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Working Paper

Better software options for public financial management

Some ideas on where to start

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Key messages

In a fast-changing world, setting up governments to be more responsive to change requires a more flexible and adaptable digital infrastructure for public financial management (PFM).

The current ‘buy versus build’ approach to making software choices for PFM makes it difficult to meet the needs of today’s users, let alone tomorrow’s, including the ability to sustain, continually improve, adapt and extend systems.

Moving to an approach that recognises how a broader range of commercial, in-house and open-source components can fit together requires conceptual shifts in thinking about the IT architecture of PFM. It also requires changes in funding practices.

Emerging trends within PFM, as well as broader shifts in digital governance and the market for technology, can support this change in approach.

To support this change government leaders, international organisations and other funders (such as philanthropic foundations) need to assume new roles and practices.

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Abbreviations and acronyms

DPG	Digital Public Good
DPI	Digital Public Infrastructure
ERP	Enterprise Resource Planning system
(I)FMIS	(Integrated) Financial Management Information System
PEFA	Public Expenditure and Financial Accountability
PFM	Public Financial Management
RFP	Request for Proposal
SaaS	Software as a Service

Executive summary

The pressure on governments to manage funds more efficiently and transparently is ever-present and ever-changing. However, the current environment – of increasing threats and instability amidst limited fiscal space – are placing an even greater onus on public finance systems to be more flexible and responsive to change.

Technology plays an important role in how governments manage public finances. Governments need a broad range of capabilities to ensure they are continuously improving their digital infrastructure for public financial management (PFM). The ability to make good software choices, based on principles that recognise both current and future needs, is key.

Within PFM, these choices are often framed in terms of buying versus building software, and centralised versus decentralised architectures and systems. Technical, commercial and funding arrangements often drive this framing. However, emerging trends are exposing these choices as false dichotomies, and it is increasingly possible to think about financial management technologies as encompassing a range of commercial, custom-built and open-source options.

Within PFM itself, governments including the United States, Denmark, Rwanda and South Africa are looking to continuously improve the services their software systems provide for financial managers, decision-makers, civil servants and citizens. Broader trends include the establishment of *digital transformation units* within government, the increasing availability of *digital public goods,* the importance of *digital public infrastructure* in national and global agendas and market trends such as the move to cloud computing.

Shifting from the current approach, where governments buy commercial Enterprise Resource Planning systems (ERPs) or build them themselves, requires new thinking about the IT architecture of PFM: from monolithic systems to smaller parts, loosely joined; from one-off builds to ongoing care; from siloed IT to continuous, integrated service delivery; from data stores to data flows; from an all-or-nothing approach to starting small; and from centralised to federated architectures.

These conceptual shifts need to be accompanied by more active interventions and investments to increase and improve the supply of software and skills. This includes investing in improving outcomes rather than solely focusing on functional improvements in PFM; building an initial supply of new generation open-source components

to fill gaps in the ecosystem; the establishment and continuous development of interoperability standards (such as those that have already been established for open contracting and aid transparency); introducing new skills within finance ministries and finance functions across government; developing new procurement mechanisms and market-shaping approaches; and introducing new funding and governance mechanisms, including a shift from capital to operating expenditure.

There are important roles for senior government leaders, international organisations and funders such as foundations in making and driving these shifts in thinking and practice. Government leaders need to create space for more innovation, and funders need to adapt their funding models to focus more explicitly on outcomes rather than functional specifications.

Finally, there are questions for research. What is the state of the current market when mapped against these shifts in IT architecture and other characteristics? What existing software and standards could have greater impact if more broadly recognised and supported? How might governments and funders more actively use their buying power and market influence to shape the markets they want? Beyond technical assistance, how can the supply of skills be improved, alongside the supply of software?

1 Introduction

Expectations of public finance systems are always evolving. The pressure on governments to manage funds more efficiently and transparently are ever-present and ever-changing. New policies create new demands on financial management systems. The demands for information on the costs, outputs and outcomes of existing programmes continue to expand. Citizens and businesses expect their financial interactions with government to be modern, seamless and secure. And all of this is expected at the least possible cost to the taxpayer.

Technology has always played a major role in meeting these expectations, but it is hard for governments to keep up to date. Often, technologies for financial management are addressing yesterday's expectations rather than today's, let alone tomorrow's. In an increasingly uncertain environment, governments and public finance systems are expected to be more flexible and responsive to emerging challenges – for example, responding to the threat and effects of climate change, disease outbreaks and global instability.

Although there is an emerging consensus that the technology architecture for public financial management (PFM) needs to be more adaptable to changing needs and expectations (Pimenta and Seco, 2019; Uña, Allen and Botton, 2019; Goodwins, 2023; Long et al., 2023), there is uncertainty about how to achieve this in practice. Governments can find it challenging to identify the full range of technology options available to them and how they fit together. They may face strong incentives to use established vendors and solutions,[1] rather than using their buying power to shape the market they need. This can constrain their ability to continuously improve and adapt the financial management services they provide across government and to the wider public.

Bringing public finance (or any part of government) into the digital era is not simply a question of choosing the right software. Broader challenges include the need to: better understand user needs and incentives; address skills gaps; adopt new ways of working; and change funding models (Middleton et al., 2023). Nevertheless, it is

[1] This can result from legislation and other rules and procedures that discourage those making procurement decisions to engage with less established suppliers and solutions. It may also be due to the level of knowledge and comfort that staff tasked with managing and using technology have with established solutions.

clear that the available technology options have a significant impact on the perceived and actual options available to finance leaders.

In this paper we explore the current software-related challenges facing PFM, lay out what is needed for the future and identify areas for action to create markets and technology architectures better suited to governments' current and emerging needs. The paper is based on existing literature, a sample of country cases and our own observations from the field. The paper proceeds as follows. Section 2 provides an overview of current challenges and emerging themes and trends related to software for financial management and more broadly. Section 3 sets out 'what good looks like', and the shifts and actions required to realise that vision. Section 4 concludes with some questions for future research and consensus-building emerging from this exercise.

