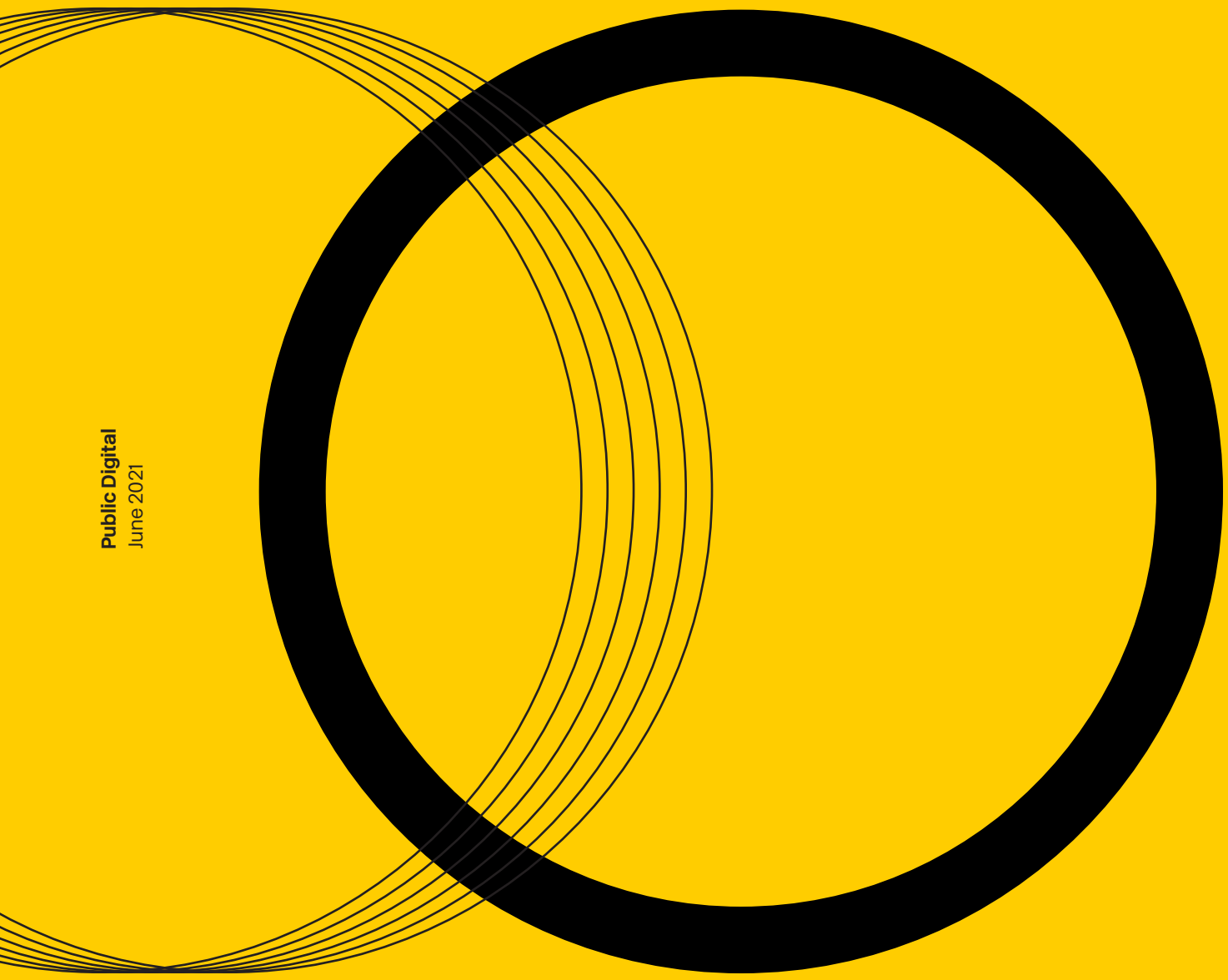
Open source in government: creating the conditions for success

public digital



Public Digital
June 2021

About Public Digital

Public Digital is a disruptive global consultancy that helps organisations that matter to thrive in the internet era. Public Digital advises leaders in governments and large organisations around the world on how to meet the needs of their citizens/customers through use of the internet. The shorthand for this is digital transformation: how to use the culture, technology, processes, and operating models of the internet era to improve the services they deliver to people. We help governments:

— set up transformative digital institutions
— recruit and retain people to fill vital roles within them
— implement agile, iterative, user-centric policy and service design
— assess existing technology programmes and capabilities
— understand and emulate global best practice in digital government

Acknowledgements

This report was prepared for Public Digital by Emma Gawen, Anna Hirschfeld, Angeles Kenny, James Stewart and Emily Middleton. It was made possible through the generous support of the Omidyar Network. The views herein, however, do not necessarily reflect those of the funder. We would also like to thank input from colleagues at the World Bank, New Legacy Digital, NORAD, MOSIP, Mojaloop, e-Governance Academy (eGA), Open Forum Europe, UNICEF; and representatives of the governments of Bangladesh, Cote d'Ivoire, Morocco, Peru, Portugal, Sierra Leone, United Kingdom and Uruguay, who were generous with their time and introductions.

About this report

This report was released June 2021 under a Creative Commons Attribution-ShareAlike 4.0 license, and should be cited as: Public Digital, Open source in government: creating the conditions for success, 2021. Available at **https://public.digital/research**

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Open source in government, creating the conditions for success

Executive summary

Governments globally have sought to digitise their operations and services for many years. Covid-19 has made this an imperative: countries that have been able to serve their citizens remotely have seen the benefits of their digitisation efforts; those further behind have seen the gap more acutely.

Adoption of open source software is a powerful tool to accelerate digitisation; it allows governments to share and reuse solutions across borders; to quickly experiment and pilot services without complex and expensive procurement, and then scale at a lower marginal cost. In the best cases, a global community can be created and connected through an open source software project, will share ideas and best practices, and help to deliver more sustainable and flexible services.

Open source software can also be a powerful lever for change. It can:

- enable greater digital sovereignty by helping governments to move away from contracts where they are locked-in to specific vendors for decades at a time
- support the development of local or regional digital economies
- create competition thereby bringing down prices
- grant governments greater flexibility and control over how their services are delivered.

To gain a deeper understanding of governments' experiences and needs when implementing open source software we conducted 19 interviews across 4 continents. We spoke to a mixture of government decision-makers, technical experts, funders and people delivering digital services to citizens.

In this report we have synthesised their experiences, and set out an **Open Source Capability Model for Governments**[1]. It is a tool intended to help stakeholders build a common understanding of capability.

Invest in the conditions for success

Decision-makers should understand governments' open source capabilities, using this to prioritise investment in building open source knowledge, skills, and an enabling environment.

This is especially critical for leaders who want open source software to play a major role in their government's technology strategy, or those who are planning to use major open source platforms. Our capability model can help governments see where they need to invest in skills and capacity so they can strengthen an open source software implementation.

By investing in capability, and by creating a pathway for the sustainable use of open source software, countries will receive a range of direct and indirect benefits. They will enjoy more strategic control of technology, stronger capabilities for managing a government's technology stack, and ultimately, citizens will enjoy better outcomes and services.

The decision to use open source software, like any software choice, should be made in terms of the service and strategic outcomes a government intends to achieve.

1 This model is inspired by – and designed to complement – the Harvard Maturity Model for Digital Services, which Public Digital contributed to. Eaves (2018)

Part 2: Proposing A Maturity Model for Digital Services. Available at https://medium.com/digitalhks/part-2-proposing-a-maturity-model-for-digital-services-9b1d429699e7

We have made a series of recommendations for governments to consider:

1. Policy environment

Build political consensus and support for open source software adoption, to strengthen long-term sustainability.

Publish and promote a technology strategy for use across government, including clear objectives for open source software.

2. In-house skills and capabilities

Make a central official or team responsible for setting open source standards and policy, to support and guide its use in government.

Find champions and develop the government's internal open source community.

Take steps to encourage reuse within government, including finding opportunities to release publicly-funded code in the open.

3. Open source vendor ecosystem

Review procurement policies and practices to ensure they aren't inadvertently blocking open source software.

In the longer term, develop a range of appropriate procurement options for buying software and related services.

