and their advisors, as well as other practitioners in the field.

Chapter 4 discusses the main benefits of this emerging *digital PFM* paradigm – finding a better balance between standardisation and flexibility, delivering on the promise of interoperability and getting better value for money. Chapter 5 concludes with some thoughts on next steps for realising the benefits of *digital PFM*, as well as questions for future research by ourselves and, we hope, others.

In creating such a sharp dichotomy between the prevailing and emerging paradigms, we recognise that we are building a straw man of the prevailing paradigm that is never wholly applicable to any one context. We also recognise that, for some stakeholders and contexts, our description of the prevailing paradigm may be somewhat dated. Nevertheless, we feel it is useful for readers to have a sense of the digital journey PFM has been on, as a prelude to where it might be going.

Finally, readers from outside the PFM domain may recognise the problems with the current paradigm as applicable to their own domains. Indeed, these criticisms can be generalised to other IT projects across government. Nevertheless, our contention is that PFM as a discipline, and finance ministries as institutions, are different. By embracing the approaches to digitalisation described under the emerging paradigm, they have the potential to act as a force multiplier for digitalisation across the rest of government, which we see as one of the main benefits of *digital PFM*.

2 The problem with the prevailing paradigm

The current approach treats PFM as a 'closed' system, in which the PFM processes and conventions that drive operational performance are considered to be unchanging ends in and of themselves (Manning et al., 2020).

Despite significant investments in IT for PFM, governments often fail to reap the benefits of digitalisation. Part of the problem is governments' approach to funding and delivering digital infrastructure, which is based on the same methodology used to deliver physical infrastructure. This also contributes to a closed technology architecture in which parts of the PFM system are siloed from each other, and the PFM system as a whole is siloed from the wider government data ecosystem.

These problems are inseparable from a broader approach to PFM reform in which best practices, along with the digital solutions that underpin them, are pursued, not in the interest of resolving a clearly articulated problem, but for their own sake or as a signalling tool to gain external legitimacy.

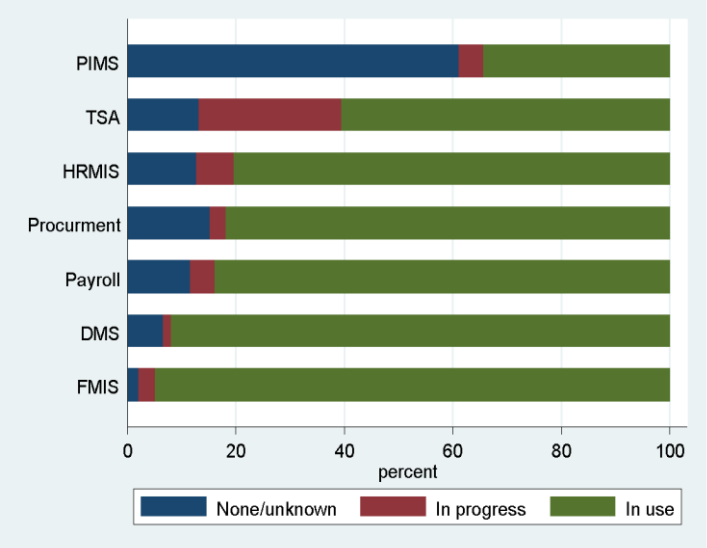
This chapter begins by considering the current approach to funding and delivering IT for PFM, before outlining the technology architecture that characterises the PFM system. It concludes with a discussion of how they are embedded in an approach to PFM that is rigid and losing policy relevance.

2.1 An unsuitable funding and delivery model

In many cases, there remains a disconnect between having these systems in place and real functional improvements (Fritz, 2017).

Over the past 30 years governments have made significant investments of time, money and political capital in IT for PFM reform (see Figure 1). These investments have automated processes for budgeting, spending controls, payments, accounting and reporting, and have made fiscal transparency easier. Nevertheless, these efforts often fall short of expectations, and sometimes result in outright failure (see Box 2). The way in which these projects are funded and delivered contributes to this disappointment.

Figure 1 The adoption of IT for PFM

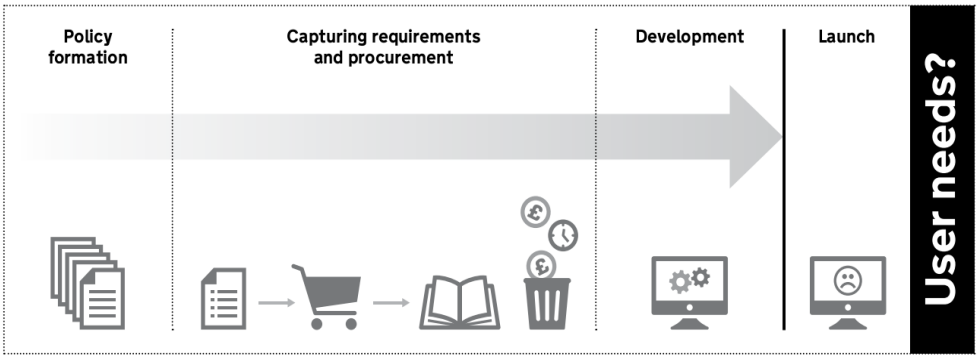


Note: Across 198 countries. PIMS = public investment management system; TSA = treasury single account; HRMIS = human resource management information system; DMS = debt management system; FMIS = financial management information system. These and other IT systems are often referred to collectively as an integrated financial management information system (IFMIS).

Source: World Bank Group (WBG) GovTech Dataset (October 2022)

Governments often rely on a waterfall approach[3] for delivering IT projects (see Figure 2). This sequential approach to project management is supposed to reduce uncertainty by capturing all of the system requirements up-front, before advancing to procurement and/or development. Funding is also budgeted up-front and linked to implementation milestones. This approach equates digital infrastructure with physical structure and, by extension, with capital investment.

Figure 2 The waterfall approach to digital solutions

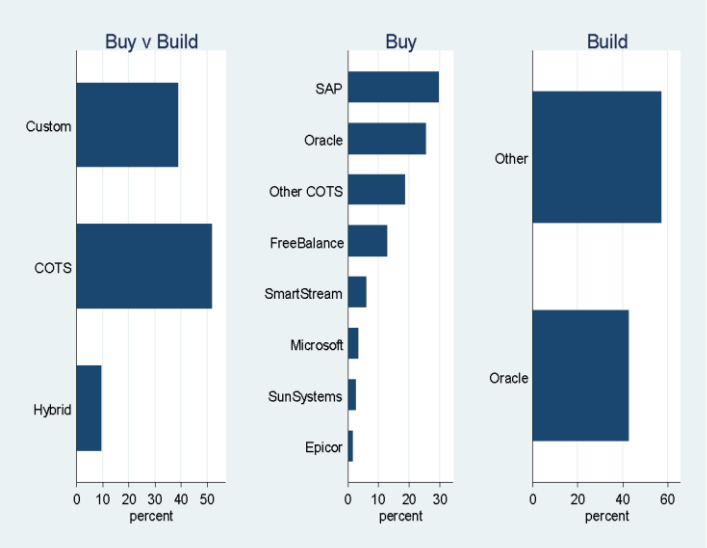


Source: UK Government (2022), adapted by Public Digital

[3] See Kavlakoglu (2020) for a further discussion of the waterfall approach.

In practice, governments tend to take a solution-driven approach, e.g., looking at what products are available rather than the problems they are trying to solve. This tends to bias many towards a small group of international vendors that provide comprehensive commercial off-the-shelf solutions (COTS) (see Figure 3). For example, in Ghana and Zambia, a solution-driven approach prioritised advanced budget preparation methodologies over more fundamental problems in budget execution in their choice of technology,[4] and failed to produce the desired improvements (Hashim and Piatti, 2018).

Figure 3 Reliance on COTS for FMIS



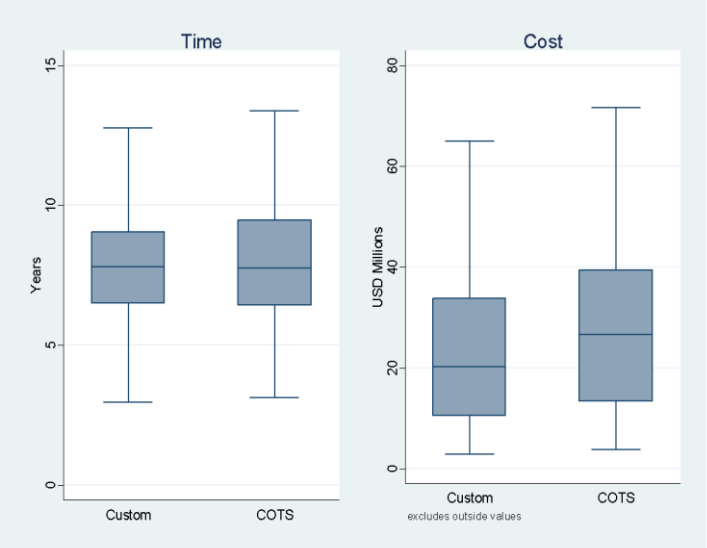
Note: For 193 of the 198 countries with an FMIS. Approximately 61% of countries use COTS (9% of which are hybrid combinations with custom software). Of this 61% SAP, Oracle and FreeBalance have 68% of the market. Of the remaining 39% of countries with custom solutions, Oracle supplies the database for 43%.

Source: WBG GovTech Dataset (October 2022)

Comprehensive COTS solutions are expensive and take a long time to implement. The average time to implement a COTS FMIS was eight years in the period 1995–2017, while the average cost was $27 million (excluding outliers: see Figure 4). These substantial investments of time and money (as well as political capital in change management) can result in implementation becoming the goal, rather than the benefits these investments are supposed to deliver for users and ultimately the wider public (Andrews, 2010; Fritz et al., 2017). Lengthy implementation periods also present a problem when ‘requirements’ change, as they inevitably do over such long periods of time.

[4] Ghana and Zambia implemented Oracle and SAP respectively. Source: WBG GovTech Dataset (October 2022).

Figure 4 Time and cost to implement an FMIS



Note: For 124 completed projects approved over the period 1995–2017. Including outliers, the average cost of a custom and COTS FMIS was $26 million and $49 million, respectively. Costs are in nominal terms and therefore understated.