2 Current challenges and emerging themes and trends

2.1 The status quo and its challenges

The prevailing approach to using software in PFM has focused on the implementation of Integrated Financial Management Information Systems (IFMIS). While the name allows for a wide range of technology architectures, in practice IFMIS has become synonymous with centralised software systems usually based on commercial off-the-shelf (but heavily customised) Enterprise Resource Planning (ERP) systems or custom-built systems that mirror the structure of commercial ERPs.[2]

As discussed in the first two working papers in this series,[3] the IFMIS approach has been plagued with challenges common to large IT projects.[4] These relate to the cost and complexity of implementation, and the lack of flexibility that results. This inflexibility is often driven by a combination of technical, commercial and funding arrangements (see Box 1).

Box 1 The costs of inflexibility

- Honduras – growing obsolescence of the *Sistema de Administración Financiera Integrada* (SIAFI) limits the government's ability to introduce new budgeting and transparency initiatives (World Bank, 2025).
- Papua New Guinea – lack of architectural and connectivity options risks compromising the rollout of the FMIS (Auditor-General's Office of Papua New Guinea, 2014).
- Tanzania – failure to adapt commitment control functions in the FMIS contributes to the accumulation of arrears (Lawson, Hedvall and Muikia, 2022).

[2] For more on the concept of an IFMIS and its functions, see Dener, Watkins and Dorotinsky (2011), Pimenta and Seco (2019) and Uña, Allen and Botton (2019).
[3] Long et al. (2023) and Middleton et al. (2023).
[4] Reports from The Standish Group track IT project success and failure rates. These differ by year, but typically only 31% of large projects succeed. See https://www.standishgroup.com/benchmark.

- Indonesia – pressure to speed up delayed implementation discourages experimenting with alternative solutions to unforeseen issues (Ariadharma and Purnomo, 2018).
- United Kingdom – rigid legacy IT systems were blamed for the inability to implement inflation-based increases in benefits (Gooding, 2022).

Technology decisions are often framed as 'buy' versus 'build'. The reality is that very few complete systems are entirely off-the-shelf (there is at least some degree of customisation involved) or entirely bespoke (all modern software relies on other existing software). Common issues regardless of which primary direction is taken include:

- Without careful management, there may be a significant cost to future change as a result of vendor dependence, for example lack of clarity on intellectual property ownership, technology choices that limit the pool of available skills or lack of in-house understanding of how the system works.[5]
- Funding models that prioritise capital expenditure for the initial project implementation over operational expenditure for teams that focus ongoing maintenance and improvement. Failure to consistently maintain software increases risk and cost over time (Mann et al., 2021; Pahlka, 2024a). This includes reputational and security risks and costs.[6]
- Rigid planning and governance structures prevent implementation teams from changing course as new understanding develops and opportunities arise, alternative options from the market emerge or past assumptions turn out to be false. Many governments fall prey to the 'sunk cost fallacy' due to these structures.[7]
- The fact that choices usually result in an IT procurement often leads to ownership sitting in an IT department, whose incentives are to manage for stability rather than evolve the system to support changing organisational goals and outcomes. This contrasts with the use of multi-disciplinary teams that focus on meeting user needs.

[5] Despite its role in many successful customs agency modernisations (United Nations Conference on Trade and Development, 2023), the Automated System for Customs Data (ASYCUDA) is illustrative of some of these challenges. Although a widely used system for customs management, with development and maintenance supported by the United Nations Conference on Trade and Development (UNCTAD), governments are dependent on UNCTAD for changes to the system. While UNCTAD holds much of the intellectual property rights for the system, there are also dependencies on proprietary components from commercial vendors, which governments must use (OIOS, 2021).

[6] For example, with respect to FMIS Hashim and Piatti-Fünfkirchen (2018) cite Malawi and Ghana as cases of countries failing to budget for the recurrent costs of system maintenance and continuous improvement, leading to costly deterioration of these systems. In 2023 the UK Ministry of Defence acknowledged that it would have to spend £11.7 billion on remediating its digital assets having failed to prioritise their maintenance in the past (House of Commons Committee of Public Accounts, 2023).

[7] A widely cited example is Canada's Phoenix payroll system, which has created significant disruption for the federal workforce and cost 10 times its original budget. See Diao (2022).

- Discomfort with alternative approaches to funding that combine capital and operating expenditure. This may include failure to consider the ongoing need for staff to manage support, maintenance and improvements (e.g. security upgrades) as part of wider operating costs. Unless clearly articulated as part of the business case, these can seem expensive and be an easy target for cuts.

Additionally, the choice to favour buying commercial off-the-shelf software can often ignore the level of customisation required to make the software work in context, to a degree that undermines the initial decision (Boots, 2020). Alternatively, a preference for custom software can lead to an unnecessary level of 'reinventing the wheel' where potential off-the-shelf components are ignored in favour of homegrown equivalents, creating maintenance overheads (Pahlka, 2024b).

These issues are complex in that they are interrelated, but a common theme underlying them all is a sense that there are no proven alternative approaches. It is important to address these issues: to identify examples of practices that have been applied (even imperfectly) in a variety of contexts to unlock progress, and to deliberately test new approaches to unlock other issues (see Box 2).

Box 2 The benefits of flexibility

- Kenya and Sierra Leone – prototyping cash management tools using spreadsheet software has facilitated more substantive FMIS and TSA reforms (Moon et al., 2022).
- Denmark – despite having a well-established FMIS, the finance ministry retenders for core and other components on a periodic basis. Following a recent retendering it is upgrading from Navision Stat to Business Central to provide an improved user interface and allow for opportunities to continuously update, monitor functionality and connect PowerApps and GenAI-based functionality (Økonomistyrelsen, 2026).
- United States – The US Treasury's Financial Management Quality Service Management Office aims to create a marketplace for federal agencies to choose from federal and commercial solutions in the knowledge that these solutions incorporate standards and capabilities that meet baseline needs (US Treasury, 2026).

Part of addressing these issues will involve moving away from the false dichotomies of 'buy versus build' and 'centralised versus decentralised' and recognising that there are a wider range of options and choices available to governments. The broad contours of these options are discussed in the sections that follow.