Grow and support the local ecosystem of vendors, including promoting new business and delivery models built around open source software.

4. Sustainability

Evaluate the short and long term costs of open source software projects, using early experiments and pilots to understand the implementation, maintenance and support costs of the service.

Consider and evaluate what ownership and support model will be needed to support your implementation

Contribute to the open source community: share experiences in the open, support the development of local technical expertise and contribute practically by encouraging contributions to open source projects.

Many of these recommendations are good practices for all government technology, and will benefit the quality and sustainability of digital public services in general, not just those using open source.

We believe that this report, and the model within it, can be useful tools for decision-makers. We also hope that the insight and advice for governments will be helpful to funders and open source software providers when working with countries to implement new and better services for citizens through open source software.

Introduction
Make things open: it makes things better

The internet has open source frameworks, programming languages, libraries, components and services at its heart. Every day we use services which depend on open source software, without knowing it. And government developers or their vendors make choices to use open source technologies for the services they are building all the time.

But beyond the adoption of open source libraries, programming languages and components: funders, multilateral institutions and often governments[2] themselves are seeing the benefits of using open source, and open sourcing software. Public Digital believes strongly that **making things open makes them better**. In this report, we focus on the use of open source software by – and from the perspective of – governments.

What is open source software?

Open source software is a way of developing and distributing software. The code is often written collaboratively, and it can be downloaded, used and changed by anyone. Open source software is released under a license in which the copyright holder allows the licensee to use, edit and distribute the source code as they wish[3].

We have chosen not to use the term "free and open source software", or FOSS, to avoid confusion[4]. While the software license for open source is free, the implementation and maintenance of any software will have some costs associated, though with an expectation these will be lower than when considering proprietary software[5].

2 See for example https://digital.canada.ca/2020/02/24/why-open-source-matters/
3 Examples of common open source licenses can be found at https://opensource.org/licenses
4 The "free" in "free and open source software" is usually intended to mean free of intellectual property limitations ("free as in speech, not as in beer") but is too often misunderstood.
5 Sahay, S. (2019) 'Free and open source software as global public goods? What are the distortions and how do we address them?', The Electronic Journal of Information Systems in Developing Countries, 85(4), e12080. https://doi.org/10.1002/isd2.12080.

The advantages of open source software

Open source software can be a powerful lever for change, giving teams greater flexibility on how they solve problems and develop services based on users' needs[6].

Where countries have been locked into proprietary software systems for a long time, they may be experiencing a number of undesirable side-effects, such as:

— exploding costs for licenses, implementation and maintenance, without the option to move to another vendor
— a lack of control of (and sometimes lack of access to) citizen or government data
— the inability to respond quickly to changing needs (for example, change requests taking 6 to 12 months to deliver) due to inflexible software and contracts
— a lack of control of service design, and a lack of ability to develop features needed for key public infrastructure

In contrast, open source software can enable governments to build services quickly, by building on the experience of others. It can offer a way to reuse and adopt a solution without complex and expensive procurement.

The low cost and low level of friction to experiment with open source software gives governments the ability to start small, test a solution and understand how it works. This approach is good practice when thinking about adopting any technology, but open source software makes it easier, and lowers the risk of getting locked in to long license agreements.

By leveraging the flexibility and inbuilt interoperability of much open source software, governments can take an approach where the design and implementation of a service is more flexible, easier to iterate and faster in responding to changes on the ground.

6 World Bank (2019) Open Source for Global Public Goods, Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/33401

The fundamental principles and culture of open source software – including transparency, collaboration, and democratising access to information and code – also offer widespread appeal. Putting code in the open can act as a lever to improve code quality: as it opens code up to external scrutiny (and, in the best case, improvement). If an organisation wants external contributors, it will also need to make sure the code has quality documentation: another lever that improves quality. These actions in turn can help organisations attract top software engineering talent[7], strengthening their technology capability.

There are also wider economic benefits to developing a technology strategy that embraces open source software. A 2021 study conducted by the European Commission found that "a 10% increase in the number of [open source] contributors would increase EU GDP by 0.6%, i.e. Euro 95 billion per year".[8] The act of a government embracing open source can encourage the local vendor ecosystem to do the same: delivering benefits not only for government software but the wider economy too.