Source: WBG FMIS Projects Database (July 2022)

The benefits of these comprehensive COTS solutions are also difficult to realise. The advantage of COTS solutions is that they allow for the adoption of best practices in financial management. But this means that they 'tend to impose a standard structure on business processes, forcing the government to organize the application, not the other way around' (Rodin-Brown, 2008). In reality, many governments are unable to customise the solution and require the vendor to do so.[5] Customisation increases the cost and the time it takes to implement these solutions, and also makes them more difficult to maintain later (Joshi et al., 2015; Boots, 2020; Central Digital and Data Office, 2021).

This funding and delivery approach is also problematic for governments that develop their own custom solutions. A willingness to make up-front investments in developing these solutions is frequently not matched by a willingness to spend on the in-house skills and operating costs of maintaining them subsequently (Hashim and Piatti, 2018; Pimenta and Seco, 2019).[6] And while the advantage of custom solutions is that they can be designed with local capacity and context in mind, they have been associated with simply digitising inefficient processes rather than realising the benefits of digital

[5] In such instances, Boots (2020) refers to these as 'fake COTS'.
[6] Audiences from outside PFM may recognise this as a problem in their own domains. For example, in the education sector, governments have struggled to maintain education management information systems (EMIS) following the conclusion of donor projects (Powell and Trucano, 2006; Abdul-Hamid et al., 2017).

transformation through process redesign (Rodin-Brown, 2008; Hashim, 2014; eGov Foundation, 2023).

It is not just lower-income country governments, or indeed governments, that struggle to deliver financial management IT projects (see Box 2). Nevertheless, in lower-income countries where PFM reform attracts major technical and financial support, and IT systems for PFM are a substantial component of that spend (AlphaBeta, 2018b), waterfall approaches are often reinforced by donors. This is because their funding operations and procurement rules tend to favour the false certainty of large business cases, established solutions and up-front investments.

Box 2 IT failures in OECD countries

While there is a plethora of examples of government IT implementation failures, the Phoenix and Novopay payroll systems stand out.

Phoenix – Canada

The Phoenix project involved the replacement of a decades-old payroll system covering over 40 departments and agencies. It cost CAD 310 million over seven years, and was expected to deliver CAD 70 million in cost savings after going live in 2016. But employees were paid late, too much and too little – with as many as 51% of employees affected. Auditors subsequently described the initiative as an 'incomprehensible failure of project management and oversight' and 'less efficient and more costly than the 40-year-old system it replaced'. They noted that the 'Phoenix executives were more focused on meeting the project budget and timeline than on what the system needed to do' (Office of the Auditor General of Canada, 2018).

Novopay – New Zealand

Novopay was intended to streamline payments to the 110,000 teachers, administrators and staff working in New Zealand's education system. It was implemented in 2012 after seven years and a series of delays, and ultimately cost NZD 182 million.[7] 'Dubbed the Novopay debacle, at one point affected staff had reported more than 18,000 payroll errors and the operational staff supporting the system appear to have been overwhelmed by the amount of manual intervention needed to correct those errors' (Calleum Consulting, 2022). The 'debacle' ultimately led to the resignation of the education secretary.

[7] For more information, see: Digital Government Case Studies: Novopay.

Private sector

Along with the United States Navy and utility company National Grid, other entities such as Nike, Revlon and MillerCoors feature in a recent top-10 list of enterprise resource planning (ERP) failures (Kimberling, 2021).

Much has been made of the buy versus build debate in PFM. But the bigger issue is the failure to invest in in-house digital capabilities. These capabilities are required to help governments decide whether and what they should buy or build; manage relationships with vendors; and maintain in-house solutions.

More fundamentally, they are needed to manage more problem-driven and iterative approaches to funding and delivering IT projects for PFM. Under the current approach, the IT component of PFM reforms tends to be too big to fail. This leads governments to persist with their implementation long after the intended benefits have failed to materialise, locking themselves into legacy technologies at the same time as new opportunities are becoming available,[8] and often contributing to a closed and siloed architecture.

2.2 A closed and siloed architecture

Most countries already have operational core public financial management (PFM) and other systems to support core central government operations … [but] … most of these systems are not interconnected and data exchange is not sufficiently automated (World Bank, 2021a).

One of the reasons governments struggle to get the most from their IT investments for PFM is that they have trouble connecting them into what is often referred to as an integrated financial management information system (IFMIS).[9] Systems for different PFM functions are often siloed from each other, as well as being siloed from the wider government data ecosystem. This limits their potential for improving the efficiency of government operations and for providing timely,

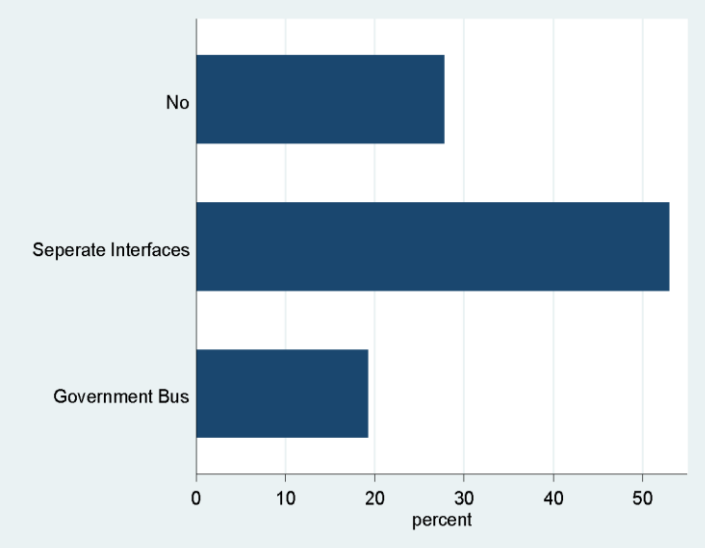
[8] For example, most governments have now invested millions in heavily customised FMIS, which vendors are now beginning to replace with the next generation of cloud-based ERP systems that provide Software-as-a-Service (SaaS).

[9] 'Whenever FMIS and other PFM information systems (for example, e-Procurement, payroll, debt management) are linked with a central data warehouse (DW) to record and report all daily financial transactions, offering reliable consolidated results for budget analysis, decision support, performance monitoring, and web publishing, these platforms can be referred to as integrated FMIS (or IFMIS). IFMIS solutions are rare in practice, and to avoid unrealistic expectations, the term should not be used as a synonym for core FMIS functionality' (Dener and Min, 2013). Despite this recommendation, the terms FMIS and IFMIS are often used interchangeably.

quality information for policy decisions. Part of the problem relates to technology choices, but poor data governance is a major contributor.

Reliance on COTS can play a role in this closed and siloed architecture. It is in the interest of commercial vendors to provide a suite of integrated modules, rather than ensure interoperability between their software and others. To enable data exchange between different solutions, governments may need to purchase proprietary interfaces and manage the services of systems integrators, which requires expertise many do not have.[10] At best, this can lead to a plethora of expensive separate interfaces between different systems, but in many cases these systems remain siloed from each other (see Figure 5). This contrasts with a minority of countries that make data from the FMIS available to other systems via a government service bus.[11] Data exchange between custom solutions can be equally as challenging where there are insufficient in-house resources (Pimenta and Seco, 2019).

Figure 5 Does the FMIS exchange data with other systems?



Note: For 193 of the 198 countries with an FMIS.

Source: WBG GovTech Dataset (October 2022)

Beyond finding the right technology mix, governments often make things difficult for themselves through poor data governance. For systems to exchange data they need to share the same data

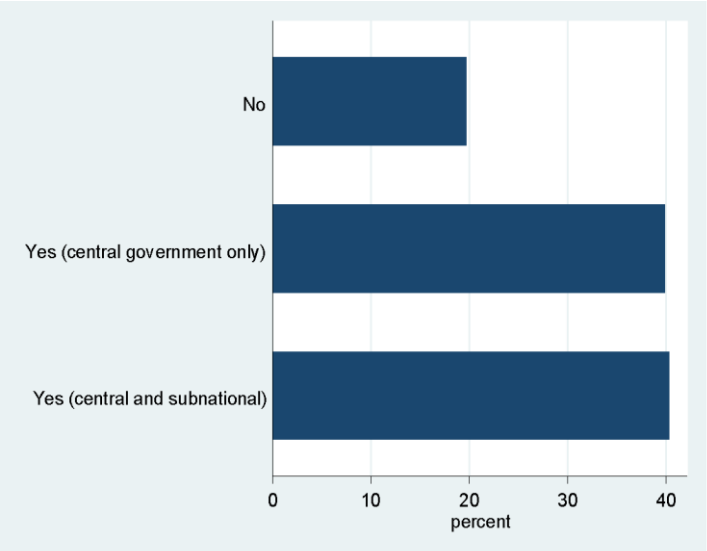
[10] 'Systems integrators – the companies that support implementation and maintenance – often do not have experience with blending different types of systems (open/proprietary, legacy/new). Building more open digital public infrastructure does not necessarily prescribe using open or proprietary solutions, but governments need more knowledge on how to blend the two in practice' (Gates et al., 2022).

[11] E.g., an interoperability platform for the exchange of data.

structures.[12] One of the most fundamental data structures in PFM is the *chart of accounts*, described as the 'lynchpin of a well-functioning PFM system' (Pattanayak and Cooper, 2011).

However, differences frequently persist between the charts of accounts used in budget preparation systems and treasury management systems.[13,14] Only 40% of governments have a unified chart of accounts covering the whole of government (see Figure 6). Even where a unified chart of accounts is established, frequent changes are not reconciled with previous iterations, making it difficult to understand changes in spending over time.[15]

Figure 6 Is there a unified chart of accounts?



Source: WBG GovTech Dataset (October 2022)

[12] Or it needs to be possible to translate data from one system to make it readable for another system.