However, if we purely focus on the issues listed above, we still run the risk of solving yesterday's problems, rather than considering the problems of today and tomorrow and working from those to identify the characteristics of the technology needed to support effective public finance responses.

2.2 Emerging themes and trends

While the world we are entering is uncertain, it is clear that it is one characterised by more crises, where governments and public finance systems will need to be more flexible and responsive to emerging challenges.

The experience of Covid-19 showed that many governments had to bend or break their own practices and operate outside of established systems to mobilise healthcare responses and provide social protection to their citizens. Those that had already invested in digital capability that allowed them to rapidly adapt or develop their systems were better positioned to respond than those that had not (Stewart, 2020).

While public finance systems were relatively responsive, and digital technologies played an important role, many features of prudent fiscal management were set aside for the sake of expedience (OECD, 2020; Long et al., 2023). For example, in the United States there were issues around delays and targeting of stimulus payments to individuals[8] and billions of fraudulent business support claims were uncovered later.[9] In the UK, billions of pounds were lost to fraud and error.[10]

2.2.1 Public financial management themes

Appendix 1 provides a snapshot of different approaches to maintaining financial management software for four countries – Rwanda, South Africa, Denmark and the United States. Several themes emerge:

- First, no technology system is ever *finished.*[11] Hardware and software both need ongoing maintenance for reliability and

[8] Even as the United States rolled out unprecedented Covid relief payments to individuals and households, there were reports of delays in receipt, together with difficulties in reaching some of the poorest, especially those who had not filed tax returns because they were below the income tax threshold. More significant issues emerged in 2021, as the processing of tax returns piled up at the Internal Revenue Service (IRS) – which had to account for multiple exemptions and tax credits provided as part of the Covid response – in turn delaying payment of tax refunds (Menton, 2021). Payments reportedly also went to inaccurate, invalid or closed bank accounts (Picchi, 2021).

[9] In 2023, an Associated Press analysis estimated that approximately 10% ($403 billion of $4.2 trillion) of US government Covid relief was either stolen by fraudsters or misspent (Lardner, McDermot and Kessler, 2023). As of March 2025, the IRS estimated that fraud in Covid relief payments totalled $10 billion (Internal Revenue Service, 2025).

[10] In the UK, the final report of the COVID Counter Fraud Commissioner estimates that, as of December 2025, approximately £10.9 billion was lost to fraud and error, of which £1.8 billion has been recovered. These estimates span issues of fraud and over-ordering in contracts for personal protective equipment (PPE), fraudulent applications for the Bounce Back Loan Scheme and overpayments through the COVID-19 Support Scheme (Hayhoe, 2025).

[11] This applies even in cases where buying commercial solutions is the main approach, as the case of Denmark illustrates (see Appendix 1).

security,[12] and there are always further policy, process or rule changes to adapt to[13] and challenges and opportunities to be met.[14] Rwanda and Denmark's models are clearest in building in ongoing management of change, but this is also implicit in South Africa's recognition that other, potentially more flexible, tools are required to supplement its core FMIS.

- Second, countries are investing in capabilities required to manage ongoing change. There are challenges, especially the need for continuous funding – Rwanda is hardly alone in needing to manage the pace of change in a situation of shifting funding – but the ability to continually change is key, even in *normal* times let alone those of complex change.[15]
- Finally, technology choices are not made in isolation, but are affected by (and affect in turn) a set of wider factors. Rwanda's choices were influenced by a wider government strategy to encourage a knowledge economy. The US is able to use its large operating budgets and commercial power to more forcefully influence market players. In line with the previous two points, this reinforces the importance of local capabilities to make nuanced decisions over time.

These themes resonate further given the broader changing technology and market environment in which governments are making decisions.

2.2.2 Broader themes

The public sector and development discourse has seen three major trends in recent years: the rise of government digital transformation units, the advent of Digital Public Goods and the recent focus on Digital Public Infrastructure.

- Digital transformation units are (often small) teams at the centre of government. They lead digital transformation and introduce new working practices with more emphasis on user-centred, agile and iterative ways of working (Clarke, 2020).
- Digital Public Goods are 'open-source software, open standards, open data, open AI systems, and open content collections that adhere to privacy and other applicable laws and best practices,

[12] For example, 'failure to install timely upgrades in Malawi led to system deterioration with long-outdated software, insufficient capacity to manage transaction requirements, and system exposure to various security risks. This situation alienated stakeholders and led to a lack of trust in the system' (Hashim and Piatti-Fünfkirchen, 2018).

[13] Many governments are adapting their PFM systems to improve how they report on cross-cutting themes such as gender and climate.

[14] Many governments are exploring the potential opportunities of using AI in their PFM systems (Nandakumar, Long and Botton, 2025).

[15] This need to continuously manage change can look different across different countries. In Rwanda, while transition to accrual accounting and the implementation of new modules are modernisation priorities, balancing growth in functionality, greater public sector coverage and security concerns is considered a challenge. In South Africa the cost of maintaining legacy and supplementary systems is the primary motivator for a potential upgrade to a commercial solution. In the United States, legacy systems becoming unsupported and the opportunity to consolidate around modern cloud-based SaaS ERPs is driving change.

do no harm, and help attain the Sustainable Development Goals (SDGs)' (United Nations, 2020).

- Digital Public Infrastructure encompasses 'digital solutions that enable basic functions essential for public and private service delivery, i.e. collaboration, commerce, and governance' (Shivkumar, O'Neil and Kristiansen Nordhaug, 2021). DPI is usually thought of as both an approach to developing such infrastructure and a set of common components, including digital identity, payments and data exchange mechanisms (CDPI, 2026).

Together, these trends are allowing governments to move away from monolithic systems and outsourced contracts and towards more reusable platforms, structured data exchange and component-based ways of constructing software. This in turn shifts the practicalities and economics of traditional buy versus build conversations.

2.2.3 Market trends

There are some parallels to be found in the wider market shift to cloud computing, the rise of open-source software and a set of practices grouped under the label *continuous delivery*,[16] which focus on making it easier and safer to continually improve software.