A 2021 study conducted by the European Commission found that "a 10% increase in the number of [open source] contributors would increase EU GDP by 0.6%, i.e. Euro 95 billion per year".[8]

Furthermore, the adoption of open source software can be an important tool for countries looking to increase their digital sovereignty. 'Digital sovereignty' is generally taken to mean the power and authority of a national government to make free choices about decisions affecting citizens and businesses within the digital domain – covering data, software, standards and protocols, infrastructure and public services.

7 See for example https://www.linuxfoundation.org/resources/open-source-guides/recruiting-open-source-developers/

8 Open Forum Europe (2020), First results: European Commission Open Source Study First results European Commission Open Source Study

Open source software – combined with the use of common standards and modular architectures – can enable governments to make decisions about where in their digital infrastructure they want to take more control.[9] This could be, for example, prioritising citizen privacy when storing citizen data or bringing services that are of national strategic importance completely in-house. The opportunity to build local capacity can also reduce lock-in, and reliance on multinational technology firms and other commercial entities.

Scope of this report

Open source software operates across the technology stack: from frameworks, programming languages, libraries, components and user facing services. There is increasing interest in developing open source software solutions that support mission-critical public services, and platforms that form part of a government's digital infrastructure[10] (sometimes referred to as Digital Public Infrastructure, or DPI). For the purposes of this report, we are mostly referring to the use of open source software and platforms which enable governments to deliver these mission-critical public services. For example, a civil registration platform or health management information system.

In the development and use of these larger scale services and infrastructure, a decision between a proprietary solution and an open source software alternative becomes more complex: as the advantages of open source software meet the reality of implementing any kind of large scale technology program in government.

Implementing a proprietary solution can seem like an easier path, particularly if a government is used to outsourcing technology delivery; but the long-term benefits of taking control of technology choices often outweigh the investment of effort.

This report has primarily been written for decision-makers and technology specialists in national governments. However, we hope it will also be useful for officials in other levels and areas of government; as well as for funders, open source software developers, technology firms, and others who have an interest in supporting governments' use of open source software.

9 In December 2020 EU member states adopted the "Berlin Declaration on Digital Society and Value-Based Digital Government", which agreed to strengthen sovereignty by "Implement[ing] common standards, modular architectures and – when suitable – open source technologies in the development and deployment of cross-border digital solutions." https://www.bmi.bund.de/SharedDocs/pressemitteilungen/EN/2020/12/berlin-declaration-digitalization.html

10 United Nations (2020) Roadmap for Digital Cooperation, Report of the Secretary-General. Available at https://www.un.org/en/content/digital-cooperation-roadmap/

Structure of this report

This report is divided into the following sections:

— **Open Source Capability Model for Governments** (page 11) introduces a new framework for assessing open source software knowledge, skills and experience in government.

— **Conditions for success** (page 18) examines each dimension of the capability model in more detail, and provides practical considerations and questions for governments.

— **Conclusion** (page 31) summarises the main takeaways for decision-makers

Our methodology

Our research methodology for this report has been qualitative, and primarily based on interviews with a range of stakeholders. We conducted 19 interviews across 4 continents, speaking to a mixture of government decision makers, technical experts, funders and people delivering digital services to citizens.

We also spoke to a range of key experts in the open source software community and civil society to get a greater understanding of some of the challenges governments face. This helped us gather insights into the use of open source software in a wide variety of institutional contexts. This was supported by desk research, to gather best practice examples and other relevant research, to supplement Public Digital's knowledge and expertise.

Open Source Capability Model for Governments

Our research found that the extent of open source software use is highly variable between governments. We found that governments achieving successful outcomes with open source software have embedded practices and policies across four dimensions of capability[11]:

1. Policy environment: political leadership and legislation; government standards and policy.

2. In-house skills and capabilities: open source leadership and coordination; technical skills or experience in implementing open source software.

3. Open source vendor ecosystem: open source software procurement policy; ecosystem of vendors (national, regional or international).

4. Sustainability: sustainability of funding; ability to manage and maintain software; engagement with the global open source software community.