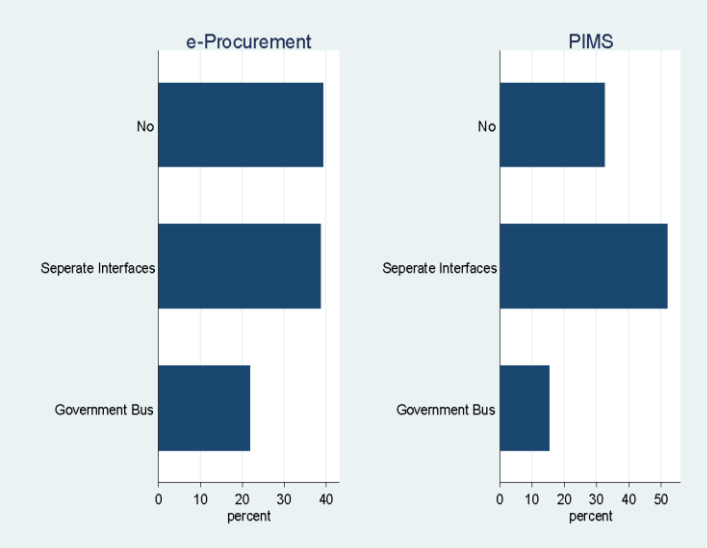
[13] For example, in Kenya 'the financial management information system (FMIS) captures information according to budget lines but not the structure underpinning the program-based budgets produced by the central and county governments' (ThinkWell and WHO, 2022). For Mongolia the chart of accounts for budget and treasury 'had some level of unification in the earlier stages but overtime has deviated substantially from the requirements, especially in terms of the new budget law of 2011' (Joshi et al., 2015).

[14] The perceived answer to this problem is often to purchase an integrated solution. However, there are often good practical reasons for developing a separate budget preparation module. Most notably, separate software for budget preparation can be more easily and cheaply provided to spending units compared to providing them with software licences for the budget module of a COTS solution. And governments often have distinct requirements for how their budgets are prepared and presented, which the budget modules of COTS solutions cannot deliver without customisation.

[15] A long-term review of public expenditure in the UK notes 'the remarkable difficulty we have experienced in collecting and interpreting data on plans and out-turns which are consistent over time' and raises concerns about transparency and accountability (Crawford et al., 2018).

Lack of integration between budget preparation and treasury systems is emblematic of this problem, but similar issues apply to other systems that make up the technology architecture that underpins the PFM system. For example, debt management systems are often siloed from treasury systems (Rivetti, 2021). Similarly, e-procurement systems and public investment management systems (PIMS) mostly do not exchange data with other systems or do so through separate interfaces, rather than providing open access through a government service bus (see Figure 7).

Figure 7 Do the e-procurement and PIMS exchange data with other systems?



Note: For the 168 and 77 of 198 countries that have an e-procurement system and a PIMS respectively.

Source: WBG GovTech Dataset (October 2022)

It can also be challenging to extend access to systems across and between levels of government. Most countries take a centralised approach to technologies including their FMIS, mirroring a centralised approach to PFM operations (see Table 1). However, onboarding different ministries, departments and agencies can be difficult because they need to conform to the business processes of the central technology (Rodin-Brown, 2008; Joshi et al., 2015).[16] And extending coverage to local governments and service delivery units requires more expense in terms of hardware and software licences (Joshi et al., 2015).

[16] Hashim and Piatti (2018) cite the example of Pakistan, where 'self-accounting agencies with departmentalized accounts, such as the defense department, railways, the post office, and others at the federal level, and the public works department, forest, irrigation, and others at the provincial level' only post periodic summaries to the FMIS ex-post.

As a result, governments often rely on a *treasury-centric approach*,[17] which can leave gaps in the digitalisation of expenditure management and reporting (see eGov Foundation, 2023), create administrative burdens for the treasury[18] and cause delays for spending units.[19] A minority of mostly OECD anglophone countries take a decentralised approach to their PFM operations, including devolving technology choices. While this allows spending units the autonomy to purchase technologies that better match their requirements, it also results in costly duplication and a coordination burden for the central fiscal agency.

Table 1 Centralised versus decentralised PFM operations by income group

	HIC	UMIC	LMIC	LIC	Total
Centralised	35	53	48	29	165
Decentralised	29	2	2	0	33
Total	64	55	50	29	198

Note: In governments with centralised PFM operations the treasury is predominantly responsible for processing payments. In governments with decentralised PFM operations, some responsibilities for payment processing are delegated to spending units. HIC = high-income country; UMIC = upper middle-income country; LMIC = lower middle-income country; LIC = low-income country.

Source: WBG GovTech Dataset (December 2020)

This lack of coverage and/or integration between different systems across and between levels of government makes it more difficult to provide policy-makers with a comprehensive overview of spending or to answer more detailed questions about spending. For example, the last IMF Government Financial Statistics (GFS) yearbook shows that

[17] Under a treasury-centric approach, spending units are required to bring or submit expenditure and receipt transactions to a designated treasury office, which processes the transactions on their behalf. For further discussion of the pros and cons of the treasury-centric approach, see Hashim (2014) and Joshi et al. (2015).
[18] Describing the treasury-centric approach in fragile states, Symansky (2010) notes that 'the result was that payment requests piled up in the [finance ministry] and staff had the choice of either approving without properly analysing the payment order or generating substantial delays'. Government spending is typically skewed towards a high volume of low-value transactions that account for a small share of the total budget (Hashim and Piatti, 2018; Hashim et al., 2019). Hashim and Piatti (2018) suggest a risk-based approach to the centralisation of payment processing by focusing on routing the 20% of large transactions that make up 80% of the budget through the FMIS and delegating responsibility for controlling the other 80% of transactions to the responsible spending units.
[19] Describing the use of advances in Cambodia, Hashim et al. (2019) note that 'The entire process of using advances for a major part of the recurrent expenditure is necessitated by the fact that on average it takes about three weeks to process an expenditure transaction through the normal payment process and agencies adopt these alternative methods to avoid these delays'. Moreover, 'evidence has shown that without timely budget release procedures, managers develop informal arrangements to bypass the FMIS' commitment and budget control procedures (Ghana and Malawi are examples)' (Hashim and Piatti, 2018).

78 out of 167 countries do not produce consolidated fiscal reports for the whole of government,[20] let alone on an accrual basis (see Table 2). And in many lower-income countries, decision-makers in the health sector 'struggle to get timely and detailed data about the allocation, flow, and use of health funds by different government agencies at all levels of government as well as by health providers' (Banks et al., 2023).

Table 2 General government (consolidated) reporting by basis of reporting and income group

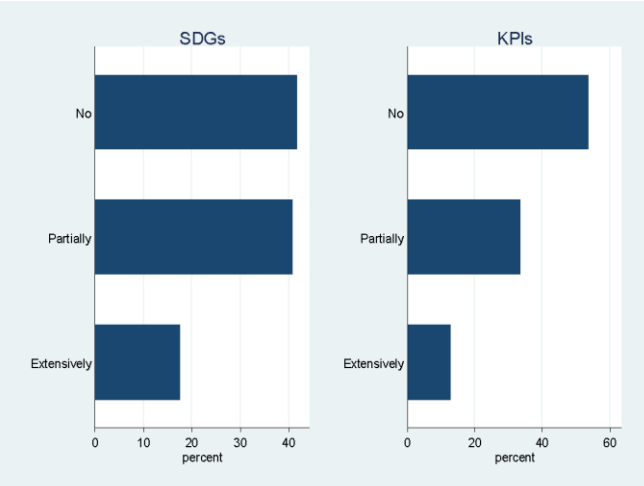
	LIC	LMIC	UMIC	HIC	Total
Non-cash/ accrual	1	3	12	39	55
Cash	2	13	15	4	34
Not available	16	30	21	11	78
Total	19	46	48	54	167

Source: IMF (2017)

Data exchange between the PFM system and the wider government data ecosystem is even more challenging. For most countries, spending data is only partially linked to performance indicators like the Sustainable Development Goals (SDGs) (see Figure 8). Linking spending to inputs, outputs and outcomes requires the ability to join up datasets across government siloes. This again requires a level of coherence in data structures that is often absent. For example, in Ghana, Zahra Diop et al. (2020) note substantial challenges linking Human Resources (HR) and finance datasets with data on service delivery indicators from health information management systems. Morgado et al. (2022) note similar challenges in analysing the equity and efficiency of public expenditure in Uganda.

[20] E.g., covering central government, extra budgetary units/entities, social security funds and subnational governments.

Figure 8 Does the FMIS link spending to the SDGs and key performance indicators for programmes and projects?



Note: For the 194 of 198 countries that have an FMIS.

Source: WBG GovTech Dataset (October 2022)

These problems are not confined to lower-income contexts. For example, the UK's Infrastructure and Projects Authority has criticised the Treasury's FMIS for not allowing it to meet its core objective of tracking project costs and schedules to ensure they remain on track.[21] The efforts of higher-income countries to link budget, spending and performance data – often referred to as performance budgeting – are another example. A review of the experiences of seven countries with performance budgeting notes that 'no country studied could point to an IT approach that has solved basic issues of how to efficiently collect and distribute the appropriate amount of information to each audience' (Moynihan and Beazley, 2016).

Solving these interoperability issues is less about new technologies, and more about how governments approach technology choices and manage the wider data ecosystem. A shift in mindset is imperative as the current closed and siloed architecture that results from this lack of interoperability contributes to a rigid PFM system that is losing relevance.

[21] Among the issues the Authority cites with the Online System for Central Accounting and Reporting (OSCAR) are that it is expensive to maintain; it is complicated to use; it is inflexible to changes without further expenses charged by the vendor; it does not have enough licences for users; and it does not allow users to access their data. See Online Platform for Projects (ESOPP) Discovery - Digital Marketplace.

2.3 A rigid PFM system that is losing relevance

From a policy perspective, the PFM paradigm is at the limits of relevance and utility in its current, inwardly focused form (Manning et al., 2020).

The problems with the prevailing PFM and digital paradigm discussed in the previous two sections are inseparable from a broader approach to PFM that is rigid and losing relevance. Under this approach, best practices are pursued for their own sake, and often at the expense of a PFM system that could be more responsive to emerging challenges, changing expectations and new policy priorities. Just like the PFM system itself, digital solutions for PFM struggle to strike the right balance between standardisation and flexibility.

This lack of flexibility was exposed during the Covid-19 pandemic, when governments relaxed or suspended good practices for the sake of expediency (Bandy and Metcalfe, 2021). While the consequences remain unclear, there are signs that this may further undermine already faltering trust in government. In the US, for example, 'lax oversight allowed a spree of scams with few recent parallels' (New York Times, 2020). In the UK, the relaxation of procurement rules has been associated with political cronyism and was subsequently ruled unlawful by the courts (Busby, 2021). There was in effect no 'Covid module' to deal with the demands of the crisis on the PFM system; rather, the response was often to abandon processes for financial control, reporting and accountability in the name of flexibility.