Cloud computing builds on increased standardisation (e.g. ready access to the internet, web browsers as a consistent way of accessing applications) to enable access to *on demand* computing resources, from low-level computing through to sophisticated applications.

This allows organisations to much more easily assemble the applications they need from a *kit of parts*, and to adopt a more experimental approach to their software choices without the sunk cost of large capital investments. Similarly, open-source software provides a wide range of components that can be assembled by skilled teams, and *continuous delivery* provides a range of practices to improve the quality and speed of software delivery. These too shift the practicalities and economics of traditional buy versus build conversations.

None of these technology trends in and of themselves automatically change the way PFM software operates or set it up to respond to the challenges outlined earlier in this paper. However, we can begin to see a shift:

- Open source and cloud tools, when harnessed by an appropriately skilled team, can allow new approaches to be explored much more rapidly. The risk of trying new approaches is

[16] Continuous delivery describes a set of practices providing the 'ability to get changes of all types – including new features, configuration changes, bug fixes and experiments … into the hands of users, *safely* and *quickly* in a *sustainable* way' (Humble and Farley, 2010). It usually comprises a high level of automation of testing and deployment of software, sophisticated monitoring and logging techniques to help ensure software is working correctly and collaborative practices to ensure a collective focus on the quality and pace of change.

significantly reduced, as can be the costs of managing custom-built solutions.

- The emergence of DPI increases the options and desirability of reusing some basic functionality – such as payment mechanisms and identification – that otherwise would need to be built into PFM systems. This in turn reduces the appeal of entirely integrated systems in favour of *small parts, loosely joined*.
- Cloud-hosted *software as a service* (SaaS) changes the options for customisation as customers typically cannot modify the service, and instead need to think about standardising practices, or consider other modes of integrating their custom requirements (similar to Denmark's architectural approach described in Appendix 1).
- Cloud and open-source options reduce the cost of duplication. The financial case for having only single versions of particular modules is lower if the cost to implement is lower, or the pricing is consumption-based. This reduces one of the arguments for the centralisation of systems.
- The development of continuous delivery methodologies changes expectations about how quickly and easily new features can be added or existing features modified, allowing for more responsive systems.

Together, these shifts may allow the IFMIS to be broken into smaller pieces, and some functions may not be required centrally at all. This in turn can open up different, more federated options for governments, including:

- informed and trusted local decision-making, which will generally always be faster than centralised decision-making;
- tooling that is more context- and task-focused, with more options to optimise for process and decision efficiency; and
- experimentation is lower-risk and requires fewer resources.

These possibilities can seem far off in environments where many basic public finance functions have proven hard to implement, digitally or otherwise. Careful consideration is needed of where these new techniques may allow bypassing some of the issues of the past, and where other foundations are needed. New skills will be required to fully harness new approaches, and there is likely to be resistance from market incumbents threatened by change.

3 What does good look like?

3.1 **Starting principles**

While it is not the purpose of this paper to lay out a new reference model for PFM software and data architecture, a few principles are crucial to what follows:

1 The ongoing importance of providing decision-makers with a comprehensive picture of the fiscal position.[17]

2 The timely flow of information and funds is a primary concern of good PFM.[18]

3 Trade-offs between standardisation and localisation need to be made locally and dynamically.[19]

4 No technology system exists in isolation: systems need to be developed as part of wider services to meet the needs of users (including financial decision-makers, public service providers and others).

Underlying these principles are a set of common basic needs. As discussed in the previous paper in this series (Stewart and Bacon, 2024), we believe technology choices should also be considered in the context of two other sets of outcomes:

1 Attributes such as *usability, reliability, scalability, security* and *performance*, that determine whether we can meet the needs of today's user; and

2 The *ability to sustain and continually improve*, and *optionality to adapt and extend*, to set us up for the future.

[17] When transactions occur outside established processes and systems, decision-makers lack this comprehensive overview. Hashim and Piatti-Fünfkirchen (2018) show how the picture of the fiscal position is incomplete in Pakistan, Ghana, Zambia and Malawi, due to the use of parallel processes and systems by some spending units. Piatti-Fünfkirchen et al. (2019) argue that it is not practical for service delivery units such as health posts to process small volume transactions through centralised systems.

[18] See, for instance, Rivero Del Paso et al. (2023: Table 2, p. 11): 'PFM IT systems should (1) support gathering and consolidating timely, comprehensive, and reliable data that are generated along the PFM cycle and/or required from specified outside sources to support PFM functions; and (2) enable automating data gathering and data consolidation across the general government'. In the absence of reliable data from the relevant line ministry or entity, a Finance Ministry, finance function or disbursing entity may choose to withhold allocated funds – that is, the timeliness and reliability of fund flows is inherently linked to the timeliness and reliability of information flows.

[19] For example, the localisation needed may be different for a city government and a rural government within the same country, or between a ministry for health and a ministry for home affairs, and these may change in response to circumstances.

These considerations, and particularly the ability to sustain and continually improve, require new approaches both to how software for PFM itself is managed, and which departments and individuals should be responsible for its management and for ensuring the right ongoing investment.

No technology architecture exists in isolation. Conway's Law is widely recognised as a key factor in the decisions organisations make about technology.

> Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure (Conway, 1968).

It follows that any change in software and architecture needs to be accompanied by changes in organisational practice, both in terms of technology delivery but also wider communication and decision-making structures.

The US Treasury has recognised this in its 10-year vision, which aims to use technology better while also changing the role of the CFO, recognising that, if basic data is flowing effectively, the CFO can focus on addressing issues of public trust in the efficiency of government (US Treasury, 2018). Similar if less radical goals are set in the Danish Agency for Economic and Financial Affairs' pitch – 'Get more time for your core tasks with [our] digital solutions'.[20] Arguably the lower administrative burdens and 'business intelligence' for decision-making South Africa and Rwanda seek is about the same thing. (See Appendix 1 for further discussion of these country cases.)