We have summarised these areas in a new framework: the **Open Source Capability Model for Governments** (below). This model is based on – and designed to complement – **the Harvard Maturity Model for Digital Services**[12], which Public Digital contributed to.

In our experience, a government's open source software capability is often correlated with its digital maturity, but that will not always be the case. Because adoption of open source often requires a conscious shift from existing practices, there is real power in adopting open source capability as a lens distinct from technology capability more broadly.

11 We define capability as the application of knowledge, skills, and experience to achieve an outcome, as described by Emily Webber. See https://emilywebber.co.uk/mapping-skills-and-capabilities-with-communities-of-practice/

12 Eaves (2018) Part 2: Proposing A Maturity Model for Digital Services. Available at https://medium.com/digitalhks/part-2-proposing-a-maturity-model-for-digital-services-9b1d429699e7

How to use this model

This Open Source Capability Model is intended to be a self-assessment tool for governments, assisting them to adopt open source practices and calibrate their current policy and technical environment. We hope it will help government leaders to identify where they may need additional investment, focus, and training to increase the likelihood of using open source software successfully and sustainably. We assume for the purposes of this model and report that a government is considering, or has started, to use more open source software.

The model can be used to assess capability broadly across a public administration, or more narrowly within a particular ministry or government organisation. The model should also be helpful for government officials interested in building their administration's open source software capability, in anticipation of using more open source software in the future.

The model does not require an extensive research or benchmarking exercise. Governments can gather input by holding a workshop with a small cross-section of stakeholders within the organisation[13]. Any significant differences in opinion can trigger further investigation, or spark a discussion to help align stakeholders on existing capability levels.

It is not necessary for a government to be "high" on all dimensions of this model to use open source software successfully. But self-assessing as "low" on all or most dimensions of this model could prompt a discussion around the extra support the team working on an initiative involving open source may need.

Like any model, this is a simplification of reality. It is not intended to be exhaustive. We have chosen the most important factors according to our research. We are keen to receive feedback, and would encourage readers to test this model and get in touch. We hope to continue to iterate and improve this model to make it as useful as possible a tool for governments and development partners.

13 For more ideas, see exercises related to the Digital Services Maturity Model https://medium.com/digitalhks/digital-maturity-self-assessment-exercise-735647b2ba23

Open Source Capability Model

Policy environment

Area	Low	Medium	High
Political leadership and legislation	Zero engagement with opportunities for using open source from political leadership. No mention of open source software in legislation and / or legislation impedes adoption of open source.	Increasing interest or support for open source software dependent on the government of the moment, or one or two leaders.	High political interest and support across all political parties. Seen as an accepted and expected approach to take when appropriate. Legislation encourages - or does not prevent - the use of open source software.
Government standards and policy	No mention of open source in government technology strategy, procurement policy etc. Current policies prevent the use of open source software. Myths about open source software are pervasive.	Government standards and/or policy in place, but it has no enforcement mechanisms and is not widely followed.	Comprehensive open source policy, integrated in government technology strategy, supported by procurement policies and other relevant guidelines and standards. Widely accepted and followed.

Open Source Capability Model

In-house skills and capabilities

Area	Low	Medium	High
Open source leadership and coordination	One or two individuals champion open source. There is no succession plan if they leave the team or government. Little wider understanding of open source software.	A small team promotes new ways of working, including open source but lacks the leverage to change other parts of government. Open source champions have been identified in different parts of government.	An empowered team exists within government that works across departments to promote and support the delivery of services using open source. Government has an active internal open source community. Teams have a clear strategy for using open source software, and they understand when its use is appropriate.
Technical skills or experience in implementing open source software	Little to no in-house technical skills. All software has been provided through large enterprise products and contracts. Little experience in using open source. Open source may have been used by vendors but it is not something the government is directly aware of. No culture of reuse.	Some technical skills or leadership, perhaps in one team, but experience is limited and dependent on a few individuals. Some experience of evaluating software outcomes. Some open source infrastructure software, some examples of code released in a public repository.	In-house technical skills embedded across government. Ability to evaluate an open source solution (for example, features, funding, codebase etc). Have moved from one-off use of small pieces of open source infrastructure to open source platforms. Common practice to make source code for public services available in a public repository. Reuse is encouraged.