New policies and changing expectations also place demands for more flexibility on the PFM system. The drive for universal health coverage in lower-income countries is a case in point. Policy-makers are pursuing an ambitious mix of health financing reforms including mainstreaming *performance-based financing* into government operations. These reforms imply delegating greater autonomy for financial management to service providers in exchange for increasing levels of accountability for performance (Barroy et al., 2019). However, it is unclear how these policies and processes will fit within PFM systems that have been established primarily to ensure financial control and compliance (Piatti-Funfkirchen et al., 2021), and where rigidities often complicate the flow of funds for service delivery (Piatti-Funfkirchen et al., 2019).

The relevance of the PFM system for formulating and implementing policies in response to emerging challenges such as climate change and inequality is also the subject of debate. 'Gender budgeting' has focused on 'tagging' budget lines, but this doesn't help policy-makers to understand if these expenditures are having their desired impact (Hadley, 2018; Welham, 2018). 'Green budgeting' reforms are emerging in response to climate change concerns (OECD, 2021a; World Bank, 2021b), but linking expenditure to performance

information has had mediocre results, while at the same time increasing administrative burdens (Moynihan and Beazley, 2016). Similarly, the relevance of traditional financial reporting reforms[22] is being debated in OECD countries (Wynne, 2018), particularly as policy-makers increasingly get their information in real time from other sources, including social media.

Rethinking PFM in the post-pandemic era, with its associated emerging challenges and changing expectations, will require rethinking the architecture of the digital solutions that underpin it, as well as how they are funded and delivered. The outlines of what this paradigm might look like are already emerging. Understanding what this emerging paradigm could mean for PFM is the subject of the sections that follow.

[22] E.g., the transition to accounting on an accruals basis, the adoption of international public sector accounting standards (IPSAS) and the production of whole-of-government accounts.

3 What does it mean for PFM to be digital?

Definition of Digital: Applying the culture, processes, business models and technologies of the internet era to respond to people's raised expectations (Loosemore, 2017).

In this chapter we discuss how developments in digital government can (and in some cases already do) inform an emerging paradigm for PFM, in an effort to answer the question: what does it mean for PFM to be digital? The key differences we see between the prevailing paradigm discussed in Chapter 2 and the emerging paradigm discussed here are captured in Table 3.

The emerging paradigm recognises both PFM and digital as *means to an end*, and PFM processes (and the digital solutions that underpin them) as requiring ongoing iterative redesign so that they remain flexible and responsive to the needs of users and policy-makers. This implies shifting to a much more open technology architecture in which digital solutions for PFM are part of a wider ecosystem of shared digital infrastructure, data and services. To make this possible, governments need to reform their funding and delivery models to be more outcome-focused and problem-driven.

Table 3 Contrasting the prevailing and emerging paradigms

	Prevailing (*digital for PFM*)	**Emerging (*digital PFM*)**
Approach to PFM reform and digital transformation		
Approach	Unchanging ends	Means to an end
Processes	One-off digitisation	Ongoing iterative redesign
Policy	Rigid and losing relevance	Flexible and responsive
Approach to technology		
Choices	Buy or build	Range of options including open source and DPGs
Architecture	Closed – modular FMIS	Open – standardised APIs
Data	Siloed databases	Shared registers
Approach to funding and delivery		
Starting point	Technical requirements	Outcomes and user needs
	Solution-driven	Problem-driven
Funding	Capital	Recurrent
	Up-front	Incremental
Delivery	Waterfall	Agile

Note: DPG = digital public good; API = application programming interface.
Source: Authors

This emerging paradigm is not entirely 'new', in the sense that many of its elements have been discussed before and reflect incremental learning on the problems of the prevailing paradigm discussed in Chapter 2. Indeed, recognising PFM as a *means to an end* is less of a shift in mindset and more of a clarification of fact (Cangiano, 2019; Manning et al., 2020). Similarly, moving to a more open technology architecture in which a range of options can co-exist are standing recommendations (Pimenta and Seco, 2019; Uña et al., 2019). The value of taking a problem-driven, iterative and adaptive (PDIA) approach to PFM reforms has been discussed by researchers and practitioners for over a decade (Andrews et al., 2017).

The emerging paradigm combines these elements in a holistic way. All of these elements – the approach to PFM reform and digital transformation, approach to technology architecture and approach to funding and delivery – must be considered together in order to fully realise the benefits of digitalisation for PFM. This chapter begins with a discussion of what a more flexible and responsive PFM system might look like, before turning to the technology architecture and funding and delivery models that might make it possible.

3.1 A flexible and responsive PFM system

Ministers want to feel confident that the levers they pull are connected to something. All too often they realise too late, they are broken (Greenway et al., 2021).

Like digital, PFM is a means to an end (Cangiano, 2019; Manning et al., 2020). However, as discussed in Chapter 2, PFM reforms are often viewed as unchanging ends in and of themselves, and this approach is inseparable from the digital solutions that underpin them. This contrasts with an emerging paradigm in which PFM is an evolving concept (Cangiano et al., 2013), and processes (and digital solutions) are the subject of ongoing iterative redesign, allowing them to be more responsive to the needs of users and policy-makers. *Digital PFM* thus provides opportunities for governments to change, not just how they do things, but also what they do (Gupta et al., 2017b).

While the pandemic highlighted rigidities in the PFM system (see Section 2.3), there were also examples of government responsiveness. Governments across the world leveraged digital platforms for identity and payments to extend social safety nets[23] (Lowe, 2023). Similarly, institutions such as Her Majesty's Revenue and Customs (HMRC) in the UK repurposed their digital platforms in a matter of weeks, providing politicians with the confidence that their economic response could be implemented (Freeguard et al., 2020).

[23] Though not without difficulties reaching the most vulnerable, often digitally excluded households (Lowe, 2023).

And data-sharing across governments allowed for a more informed and targeted response in some countries (Rosenfeld, 2022; Lowe, 2023).

These were areas where governments had already developed significant digital capabilities prior to the pandemic. Between 1990 and 2017, the number of countries with electronic ID systems increased from fewer than five to more than 140 (World Bank, 2022), while the range of mechanisms available for governments to make digital payments had expanded (Cangiano et al., 2019; Lowe, 2023). HMRC adopted a digital strategy in 2014 that was at the time applauded by the then head of the Government Digital Service (Bracken, 2015a). And some governments made significant investments in digital infrastructure and legal frameworks for data-sharing prior to the pandemic (Rosenfeld, 2022; Lowe, 2023).[24]

In contrast, the public health response struggled with digital solutions for contact tracing, which seemed to work well in just a few countries (Freeguard et al., 2020). Among other problems, it often relied on the current approach of vendor-driven solutions that took too long to scale despite large up-front investments (Committee of Public Accounts, 2021).

The development of these digital capabilities (or lack of them) was not just about buying or building technologies, but also reflected emerging approaches to technology architecture, funding and delivery that contrast with the prevailing paradigm. This emerging paradigm and its relevance for a more flexible and responsive PFM system are discussed in the two sections that follow.

3.2 PFM as part of a wider ecosystem of data and services

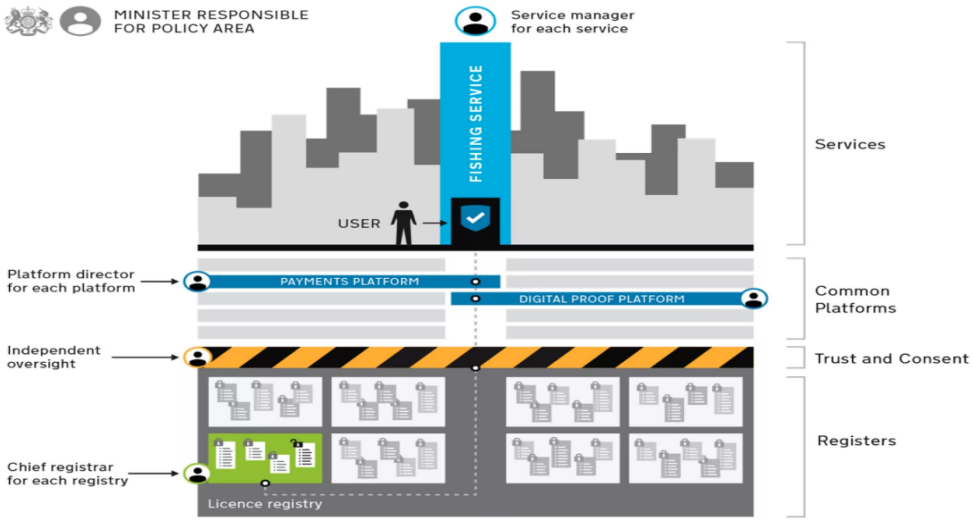
Government as a Platform holds out the promise of radically better services for the public. And to do so in a way that makes it simpler and faster for both civil servants and politicians, the private sector and non-profits, to meet people's needs. A world of government reorganized around shared components, APIs, standards and canonical datasets (Pope, 2019).

Around the world, digital teams in government are gravitating towards new thinking on the technology architecture that underpins government policy-making and delivery. This emerging paradigm goes by different names and can mean slightly different things across different organisations (see Box 3). Nevertheless, most visions are

[24] Although in other cases new data-sharing arrangements gave rise to substantial data privacy concerns, where governance had not been well established (Lowe, 2023).

consistent in terms of the underlying principles they are promoting – single source of truth, reuse and a focus on users.