On a practical level, governments often make it difficult to realise benefits by separating technology change from other types of change, resulting in either a need for complex and costly change management or stalled initiatives. Defining programmes as technology 'modernisation' or 'replacement' masks the human and process change that success requires, and casts success as 'new technology' rather than more consequential outcomes.

Success involves significant and complex change, but that does not mean that progress must be made all at once.[21] Further discussion is needed about how to effect change, but below we outline some areas for attention, along with who might be best placed to act and what this might look like.

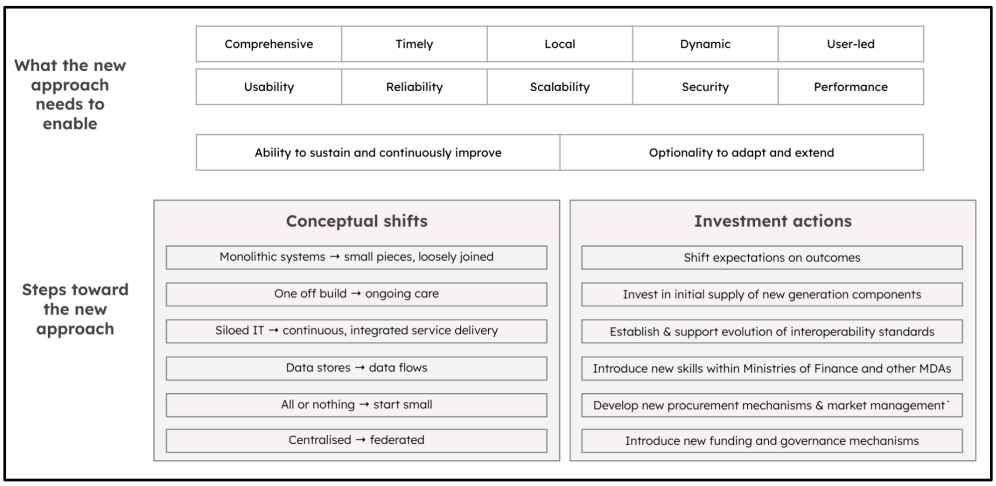
[20] See https://oes.dk/digitale-loesninger/saadan-faar-du-vores-loesninger/

[21] In Denmark the government operates a rolling plan for adaptations to components of its digital infrastructure for financial management: see https://oes.dk/digitale-loesninger/udvikling-og-udbud/roadmap/

3.2 Creating better software options

Two sets of actions are necessary to effect change. One is a conceptual change in expectations. The other is a more specific set of actions around investment (see Figure 1).

Figure 1 Building towards a new architecture



Source: Authors

3.2.1 Conceptual shifts

The first set of shifts is in the approach and concepts underpinning how we think about technology. These shifts are:

Monolithic systems → small pieces, loosely joined

Large, tightly integrated systems rapidly become fragile and hard to change. They have been preferred because of the integrated view that they promise, but with appropriate attention to standards-based interoperability there are other options for integration which do not preclude making local improvements to parts of the overall system as needs or conditions change.

One-off build → ongoing care

The need for ongoing staffing, funding and focus on the ability to change runs through all the points above. While this ongoing care is often hard to fit into the funding models used by governments it is an essential shift to ensure ongoing adaptability of systems and avoid the need for regular major changes, while potentially offering a way to more effectively prioritise change and reduce costs.[22]

Siloed IT → continuous, integrated service delivery

Where technology provision is considered separately from the overall delivery of the services it supports (whether public services or

[22] Stuart McGuigan, former CIO of the US Department of State and Johnson & Johnson, reports reducing ERP change costs at J&J from $200 million to $100 million through the use of stable teams and agile approaches (Bendor-Samuel, 2021).

services to enable public servants) it is easy for management incentives to become about stability or minimising direct costs. To drive different approaches, management of the technology needs to be considered and measured as part of wider organisational success.

Data stores → data flows

Data only has value when it is used to improve experiences, provide insight or support decisions. Many public finance systems focus on the collection and reporting of data, with undue emphasis on ensuring that data is stored in the right place, rather than ensuring that the right people have access to it in the right format to support better decision-making. A shift in priorities towards making data available and useful can also change the incentives around gathering and quality-assuring it.[23]

All or nothing → start small

Many of these shifts require a very different approach to existing technology systems and practices. It can be tempting to suggest that the best option is to start again, but in practice this is both highly risky and can run counter to the *small pieces, loosely joined* approach. Taking a *start small* approach is more practical, and a foundation for considering the system as a set of inter-operating services.

Centralised → federated

As these architectures develop it becomes more feasible to shift from a mindset that PFM systems are either centralised and integrated, or decentralised and fragmented. In practice, all PFM systems have a measure of decentralisation as it stands,[24] but by moving towards new architectures there is an opportunity to recognise that decentralisation and employ new practices to effectively manage it.

3.2.2 Investment actions

These conceptual shifts are prerequisites for the adoption of new architectures and better software, but more active interventions and investments are also necessary to drive better supply, of both software and skills. We present summaries here and an expanded view in Appendix 2.

Shift expectations on outcomes

Digital transformation initiatives in PFM are frequently approached in a siloed manner, delivered against functional specifications defined against international norms. This means that the specific outcomes that an initiative is intended to meet are quickly lost, and with that the opportunity to work in a multi-disciplinary way, do effective change

[23] For further discussion see Stewart (2023).

[24] The OECD reports that 'less than half of OECD countries are requiring all agencies to use the centralised FMIS. Only four OECD countries report that sub-national governments use the centralised FMIS, and this is only limited to some entities' (Moretti, Keller and Beazley, 2024).

management and create space for finding simpler ways to solve problems. Focusing teams on outcomes (even where international norms/practices exist) will better enable them to find solutions that meet the needs of users in context.

- Senior government leaders can provide clear leadership focus on outcomes and challenge siloed or overly complex approaches.
- Funders and international financial institutions can signal support for iterative progress and ensure an ongoing focus on outcomes by creating space to change course based on learning.

Invest in building an initial supply of new-generation components

Governments are generally faced with the choice of building the systems and tools they need or buying/renting large complex systems. Locally developed software is rarely shared and there are few examples of it being developed for wider use – the teams developing it are rarely incentivised to focus on what is general and so concentrate on high levels of customisation. More modern software practices move beyond the buy/build dichotomy by drawing on a rich ecosystem of cloud services and open-source components. For the public finance field, investing in filling out the gaps in the ecosystem with open-source software is a way to demonstrate different approaches and raise the baseline expectations of what should be readily available.

- Foundations and international financial institutions could commission a comprehensive study of PFM-related packages that are or could be made reusable, and provide funding and other support to make those pieces reusable (as they already are in other domains).
- Government leaders can encourage teams to share openly about the software they are developing in-house or commissioning, and recognise the value of sharing and reuse to unlock new multilateral funding.[25]

Support the establishment and continuous development of interoperability standards

The vast scale of the open internet has been enabled by a growing and evolving range of open standards supporting innovation and interoperability.[26] By contrast, most public finance systems are hard

[25] For more on 'working in the open' see Flemming (2022). For examples of the impact of open working see Stewart (2020).

[26] Interoperability is a broader concern than technical standards, with legal, regulatory and semantic considerations. Standards efforts that seek to address the full set of considerations in a domain are notoriously complex. The evolution of the standards underpinning the internet has shown that it is possible to move towards interoperability and make interoperability easier without requiring comprehensive solutions up front.

to integrate, requiring complex technology solutions[27] and understanding of proprietary standards that increase vendor lock-in. Standards exist for the exchange of some financial information, but there is no simple way to understand which standards are royalty free (to allow for genuinely open technology choices). Addressing this would ensure that software provides basic interoperability *out of the box*.

- Funders and international financial institutions could ensure that a comprehensive, usable set of standards exist for most common public finance data exchange. They could also establish appropriate bodies to steward those standards over time and bring together an ecosystem of interested parties, building on experiences such as the development of the Open Contracting Data Standard[28] and International Aid Transparency Initiative.[29]
- Government leaders can ensure that standards are mandated in requests for proposals (RFPs) and other procurement activities, and refuse to accept extra cost for access to their data via open standards.

Introduce new skills within finance ministries and spending agencies

Working differently and introducing new options requires new skills. Building skills in-house allows for a depth of partnership (focused on shared outcomes) that is hard to achieve through outsourcing arrangements. In many contexts similar new skills need to be grown in order to build the market of local service providers. Introducing new skills can be challenging in resource-constrained environments, but the 'start small' approach identified above, along with the right mode of technical assistance, can enable this without waiting for large-scale training programmes. Small teams are often more effective than very large ones.

- Government leaders can establish modern digital leadership roles and empower them, and expect and support multi-disciplinary working – not accepting any separation between policy and delivery.
- Funders and international financial institutions can support governments in creating the appropriate working environments and incentive structures[30] to get the right leaders and practitioners

[27] Beyond the common practice of introducing interoperability platforms or service buses to connect systems, it is not unusual to have to perform complex transformations to combine datasets and convert them to useful formats. This practice can be fragile when the source systems do not provide clear guarantees about how data is handled.
[28] See https://standard.open-contracting.org/latest/en/
[29] See https://iatistandard.org/en/
[30] Salaries are a common challenge in attracting and retaining technical talent: see for example Peixoto, Kaiser and Rakotomalala (2022). Governments have taken different approaches to addressing this, such as the UK government's Digital, Data and Technology

in post, and invest in training and support networks/mentoring for those leaders.

Develop new procurement mechanisms and market-shaping approaches

Governments are biased towards large, incumbent suppliers due to the overhead involved in navigating their procurement processes. This also encourages risk aversion: the larger the procurement, the less you can afford to experiment. Lighter-weight procurement practices allow for more innovative and iterative approaches. This in turn creates more opportunity to trial and work with new market entrants, or explore options across a range of suppliers, rather than a single system integrator.

- Funders and international financial institutions can review conditions attached to funding to ensure they enable nimble procurement practices and *start small* to scale approaches that open up markets and reduce the risk from failure. They should consider other financing mechanisms that make it more feasible for innovative suppliers to work with governments.
- Governments should ensure procurement practices are proportional and reduce barriers to SME involvement, actively working with expert buyers in government and local suppliers to identify where processes can be simplified without sacrificing transparency and accountability.

Introduce new funding and governance mechanisms

Funding mechanisms within governments and from external funders are typically designed to support initiatives that start large and work to a fixed plan. Governance is typically designed to measure adherence to the initial plan, rather than test, recognise and reward learning and adaptation. Both funding and governance are usually reduced once a new system is implemented, rather than supporting and guiding its ongoing operation and improvement. Metrics often focus on delivery rather than outcomes (supporting user success, etc). The practices described above require a shift to more operational expenditure over capital expenditure (Mann et al., 2021; Pahlka, 2024a).

- Funders, international financial institutions and governments can all adapt governance practices to recognise a certain amount of change based on learning as a good attribute of any delivery, and look for metrics that encourage rapid test- and-learn approaches with real users.

Profession, or Rwanda's creation of Irembo as a public–private partnership. However, in the authors' experience salary is only one component of the challenge, and it is important to consider other factors, such as quality of leadership and opportunities for impact and progression.

- Further research is needed on effective budgeting, accounting and funding practices to support ongoing improvement and adaptation.

4 Emerging questions

Considering the above, we conclude with a set of questions meriting further exploration for the provision of better software options for PFM.

What is the current state of the market when mapped against more flexible architectures and characteristics?

By ‘market’, we mean a) currently installed software in countries; b) readily available options for countries that want new or replacement software (for part or all of their PFM operations); and c) the supply of relevant skills, including for designing, building, procuring, maintaining and evolving such software. Which aspects of the market are more versus less evolved, and what levers and touchpoints could be most catalytic in driving change?

What existing software and standards could have greater impact if more broadly recognised and supported?

A wide variety of locally developed software exists across the global public finance ecosystem, alongside a wide range of specifications and standards for data exchange. Which of these might provide foundations for further work, either through lessons learned or by investing to make them more widely applicable and available?