Figure 9 Government as a platform (GaaP)

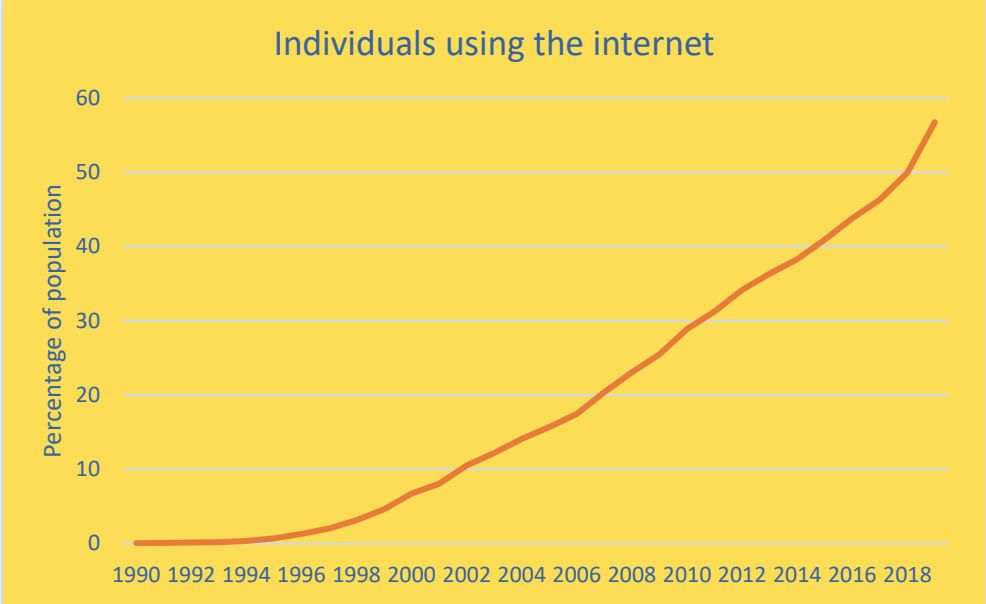


Source: Loosemore (2018)

Figure 9 is an illustration sometimes used by the UK Government Digital Service to illustrate the core concepts and principles of this new paradigm. It depicts services (purchasing or renewing a licence) built on top of shared components (common platforms for identification and payments) which are granted access to registers (canonical datasets) via trust and consent systems. Open standardised APIs allow for interoperability between the shared components and services built on top of them. This means that different government entities can reuse common platforms and data rather than duplicating them, and focus their attention on building services for their users.

Box 3 What does it mean for government to be digital?

The movement towards digital government has been in progress for decades and has carried different labels along the way. The advent of the internet era, roughly corresponding to the beginning of the 21st century and greater internet usage, represents a demarcation point between *digitisation* (or e-government) and *digitalisation* (or digital government).



Source: World Bank Development Indicators

While digitisation contributed to improved vertical integration in individual public sector bodies (OECD, 2021b), digitalisation is characterised by efforts to use internet-era technologies and thinking to de-silo government to achieve horizontal integration, focus attention on meeting user needs and implement digital approaches to service delivery (Dunleavy et al., 2006; Margetts and Dunleavy, 2013; Mergel et al., 2019).

Within this wider digital government paradigm, the concept of *Government as a Platform* (GaaP) has gained prominence. The term was initially coined by Tim O'Reilly for the application of 'platform thinking'[25] as 'an antidote to the complete specifications that currently dominate the government approach not only to IT but to programs of all kinds' (O'Reilly, 2010). However, the approach implied starting afresh, whereas governments are always starting from somewhere (Margetts and Naumann, 2017). Since then (and in some cases independently), different governments and international organisations have adopted similar approaches based on the idea of an ecosystem of data, platforms and services.

UK

Though not explicitly government policy, the UK Government Digital Service uses GaaP thinking to guide its digitalisation efforts (Bracken, 2015b; Margetts and Naumann, 2017; Heaton, 2021). These efforts include developing central government platforms for notifications and payments that are used across the whole of government.

[25] E.g., software as basic foundational infrastructure that can be reused and extended by others.

Estonia

With its three layers of digital government – a system of registries and data exchange that allows departments and agencies to share data (X-Road); a system of digital and mobile identification (eID); and a service layer accessed through various portals – Estonia is now an exemplar for GaaP, despite it never being used as an explicit model there (Margetts and Naumann, 2017).

India

India is another GaaP exemplar that seems to have developed independently of this thinking. The India Stack[26] includes common platforms for identity and payments, used by over 95% of India's population of 1.4 billion to access government services. There are plans to build a third layer for data exchange.

OECD

The OECD (2021b) defines GaaP as allowing 'civil servants … to focus on meeting the needs of users by working in an ecosystem that leverages shared and integrated tools and resources', and includes it as one of six dimensions in its Digital Government Policy Framework, noting different levels of maturity in applying it.[27]

World Bank

With its 'whole-of-government approach' (WGA) and similar distinctions around service, platform and data layers,[28] the World Bank's GovTech initiative also has clear parallels with the GaaP approach. The GovTech Maturity Index (GTMI) places significant emphasis on the technologies and institutions used to operationalise the GaaP approach in the countries discussed above, i.e., platforms for identification, payments and data exchange, as well as institutions for data governance and digital transformation (World Bank, 2021a). The agenda also builds on calls for improving data governance and systems to enhance the flow of data across governments (World Bank, 2021c).

Digital public infrastructure

O'Reilly also likened the GaaP approach to physical infrastructure such as the construction of highways, an analogy that remains

[26] See: India Stack.
[27] See: OECD (2020). The three levels of maturity outlined are: an ecosystem that supports service teams to meet needs; a marketplace for public services; and rethinking the relationship between citizens and the state.
[28] The GovTech Maturity Index distinguishes between technology for service delivery and citizen engagement, core government systems and GovTech Enablers, which can be associated with the services, platform and trust and identity/registers layers of the GaaP approach.

popular among advocates of similar approaches to digital transformation under the moniker *digital public infrastructure* (DPI).

DPI is defined as 'solutions and systems that enable the effective provision of essential society-wide functions' (DPGA, 2021). Platforms for identity,[29] payments[30] and data exchange[31] are prominent examples of DPI that advocates believe should be the focus of greater international investment and cooperation, because they are 'critical almost everywhere' (Rockefeller Foundation, 2021).

Digital public goods

The DPI agenda has also recently become twinned with the *digital public goods* (DPGs) agenda (ibid.). DPGs are defined as 'open source software, open data, open AI models, open standards and open content … [that] adhere to privacy and other applicable laws and best practices, do no harm, and help attain the SDGs' (United Nations, 2020).

The Digital Public Goods Alliance (DPGA) maintains a registry of approved and nominated DPGs.[32] Prominent examples of DPGs include MOSIP and Mojaloop, open-source platforms for building national ID and payments platforms respectively.

The twin agenda aspires towards a 'global commons' of DPGs which can be used to build DPI (Rockefeller Foundation, 2021).

In what follows we discuss each of the four layers of this emerging architecture – registers, trust and identity systems, platforms and services – as well as their underlying principles, and what they mean for PFM to be digital.

3.2.1 Registers

Data gets treated differently because it behaves differently. Software ages like fish, but data ages like wine. It should be looked after carefully (Loosemore, 2018).

Across government, different digital solutions often rely on the same data. These canonical datasets are referred to as registers[33] –

[29] See Rockefeller Foundation (2021). As well as 'personal identification', their definition encompasses 'civil registration and vital statistics systems'.
[30] See Rockefeller Foundation (2021). Their examples include 'digital money transfers or government-to-person payments'.
[31] See Rockefeller Foundation (2021). Their examples include 'health information exchanges or information management systems, logistics management systems, and financial data exchanges'.
[32] See Registry » Digital Public Goods Alliance.
[33] The notion of a register is a longstanding concept in government, dating back to at least the creation of the first paper-based registers for land and companies over 100 years ago (Loosemore, 2018).

authoritative lists which provide a ‘single source of truth’ (Loosemore, 2018). Governments keep thousands of registers and are increasingly maintaining these digitally, which become exponentially more useful when they can be easily linked together (Downey, 2015a, 2015b).

The concept of a register is highly applicable to PFM. Indeed, the main digital solutions used in PFM are already notionally built on these types of data structures. One of the main motivations for an IFMIS is that it should enforce the use of a unified chart of accounts across government. Each segment of the chart of accounts can be thought of as a register with links to each other through hierarchical relationships and coding structures.[34] Different IFMIS modules also aim to share the same registers of employees,[35] suppliers,[36] beneficiaries[37] and projects,[38] so as to minimise data entry requirements, maintain a single source of truth and allow more seamless data exchange between them along the chain of fiscal events.

To provide data for spending decisions, the PFM system is also reliant on datasets from other systems across government. To be useful it needs to be possible to link this data through authoritative lists. For example, to target more resources for healthcare to underserved areas it needs to be possible to link datasets on the characteristics of populations, patients, health workers, facilities and local governments. Similarly, reforms to bring more performance information into budgeting, and to make *payments by results,* require links between the digital solutions that underpin the PFM system and the systems that underpin operations in the relevant sectors, such as EMIS in the education sector (Lee and Medina Pedreira, 2019).

This reliance on shared registries works both ways. Just as the finance function requires data from management information systems in other parts of government, analysts in other parts of government require financial data for monitoring and evaluation that can inform future decisions on resource allocation by policy-makers. For example, in the education sector, Rossiter (2020) notes that ‘linked data allow us to examine things like equity in resource allocation, including key dimensions such as teacher quality, or identify relatively high-performing districts and schools and test relationships between school inspection and student achievement’.

[34] See Pattanayak and Cooper (2011) for a discussion of the chart of accounts.
[35] E.g., to link payroll systems and human resource management information systems.
[36] E.g., to link procurement, contract management, payment and in some cases tax systems.
[37] e.g., Turkey and Chile use their national ID system to link social registries to carry out eligibility checks (Lowe, 2023).
[38] i.e., to link budget planning and preparation systems, public investment management systems, contract management systems and payment systems.

Problems linking datasets, such as those discussed in Section 2.2, arise when different systems do not use the same authoritative lists. This is because they are 'often held by different units/departments, in varying database applications, using different coding systems, and with a reluctance for sharing' (Hua and Herstein, 2003). In contrast, definitions of a register emphasise exposing the data via APIs; using open standards; and having appropriate governance and ownership in place (Pope, 2019).

- **Exposing data via APIs** mitigates against problems associated with 'sharing' data, namely its duplication.[39] 'Not having direct access to the data through an API introduces potential errors, and a lag between a change to the data being available to users of the service' (Downey, 2015b). A common example of such a pain point for PFM is an authoritative list of local governments (see Box 4).
- **Using open standards** means that 'different teams can be confident that they are speaking the same language, and the designers of public facing services can build on top of reliable, predictable data' (Pope, 2019). Within PFM, various international conventions speak to the concept of open standards which allow digital solutions to speak the same language,[40] although their adoption has been slow in lower-income settings (Wang et al., 2015). More generally, greater attention is required on how to assign unique identifiers to the entries in registers given that these can be spelt differently and can change (Downey, 2015b) (see Box 4).
- Having **appropriate governance and ownership in place** – a register begets a registrar, a person or institution responsible for maintaining it according to agreed open standards. Registers need to be managed for the broader ecosystem rather than just their specific domain (Pope, 2019), and ensuring the right incentives are in place may require legislation (Loosemore, 2020). Clarifying these roles in lower-income contexts will be an important precondition in shifting to the emerging paradigm.