How might governments and funders more actively shape the markets they want?

Some governments individually and all governments collectively have immense buying power. Beyond establishing clearer standards and improving the open-source supply of elements of new public finance systems, how might that power be effectively exercised individually or collectively? What is the role of multilateral institutions and other funders in this?

Beyond technical assistance, how can the supply of skills be improved?

What roles and capabilities should be better understood and which role models can be shared? What training, mentoring or other schemes can improve the availability of skills at a locally manageable cost?

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Appendix 1 Country cases

Rwanda

In contrast to other countries in sub-Saharan Africa, Rwanda chose to build its IFMIS in-house using open-source and commercial components and relying predominantly on local capacity. The decision was influenced by the high costs of implementing commercial solutions (both in terms of licence fees and change management) and as part of a wider strategy to encourage a knowledge economy.

The system (SmartIFMIS) provides core functions for expenditure management and is integrated with solutions for payroll, tax, banking and procurement (Mukwende, 2021). The system covers central government entities and local governments, schools and health facilities (Mukwende, 2021). The total annual cost of development is estimated to be considerably less than other countries in the region pay for commercial licences that cover central government only. Based on their success, the in-house team now provides consultancy services to other countries in the region.

It has taken a long time to get to this point. A first attempt at building an in-house solution in the mid-2000s was criticised for failing to meet its objectives (Hove and Wynne, 2010). Reviews by a quality assurance group and others in the early 2010s considered development of the current system to be off-track (Ecorys, 2012). Ultimately, the government chose to stay the course, and progress has been steady since, as have broader improvements in public financial management.

The challenge the government now faces is how to manage the pace of modernisation versus the cost of internalising those costs as financial and technical support from development partners wanes.

Denmark

Denmark's FMIS (Navision Stat) and the company responsible (Navision) have been hailed as one of the country's most successful IT companies, software products and government IT projects (Sørensen and Nielsen, 2015). It is part of wider suite of digital solutions for financial management maintained by the Danish Agency

for Economic Affairs (Økonomistyrelsen) under the Ministry of Finance.

Notable features of the Danish model include:[31]

- Coverage – it is used by over 400 state and self-governing bodies.
- Flexibility – it accommodates some customisation for specific user requirements.
- Maintenance – it is continuously being developed by a central team in the Danish Agency for Economic Affairs based on the latest standard MS Dynamics NAV.[32]
- Integration – with other digital solutions for financial management maintained by the Agency for Economic Affairs.

To make this possible:

- There is an established long-term relationship between the Agency for Economic Affairs R&D team and the Navision R&D team. The government has been upgrading to the latest version since 1998.
- Customers for the standard model are often co-located with the R&D teams and consultants following the establishment of shared accounting service centres 2008, allowing for an agile development model.
- Customisations of the standard model are tightly controlled to make upgrades to newer releases easier, and efforts are made to eliminate them over time by converting them to extensions.[33]

Despite its success including "massive savings" the government periodically evaluates and considers options for replacing the system.

South Africa

South Africa's 'transversal system' for government financial management has been an enduring feature of its public financial management system in the post-apartheid era (Cresswell, 2021). The core systems for accounting, HR & payroll, procurement and reporting are used by most central government departments as well as provincial governments. These are supplemented by MS SQL and Excel-based tools for budgeting, cash flow management and expenditure reporting. All of these systems and tools are managed by the National Treasury, South Africa's finance ministry.

Despite contributing to an internationally respected public financial management system, the government has been actively considering replacing the transversal system since 2003. Issues with the existing

[31] See https://oes.dk/digitale-loesninger/navision-stat/

[32] In 2002 Navision was acquired by Microsoft, and subsequently rebranded as Microsoft Dynamics NAV in 2005 (Buchmann, 2023).

[33] See https://oes.dk/digitale-loesninger/udvikling-og-udbud/roadmap/

system include gaps in coverage and functionality; the cost of external consultants to build and maintain supplementary systems and ensure interoperability between different systems; and inefficiencies arising from duplication.

The initial project to procure a commercial solution in 2003 became bogged down because of concerns about the level of customisation required to cater for existing business process and difficulties coordinating project management between the National Treasury and other responsible agencies – namely the Department of Public Service and Administration and the State Information Technology Agency (SITA). The project was discontinued and relaunched in 2013, with Oracle subsequently chosen as the supplier of commercial FMIS. Rollout to pilot sites was planned for 2021 but has stalled amidst broader governance challenges, and the project was subsequently closed following an investigation.

United States

The US financial management system is highly decentralised, with federal agencies often free to choose their own software for financial management. While this provides flexibility, it also raises concerns about duplicative spending and difficulties in consolidating financial information.

The US Treasury's Fiscal Bureau has been attempting to tackle this for a number of years, notably through the Financial Management Quality Service Management Office initiative.[34] As noted (see Box 2), this aims to create a marketplace for federal agencies to choose from federal and commercial solutions in the knowledge that these solutions incorporate standards and capabilities that meet baseline needs.[35]

The initiative is tied to the US Treasury's 10-year vision, which aims to make financial management less of an administrative burden, and enable agencies to use financial information to focus on delivering on their missions.

[34] See https://tfx.treasury.gov/fmqsmo
[35] See https://tfx.treasury.gov/fmqsmo/fmcf

Appendix 2 Changes and actions

Change to be made	Issue and context	Example(s) of alternatives	Actions to be taken
Shift expectations on outcomes	Digital PFM initiatives are frequently approached in a siloed manner, delivered against functional specifications defined against international norms. This means that the specific outcomes that an initiative is intended to meet are quickly lost, and with that the opportunity to work in a multi-disciplinary way and do effective change management and the space to find simpler ways to solve problems. Risk increases.	The United States' 10-year vision and strategy for its public finance lays out three goals and focuses on the role of government as steward of public resources. This provides a guiding context for all technology decisions. The UK's Universal Credit programme was reset after IT delivery failures with the direction from the Secretary of State to 'deliver an intervention that means we support more people to find more work, more of the time, while protecting those who can't work'.[36]	Senior government leaders can: • Provide clear leadership focus on outcomes and challenge siloed or overly complex approaches. Funders and international financial institutions can: Signal support for iterative progress. Ensure an ongoing focus towards outcomes, including creating space to change course based on learning.

[36] https://options2040.co.uk/wp-content/uploads/2024/02/The-Radical-How.pdf

Change to be made	Issue and context	Example(s) of alternatives	Actions to be taken
		This guiding approach drove multi-disciplinary collaboration and a test and learn approach to delivery.	
Invest in building an initial supply of new-generation components	Governments are generally faced with the choice of building systems and tools largely from scratch, or buying/renting large complex systems. Locally developed software is rarely shared and there are few examples of it being developed for wider use. Investing in filling out the gaps in the ecosystem with open-source software is a way to demonstrate different approaches and raise the baseline. (It does not mean everything will be open-source in future.)	There is growing adoption of a range of 'Digital Public Goods' such as DHIS2 and MOSIP across governments, and the GOV.UK Notify platform has been adopted in numerous countries.[37] There are clear calls for expanding this approach to core elements of public finance.[38]	Funders and international financial institutions can: ● Commission a comprehensive study of PFM-related packages that are or could be made reusable. ● Provide funding and other support to make those pieces reusable. Government leaders can: ● Encourage teams to share openly about the software they are developing in-house or commissioning. ● Recognise the value of sharing and re-use to unlock use of new multi-lateral funding
Set standards	The vast scale of the open internet has been enabled by a growing and evolving range of open standards that support innovation and interoperability.	The IMF Digital Solutions Guidelines for Public Financial Management call for 'all software purchased for the purposes of PFM' to 'provide robust and comprehensive API access via well	Funders and international financial institutions can: Ensure that a comprehensive, usable set of standards exists for most

[37] https://public.digital/pd-insights/blog/2023/03/the-international-reach-of-uks-notify-service

[38] https://www.project-syndicate.org/commentary/three-measures-to-boost-sovereign-debt-transparency-by-pablo-saavedra-et-al-2024-03

Change to be made	Issue and context	Example(s) of alternatives	Actions to be taken
	By contrast, most public finance systems are hard to integrate, requiring complex technology solutions and understanding of proprietary standards that increase vendor lock-in.	documented open standards based interfaces'.[39] The UK government developed an open standards policy to drive adoption of existing open standards in government technology delivery and procurement.[40] Standards such as the International Aid Transparency Initiative and the work of the Open Contracting Partnership exemplify alternative options.	common public finance data exchange. Establish appropriate bodies to steward those standards over time and bring together an ecosystem of interested parties. Government leaders can: ● Ensure that standards are mandated in RFPs and other procurement activities. ● Refuse to accept extra cost for access to their data via open standards. Vendors can: Actively participate in the development of standards, sharing opportunities and challenges as well as technical advice. Demonstrate products that 'natively speak' key standards
Introduce new skills within MoF and other MDAs	Working differently and introducing new options requires new skills. Building skills in-house allows for a depth of partnership	Denmark's approach to co-location of development teams and key users allows for rapid collaboration on improvements.	Government leaders can:

[39] https://www.elibrary.imf.org/view/journals/005/2023/007/article-A001-en.xml
[40] https://www.gov.uk/government/publications/open-standards-principles/open-standards-principle

Change to be made	Issue and context	Example(s) of alternatives	Actions to be taken
	(focused on shared outcomes) that is hard to achieve through outsourcing arrangements.[41] In many contexts similar new skills need to be grown in order to build the market of local service providers. The introduction of new skills can be challenging in resource-constrained environments, but 'starting small', along with the right mode of technical assistance, can enable this without having to wait for large-scale training programmes. Small teams are often more effective than very large ones.	This is enabled by appropriate staffing models.	● Establish modern digital leadership roles and empower them. ● Expect informed and nuanced consideration of delivery options. ● Expect and support multi-disciplinary working, and reject separation between policy and delivery. Funders and international financial institutions can: ● Support governments in creating the appropriate working environments and incentive structures needed to get the right leaders and practitioners in post. ● Invest in training and support networks for those leaders.
Introduce new procurement mechanisms	Traditional government procurement biases towards large, incumbent suppliers due to the overhead in navigating processes.	The UK's Digital Marketplace was designed to provide simpler access for government to cloud-based technology services. It provided simple signup routes for new market entrants who might otherwise be deterred from selling to government, and digital design to ensure	Funders and international financial institutions can: ● Review conditions attached to funding to ensure they enable nimble procurement practices and 'start small to scale' approaches

[41] https://public.digital/pd-insights/blog/2019/10/why-internet-era-ctos-hire-developers

Change to be made	Issue and context	Example(s) of alternatives	Actions to be taken
	The overhead of most procurement practices also imbues a level of risk aversion and reluctance to experiment. Lighter-weight procurement practices allow for more innovative and iterative approaches.	the buying experience was quick, easy and still compliant. This supported a significant shift of spend to SMEs, and provided government with a wider range of delivery options.	that open up markets and reduce the consequences of failure. ● Consider other financing mechanisms that make it more feasible for innovative suppliers to work with governments. Governments can: ● Ensure procurement practices are proportional and reduce barriers to SME involvement.
Introduce new funding and governance mechanisms	Funding mechanisms within governments and external funders are typically designed to support initiatives that start large and work to a fixed plan. Governance is typically designed to measure adherence to the initial plan, rather than test, recognise and reward learning and adaptation. Both usually drop away once a new system is 'implemented', rather than measuring performance. Mechanisms that support funding of ongoing improvement, connected to outcome-based or user-success metrics, can address this.	The UK government's digital transformation efforts from 2011–2017 were driven by for KPIs for government services: digital uptake (channel shift), proportion of users able to complete a transaction successfully without assistance, user satisfaction and cost per transaction.	Funders, international financial institutions and governments can: ● Adapt governance practices to recognise a certain amount of change based on learning as a good attribute of any delivery. ● Look for metrics that encourage rapid test and learn approaches with real users.