[39] 'In a platform ecosystem data is accessed as needed, via APIs using agreed open-standards. Rather than being held in multiple places and multiple formats, data is stored in canonical registers' (Pope, 2019).

[40] For example, international classification systems for the chart of accounts such as the IMF's government financial statistics (GFS) and the UN's classification of the functions of government (COFOG); the Open Contracting Partnership's open contracting data standard (OCDS) for procurement and contract management; the International Aid Transparency Initiative (IATI) standard for publishing data on development and humanitarian assistance; and the eGov Foundation in India is developing an open standard for *fiscal events* to facilitate communication between digital solutions both within and beyond the PFM domain (eGov Foundation, 2023).

Box 4 An authoritative list of local governments – a common pain point for PFM

Local governments play an important role in delivering many basic public services, including healthcare, education, water and sanitation. In most countries they do not have the resources to meet these service delivery mandates, because the central government collects most of the taxes. They are therefore usually funded through grants from the central government.

Central governments require data on local governments to allocate these resources efficiently and equitably, and to monitor whether local governments are delivering on their mandates. This invariably involves linking datasets from different sources across government with the common reference point being the local government.

However, matching this data by local government is sometimes challenging because the list of local governments tends to change with regularity (Zahra Diop et al., 2020; Long et al., 2021; Morgado et al., 2022). They may be split into smaller local governments, merged to create larger local governments, or a new local government may be carved out due to urbanisation. Aside from these issues, local governments may be spelt differently across government (sometimes legitimately), making it difficult to match data across siloes unless a unique reference is applied.

Unless there is an authoritative list of local governments that is centrally maintained to reflect these changes, this can have consequences for the wider data ecosystem including the statistics bureau responsible for population and other demographics; sector ministries that maintain lists of facilities and the outputs they produce; the finance ministry, which maintains location segments in the chart of accounts; and any team using data based on these lists to build platforms and services for allocating resources or analysing the impact of spending.

Whether or not PFM ultimately embraces every aspect of the emerging paradigm, it could nevertheless benefit from an approach to data governance based on this concept of registers and the principle of a ‘single source of truth’. Much of PFM is organised around different authoritative lists, some within its own domain, but many outside it. For the PFM system to interact more fluently with the rest of government, datasets need to be linked across government. Given its level of influence over budgets for ICT, a finance ministry could do more to ensure that it is getting what it needs from the rest of government, but it could also be doing more to ensure that the rest of government and wider society have access to good-quality fiscal data.

3.2.2 Trust and identity

Trust and identity systems ensure that data is only accessed for appropriate purposes, and that use is understandable and trusted by citizens or their representatives (Pope, 2019).

Beyond the inherent siloed nature of government, there are other reasons why data does not flow seamlessly across government. Exposing data via standardised APIs can address the technical issues associated with sharing data. However, on their own APIs may not be able to overcome a culture of reluctance, and concerns about privacy.

A lot of data in the PFM domain should be open by design as a matter of public interest and accountability.[41] But not all data is open, nor should it be.[42] In the PFM domain, there are also databases that contain sensitive information. These include data on individual employee compensation, individual taxpayer returns and commercially sensitive information in contract registers. Similarly, systems used to compile the outputs of public spending may contain sensitive information. For example, EMIS contain information on individual students, and HMIS contain information on individuals' medical records.

However, this doesn't mean these registries should be off limits to authorised users with appropriate safeguards in place. When combined with data in other registries, they can be used to answer important operational and policy questions, without exposing sensitive information. Is the supplier who has bid for this tender tax compliant? What proportion of schools with special needs students are without teachers with special needs training? How many patients have received treatments promised in the budget?

Perhaps the most well-known trust and identity system for data exchange is Estonia's X-Road.[43] Its logic is captured in the 'once-only principle' which is enshrined in legislation[44] and mitigates against the

[41] E.g., budgeted and actual expenditure; establishment and vacancy lists of employees; contracts awarded; and the status of multi-year capital projects, with relevant classifications.
[42] See Downey (2015b) for a discussion of open, closed and private registers.
[43] 'X-Road is a system of registries whereby each has an authorised owner of the data, responsible for its maintenance and security. The system relies on a unique 16 digit personal identifier (similar to the UK National Insurance Number, but with which every citizen is issued at birth) for every person which can be used to retrieve personal data from any registry, as well as a number of other identifiers for businesses, properties, vehicles and so on. The result is like a peer-to-peer network, where any data in flight (that is, in transit) is encrypted' (Margetts and Naumann, 2017).
[44] '[I]f a new public service is developed, it is legally (under the Public Information Act) not permitted to design systems that store the same data in different repositories' (Margetts and Naumann, 2017). Essentially, the government is not allowed to ask citizens for the same information twice (Liiv, 2017).

duplication of data.[45] Solutions such as X-Road are being used to improve operational efficiency in PFM, in areas including tax administration[46] and procurement.[47] They also create opportunities for creating a data ecosystem that is more conducive to evidence-informed decision-making for improving resource allocation decisions.[48]

However, significant questions remain around the governance frameworks required to ensure these systems are secure and used by the right people for the right purposes (Loosemore, 2018; Eaves et al., 2019). And while X-Road has led to savings and improvements in how users access services, the services themselves have remained largely unchanged, and citizen satisfaction with healthcare and education has remained low (Kattel and Raudla, 2022). Moreover, it may be difficult to replicate the set of circumstances that led to the development of X-Road in Estonia (Margetts and Naumann, 2017).

A comprehensive solution to sharing data may not be possible across all domains and contexts, and it could distract attention from finding more appropriate solutions such as simple aggregation and/or anonymisation of datasets. Nevertheless, finance ministries hoping to promote greater operational and allocative efficiency should be considering:

- how to make data within their own domain more accessible to users across government and beyond, while maintaining responsible data-sharing practices; and
- how to incentivise other government ministries, departments and agencies to do the same.

[45] '… unless you have information sharing between silos, they are forced to collect information themselves, so all create databases, you end up with 100 copies of the same data, and the agency with the most data becomes the most powerful. Then there is going to be a breach, which will lead to distrust between agencies, and they are even less likely to share data' – quote from interview in Margetts and Naumann (2017).

[46] Estonia's e-Tax system prepopulates tax forms using X-Road, with an average tax filing time of three minutes, for about 95% of the population (IMF, 2018).

[47] Estonia's e-procurement system also relies on X-Road to connect it to other registries including the criminal records database, the company register and the tax registry to perform background checks on suppliers (AlphaBeta, 2018a). Similarly, Portugal's e-procurement platforms are linked to a central public contracts registry portal called BASE which receives information on all procurements proceedings occurring on those platforms and publishes the data on its portal.

[48] For example: the same company that developed X-Road in Estonia is developing a new system called Sharemind, 'which develops a way to allow the analysis of confidential data in encrypted form (hence completely anonymised), thereby creating the ability to do state-wide analysis, including potentially data from private firms such as banks, while still preserving privacy' (Margetts and Naumann, 2017).

3.2.3 Common platforms

Platforms solve problems once, meeting the common needs of users, rather than addressing the same problem multiple times, and in slightly different ways (Pope, 2019).

The platform layer tends to be the source of most confusion surrounding the emerging paradigm, particularly as it pertains to PFM. The tech sector tends to use the term 'platform' to describe any product, and the technologies for PFM discussed in Section 2 are often described as platforms. For example, SAP,[49] Oracle[50] and FreeBalance[51] all use the term to describe one or more of their products. In the media, the term is often used to refer to websites, apps or other digital services. Indeed, it is often quite difficult to separate platforms from the services built on top of them. Even within digital government circles, the term platform is used ubiquitously[52] and often interchangeably with terms such as 'building blocks',[53] which can be confusing to outsiders.

Common platforms – i.e., the things that make up the platform layer in Figure 9 – tend to be defined in terms of examples and attributes. This is because actual government platforms are still nascent and emergent. Commonly cited examples that have already achieved scale in some countries are government platforms for identity and payments. Other examples include platforms for notifications,[54] hosting[55] and publishing.[56] Commonly cited attributes are that platforms should:

- 'solve common problems for the whole of government (and potentially beyond)' (Pope, 2019);

[49] SAP describes its Business Technology Platform as bringing together its various other products into one platform. See Digital Business Technology Platform | SAP.
[50] Oracle describes its ERP Accounting Hub as an 'accounting and finance platform'. See Financials Cloud | ERP | Oracle United Kingdom.
[51] FreeBalance describes its product portfolio as being built on its 'FreeBalance Accountability Platform'. See FreeBalance Accountability Suite™ - FreeBalance.
[52] Pope (2019) notes that 'the term platform is used in the generic sense to refer to any shared API, shared component, trust and identity system, or register'.
[53] See DPGA (2021), which defines a building block as 'software code, platforms, and applications that are interoperable, provide a basic digital service at scale, and can be reused for multiple use cases and contexts'.
[54] GOV.UK Notify, originally built by the UK Government Digital Service, allows central government departments, local authorities and the National Health Service to send emails, texts and letters to their users, and has since been adopted by countries including Australia, Brazil and Canada. See Herlihy and Clement (2020) for further discussion of Notify and how it has been exported abroad.
[55] CLOUD.GOV, NIC Cloud and CloudPA provide cloud services across governments in the US, India and Italy respectively.
[56] Federalist and GOV.UK are examples of platforms that allow different departments and agencies to build government-compliant websites in the US and UK.

- ideally be built once, using open standards, so they are interoperable with other platforms and can be more easily maintained (Loosemore, 2018); and
- achieve scale by allowing different services to be built on top of them: i.e., they can be reused and extended.

The problem in PFM has been to determine what is common and what is not across government. This tension between standardisation and flexibility is inherent in PFM, as the central fiscal agency tries to impose its own controls and information requirements across the rest of the government while balancing the needs of other users. As discussed in Section 2.2, most countries take a centralised approach, while a minority take a decentralised approach. However, in both cases there are considerable amounts of dissatisfaction with the outcome.

Governments with more centralised approaches are looking to find ways to make their technology architecture more flexible. Based on the definition of a platform as 'a product that provides or enables other products or services', Pimenta and Seco (2019) argue that the IFMIS should be reconceptualised as a *public expenditure management platform* in which the core modules, auxiliary administrative systems and subsystems are implemented in a coherent architecture and custom-made and off-the-shelf software can co-exist.[57] Similarly, Uña et al. (2019) advocate a *modular approach* to the design of the FMIS. Both emphasise an unbundling of digital solutions for PFM into simpler parts, and using modern internet-era approaches – i.e., open standardised APIs – to achieve interoperability between them.

At the same time, governments with more decentralised approaches are looking to improve standardisation and reduce duplication. This can be seen in the efforts of the UK,[58] the US,[59] Ireland[60] and others to

[57] 'The concept of IFMIS as a platform proposes a robust and modular core around which auxiliary administrative systems and support subsystems are implemented in a coherent architecture with standardised interfaces to form an environment of public finance information systems that can incorporate functional upgrades and new technologies that only require better maintenance of the system without the need to rebuild the entire system from time to time. An IFMIS platform must have clear rules and interfaces so that custom-made and off-the-shelf systems or modules can coexist and interact based on the needs of each government' (Pimenta and Seco, 2019).

[58] The UK Shared Services Strategy for Government was launched by the Cabinet Office in January 2018 with the aim of standardising processes and data, achieving efficiency and value for money, and providing a better experience for users (Cabinet Office, 2018). For further discussion see Helliwell (2019).

[59] The US federal government has recently refreshed efforts to move more agencies to shared service providers by pursuing a more balanced approach to overcome the obstacles that have stymied previous efforts. See Miller (2019).

[60] In Ireland, a shift to shared services aims to provide 'consistent standardised HR, Payroll and Finance processes using modern enterprise technology systems [as] an essential core element in building "One Civil Service" supporting mobility,

move to shared services and take advantage of the latest developments in ERP solutions.[61] For example, the US Treasury is attempting to create a marketplace for in-house and commercial solutions to promote greater standardisation and reuse while still allowing flexibility for spending units to make technology choices that meet their needs.[62]

However, it remains to be seen if governments can create the marketplace for commercial providers to respond to these demands, and/or if they can deliver these sort of solutions themselves in-house. For lower-income settings it may be difficult to create these marketplaces and/or fund in-house teams, which adds to the appeal of recommendations for a 'global commons based on digital public goods' (DPGs) (see Box 3).

3.2.4 Services

A service is something that helps someone to do something (Downe, 2022).

Services are perhaps the most conspicuous layer of the GaaP approach. Unsurprisingly, the drive for digital government has focused predominantly on public-facing services.[63] But 'civil servants are users too' and digital solutions are important in helping them to do their jobs (Foreshaw-Cain and Prakash, 2015). PFM is a case in point where officials are highly reliant on digital solutions to do their jobs well, but they are often underserved.

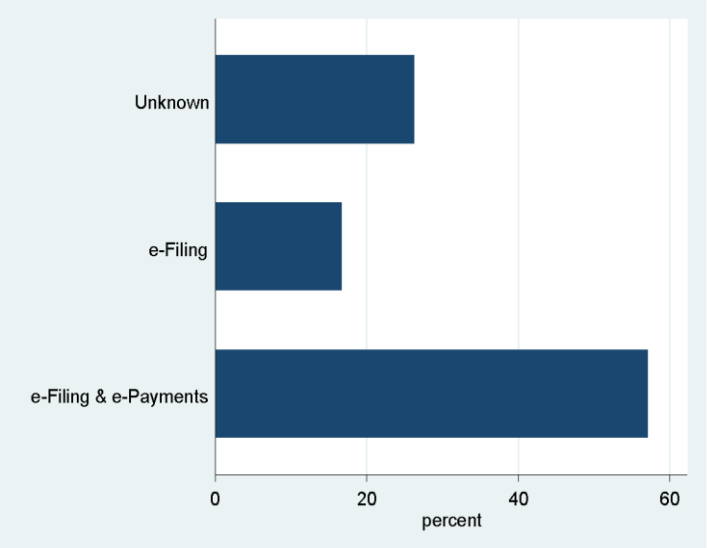
efficiency and consistency of service, and standard quality data for comparability and central reporting' (NSSO, 2022).

[61] For example, cloud hosting and the provision of SaaS.

[62] Matt Miller, Deputy Commissioner, Bureau of the Fiscal Service, US Department of Treasury. See Miller (2021).

[63] The UK government's website is a case in point. Its banner line reads 'the best place to find government services and information'. See Welcome to GOV.UK (www.gov.uk).

Figure 10 Adoption of online tax services



Source: WBG GovTech Dataset (October 2022)

Public-facing services benefit from greater public pressure and scrutiny to meet user needs. As tax administration has increasingly moved online (see Figure 10), this appears to have been the driver of its adoption of elements of the emerging paradigm in countries such as the UK (Bracken, 2015a). In contrast, processes for expenditure management and the digital solutions that underpin them tend to be more removed from this source of public pressure to drive continuous improvement. However, the demand for more user-centred digital services for PFM that meet the needs of different users across government is becoming increasingly apparent.

More governments are extending the coverage of the PFM system to local governments and service delivery units, by building new services on top of their existing platforms. For example, in Tanzania the government has extended the coverage of the PFM system to schools and health facilities by developing web and mobile applications for budget preparation and financial management that are interoperable with the core FMIS used by central and local governments (Mtei, 2020). Similarly, Indonesia is extending the coverage of its core FMIS (SPAN) by building a web-based application for spending units (SAAKTI) (Joshi et al., 2015). In the UK, a central platform for receiving online payments is used by over 300 government organisations to provide over 800 services.[64]

We are also starting to see the emergence of services that leverage multiple platforms. For example, in Tanzania, interoperability between HMIS and FMIS across and between different layers of government is making it easier for health facilities to manage their finances and supply chains, as well as increasing visibility for local

[64] See Performance data – GOV.UK Pay (payments.service.gov.uk).

governments and the Ministry of Health in their operations, making it easier to provide oversight (Mtei, 2020). In India, the eGov Foundation is supporting the state government of Punjab to implement a fiscal data exchange platform to improve visibility for different users along the chain of fiscal events by connecting different systems for financial management and workflow management systems (eGov Foundation, 2023).

These developments provide encouragement for the emergence of a more open and flexible technology architecture that is more responsive to changes in policy and the needs of users. However, iterating towards those solutions requires a change in the way technology is funded, delivered and governed.

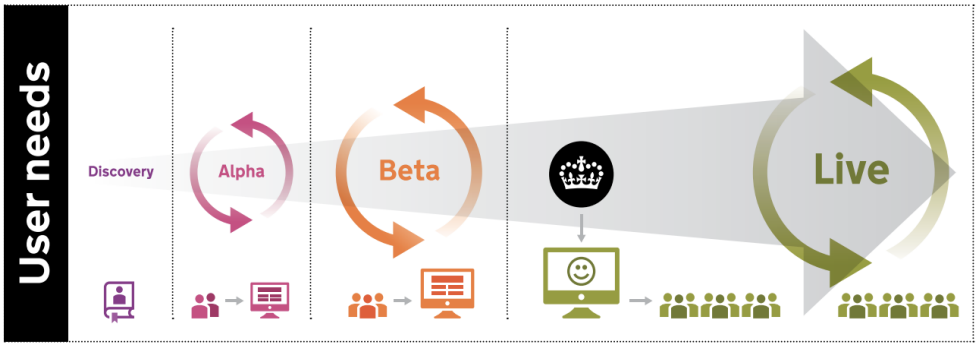
3.3 A funding and delivery model for sustainability

Funding and procurement processes intended to reduce uncertainty can eliminate the fluidity that constitutes best practice in digital product development (Rockefeller Foundation, 2021).

Funding and delivering digital infrastructure are different from funding and delivering physical infrastructure. While the *digital public infrastructure* moniker and comparisons to public highways (see Box 3) are useful in highlighting the economic importance of digital infrastructure, the analogy falls short when it comes to suggesting how they should be funded. Digital infrastructure requires a more agile approach to funding and delivery, as well as in-house capacity for maintenance and continuous improvement.

The waterfall approach to funding and delivery discussed in Section 2.1 is well-suited for delivering roads and bridges, but not software. In contrast, agile delivery approaches begin with a focus on user needs and emphasise starting small, scaling up incrementally based on user testing, and continuous iterative improvement even after the system goes live (see Figure 11). While these approaches cannot eliminate risk, they have been associated with cost savings over traditional solution-driven approaches to delivery (Mergel et al., 2021).

Figure 11 The agile approach to digital solutions



Source: UK Government (2022) adapted by Public Digital

Agile approaches to delivery also imply a fundamental shift in how digital infrastructure is funded – from capital expenditure budgeted up-front and linked to the milestones of delivering technical requirements, to recurrent expenditure that allows for funding in increments linked to meeting user needs and outcomes.[65] Recurrent funding is required for the in-house expertise[66] that maintain the platforms and the wider ecosystem, and advise the rest of government on their purchasing strategies (see Table 4), including the use of DPGs (or other open-source software) to build digital infrastructure (Pope, 2021).

Table 4 Guidance on defining a technology purchasing strategy

Choosing to build	Choosing to buy
Your user need is unique or rare	There is a commercially available way to meet most of your user needs
There are limited suppliers available who can meet your requirements	The specialist expert knowledge and support you need is commercially available
You cannot scale, adapt or integrate available commercial products to meet your core needs	Suppliers can configure settings or features to meet your user needs
You need to own your technology to keep the flexibility to modify it	You do not need a high level of customisation or bespoke changes
You have access to the capability and resources to manage the project	Your organisation has the capability to support any technology you buy

Source: Central Digital and Data Office (2021)

[65] 'Digital transformation is considered a process without an end status, unlike previously designed e-government projects with a start and an end date, a measurable and defined end status, as well as a fixed budget. Instead, digital transformation is a continuous process that needs frequent adjustments of its processes, services, and products to external needs' (Mergel et al. (2019).
[66] As well as the salary budgets to pay them, they require operating budgets for maintenance contracts, software upgrades etc.

Again, there are encouraging signs that this approach is gaining traction. Approaches to public sector reform, including PFM, have begun shifting towards problem-driven approaches over solution- and best practice-driven reforms (Andrews et al., 2017; Lawson et al., 2020; Welham et al., 2020). Hashim and Piatti (2018) find that incremental approaches to implementing FMIS are associated with more success. South Africa and Rwanda provide exemplars of where incremental approaches have been managed by in-house teams (Cresswell, 2021; CooperSmith, 2022). A central digital team played a key role in delivering digital solutions for results-based financing in Tanzania (Mtei, 2020; Dom et al., 2021), and a central platform for receiving digital payments in the UK (Freeguard et al., 2020).

However, this remains relatively nascent in PFM reform. The value of problem-driven approaches for technical assistance is still contested and debated among practitioners (Allen, 2017; Harris and Lawson, 2022). Although the number of central digital teams in government is increasing (Clarke, 2019), they mostly eschew areas like PFM and its legacy technologies in favour of greenfield sites[67] and public facing services. There is insufficient evidence on the use of DPGs (and other open-source software) in the PFM domain. For these approaches to gain more traction in lower-income settings, further reforms to donor funding and delivery models are necessary (Rockefeller Foundation, 2021).

[67] E.g., new policy areas with no existing legacy technologies.

4 The benefits of *digital PFM*

The digital revolution holds vast potential to improve fiscal policy. By transforming the way countries collect, process, and act on information, digital technology can reshape the way governments design and implement their tax, spending, and macro-fiscal policies. If technology is used in a smart way, fiscal policy will be more efficient, transparent, equitable, and impactful – improving lives all over the world. The potential benefits are huge (Lagarde and Gates, 2017).

The benefits of *digital PFM* could indeed be far-reaching. More timely, structured and granular data on spending, its outputs and outcomes opens up a world of possibilities for fiscal policy design and how it is implemented.[68] Nevertheless, we focus here on more tangible benefits in line with our view that *digital PFM* needs to produce results to be taken seriously. We see the main benefits in terms of its potential to more effectively balance competing demands for standardisation and flexibility between the central fiscal agency and spending units; to realise the potential of interoperability for improving government operations and decision-making, and responding to changes in the status quo; and to improve value for money. These are discussed in turn below.

4.1 Balancing standardisation and flexibility

We envision the marketplace will have both federal and commercial service providers. We envision that the marketplace will provide agencies with flexibility and choice, but the flexibility and choice will be of standards-based solutions. And the kind of the marquee aspect, or the centerpiece of this, is we envision the marketplace will be modern cloud-based, service-based core financial management software solutions (Matt Miller, Bureau of the Fiscal Service, US Treasury, quoted in Miller, 2021).

[68] These might include the use of 'advanced technologies' such as big data techniques and AI, which are premised on the accessibility of well-structured data.

As discussed throughout this paper, there is an inherent tension between standardisation and flexibility in PFM that the prevailing paradigm has struggled to reconcile. Governments that have given spending units discretion to source their own digital technologies for PFM are increasingly concerned about costly duplication and the cost of coordination. Governments that have looked to the commercial market for comprehensive solutions have found it difficult to match the business processes prescribed by these COTS solutions to the way in which different parts of government operate currently or want to operate in the future.

We can offer no definitive answers on whether and when a government should transition to more decentralised PFM operations. However, from a PFM perspective, one of the most compelling features of digital-era governance is that it can potentially reconcile competing demands for centralisation and decentralisation (Dunleavy et al., 2006; Margetts and Dunleavy, 2013). In the longer term, shifting to a more open architecture where the core FMIS is part of an ecosystem of data and services with standardised open APIs could allow for:

- more options for federation – for example, rather than having just one module for something, it's okay for certain modules to exist in slightly different forms in different ministries, departments and agencies where that supports more effective business processes
- more novel approaches for sharing, analysing and visualising data built on top of or around the core FMIS rather than requiring customisations of it
- more user interfaces (and thereby non-core aspects of the business processes) to be iterated independently of the core FMIS
- greater efficiency over time, as the ecosystem connects with emerging data sources and new platforms (again, without the necessity for a new 'FMIS module').

An open question is whether the next generation of cloud-based Software-as-a-Service (SaaS) ERP solutions can deliver on this vision. Another related open question is whether DPGs for PFM developed in one context can scale to others.

4.1.1 Delivering on the promise of interoperability

A more integrated approach to public service delivery, shared digital government infrastructure, effective data governance, and interoperability frameworks will be the focus of the whole-of-government solutions in the coming years (World Bank, 2021a).

Interoperability has long been the holy grail of PFM. Indeed, the original premise of the 'I' in IFMIS was essentially an attempt to ensure data exchange between different PFM functions, and across and between different layers of government. As governments pursue *digital PFM*, it will be important to think about the expected benefits of interoperability and how to realise them.

Much of the traditional view on the benefits of interoperability remains valid. The ability to exchange timely and high-quality information across and between different layers of government provides managers with the means to make informed operational decisions reducing friction in the PFM system and allowing resources to flow in a timely and predictable manner. The ability to join up data across and between different layers of government provides a better evidence base for policy-makers to make resource allocation decisions. However, as discussed in the preceding sections, the ability to exchange data seamlessly stems from good data governance rather than specific technologies. There are no APIs or interoperability platforms that can solve for registers that are not well maintained, difficult to understand or closed to others.

However, the benefits of interoperability extend beyond this traditional view. New ways of making digital payments to previously unreachable beneficiaries can allow for the introduction of new spending programmes while also promoting financial inclusion.[69] Similarly, new ways of receiving digital payments can widen the revenue base, which is particularly relevant for subnational governments. The Covid-19 pandemic showed the importance of this type of digital infrastructure. In countries with platforms for identity and payments, governments were able to be more responsive and targeted in their fiscal response. Similarly, a flexible technology architecture allowed organisations such as HMRC to repurpose their platforms to deliver new policies in short timelines.

This additional view of the benefits of interoperability is more likely to be attractive to politicians compared to the traditional view. Politicians often have aspirations beyond responding to evidence on the status quo, i.e., they want to change not only how the government does things, but also what they do. They may also need to respond to changes in the status quo, as witnessed during the Covid-19 pandemic. The opposite is also the case – when technology cannot adapt to meet change, it can be particularly embarrassing for politicians.[70]

[69] Digital cash-based transfer programmes are often the first time that individuals in lower-income countries access banking and other financial services (Sarwar et al., 2023).

[70] For example, the then Chancellor of the Exchequer, Rishi Sunak, blamed old technology for an inability to adjust benefits for a rise in the cost of living in May 2022 (Mason, 2022). More recently, lack of interoperability between education management information systems and social registries has been blamed on over

Improving data governance along the lines of the discussion in Section 3.2.1 is the most pressing issue for realising either of these views on the benefits of interoperability. Nevertheless, the journey towards an architecture based on standardised open APIs is likely to be a long and arduous one.[71] And one with no definitive endpoint, given the need for the architecture to continuously evolve. Nevertheless, the steps along the journey – establishing foundational registers and open standards – can allow governments to begin realising some of the benefits of better interoperability in the shorter term.

4.2 Getting value for money

Four years after GDS was set up, the UK government announced that it had saved over £4 billion from its IT bills[72] (Greenway et al., 2021).

Beyond the benefits of balancing standardisation and flexibility and improving interoperability, finance ministries might be drawn to emerging approaches for the funding and delivery of digital transformation given their track record of reducing costs, and in particular the cost of IT failures.

Finance ministries could be a particularly important exemplar in this instance. Adopting agile approaches to funding and delivery might lead to the realisation of efficiencies in the cost of IT for PFM, but the bigger prize would be finance ministries taking a leading role in instilling these approaches across government by using the spend control levers at its disposal. In lower-income countries, this should extend to using their influence to manage how donors engage with different parts of government on digital transformation.

Realising these benefits will require finance ministries to increase their competence in areas such as agile delivery and procurement, including hiring specialists and/or potentially delegating more responsibilities for IT spend control to a central government digital team.

200,000 school children eligible for free school meals not receiving these benefits (ibid.).

[71] For example, in the UK, open banking has taken over seven years to reach 6.5 million active users. See Delivering the roadmap - Open Banking.

[72] It has been noted that, in 2011, the UK was spending £16 billion a year on IT (Greenway et al., 2021).

5 Conclusions

Viewing PFM instead as an 'open' system that interacts more fluently with all aspects of public policy – namely, government policy choices, government actions (especially service delivery), and development results – offers the potential for developing a new generation of approaches to managing public finance (Manning et al., 2020).

In this paper we contrast the current approach to digitalisation in PFM with the emerging digital government paradigm in order to consider the question: what does it mean for PFM to be digital? We identify the most important problems with the current approach as an unsuitable funding and delivery model, and a closed and siloed technology architecture. We see these as inseparable from the current approach to PFM reform and its relationship to digital transformation, which produces a rigid PFM system that is losing relevance.

This current approach sees PFM processes and conventions as unchanging ends in and of themselves, to be digitised using solution-driven approaches, resulting in a technology architecture that is increasingly inflexible to the needs of users and policy-makers over time. In contrast, the emerging paradigm views PFM and digital as means to an end, in which PFM processes are the subject of ongoing iterative redesign in response to the needs of users and policy-makers. This is made possible by a more open and flexible technology architecture in which PFM is part of a wider ecosystem of data, platforms and services, and funded through a more problem-driven approach to delivery based on user needs and outcomes.

We refer to this emerging paradigm as *digital PFM*. We see the benefits of this approach in terms of its potential to:

- find a more effective balance between standardisation and flexibility to meet the needs of different users across government (and potentially beyond);
- improve interoperability between PFM systems, and between PFM systems and other government systems – allowing governments to change not just how they do things, but also what they do; and
- realise greater value for money by reducing duplication and promoting reuse.

Better data governance is the foundation for *digital PFM* and realising these benefits. As such, this paper is a further call to do more to address the problems that prevent effective and responsible sharing of data across government. Changing the way digital solutions for PFM are funded and delivered is another imperative, including recognising the need for governments to build more in-house digital expertise, and for international organisations to recognise the importance of recurrent budgets over up-front capital investments.

We recognise that this paper raises far more questions than it answers. More (user) research is needed to answer questions around standardisation and flexibility; how to create a marketplace in which commercial solutions, custom solutions and open-source solutions including DPGs co-exist; how the concept of open standards in digital relate to existing standards for accounting, reporting, procurement etc. in the PFM domain; and who in government should govern data registers. It also raises questions about the role of the finance ministry in managing IT spend and its relationship with central government digital teams on these matters.

Finally, while this paper has laid out a path for bringing public finance into the digital era, we believe this path will be challenging. The next paper in this series – *Making public finance digital: challenges to the emerging digital public financial management paradigm* – is published concurrently with this one. It builds on the discussion here by interrogating the different challenges governments are likely to encounter in their journey towards embracing *digital PFM*.

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