Open Source Capability Model

Open source vendor ecosystem

Area	Low	Medium	High
Open source procurement policy	Procurement lacks flexibility. Government can't access open source vendors. There's little to no transparency or openness in procurement practices.	Government starts to open a range of procurement options which allows access to open source vendors, including small enterprises and start-ups. Some limited transparency in procurement practices.	Government has a range of procurement options which open the market to small enterprises and start-ups, and are able to procure outcomes rather than solutions. Open source software procurement is highly transparent and competitive.
Ecosystem of vendors (national, regional or international)	There are few, if any, vendors with expertise in open source software.	There is a small national and/or regional ecosystem of vendors with open source expertise.	There is a wide ecosystem of vendors (including SMEs and large vendors) both in-country and outside depending on need.

Open Source Capability Model

Sustainability			
Area	**Low**	**Medium**	**High**
Sustainable funding	No plan for long term funding. There is a misunderstanding of open source (for example, that it is free). Teams struggle to find funding past the initial capital to implement a new service or tool.	There is some awareness and planning to secure funding for open source software beyond the initial implementation.	There is widespread awareness and long-term planning for sustainable funding of open source software.
Ability to manage and maintain software	Little to no in-house experience in managing or maintaining software.	The government sometimes considers maintenance and management in funding bids, RFPs, hiring plans.	Government is able to identify the level of support required based on the complexity of the software implementation. Have the capacity to develop open source software that they are the primary maintainer for with a dedicated team to support long term.
Engagement with the global open source software community	Little to no awareness of the global open source software community.	Aware and beginning to engage with the global open source software community.	Government is working to be a "good citizen" within the open source software community, making it easy for civil servants to contribute. Government is able to evidence its contributions, and secure funding for important open source projects, etc.

Conditions for success

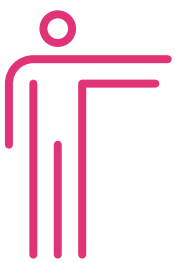
In this section we consider the conditions for success when using open source software, through the lens of the four capability dimensions:

1. **Policy environment**
2. **In-house skills and capabilities**
3. **Open source vendor ecosystem**
4. **Sustainability**

At the end of each section, we include practical considerations and questions for governments. These prompts are designed to help leaders take the next steps in strengthening their organisation's capability.

01. Policy environment

There was a general consensus among interviewees that political leadership is an important driver for carrying out larger scale open software implementations. Where political leaders are not engaged, or have little understanding, it is a serious blocker to change. Alongside this political engagement, governments need standards and policies to guide officials to know how and when to adopt open source software.



Political leadership and legislation

Significant change cannot happen without the engagement of a government's elected leaders. This is particularly true for key digital public services, but is also the case for any initiative involving innovative practices that takes time to implement. Typically anything which impacts on a large number of people and/or systems in a government, and cuts across traditional departmental silos, demands political stability and strong political support. This is equally true for major programmes involving proprietary software.

One reason for this is simply time: it can take a long time to successfully implement something new, particularly if it crosses department / organisation boundaries. If political priorities change, or interest wanes, attention and effort will move elsewhere.

A second reason is that a novel or different way of working (as open source software can be) can benefit from changes to central policies and procedures: from technology strategy, to budgets and finance, and procurement methods. In getting traction to adapt these levers, engagement at the most senior levels helps a lot.

There was a consensus from each of our interviewees that support from political leadership is essential for open source software to thrive in government, both for the early adopters such as Uruguay, who secured the necessary support from the highest levels of government **(see case study in Appendix, p47)**; and for countries recently exploring open source software[14].

Legislation and regulations can also be a useful way for political leaders to show their intent, and leading open source adopters like Uruguay have made sure their legal environment is supportive of open source software. However, a number of interviewees agreed that legislation on its own is unlikely to be enough to spur wide-scale open source software adoption, and there is a pattern of governments adopting such policies as a political statement of intent, and having less success with implementation[15].

15 Open Forum Europe (2020), First results: European Commission Open Source Study First results European Commission Open Source Study

14 For more an empirical assessment, see OSOR - OSS Community Success Factors (2020), p30 https://joinup.ec.europa.eu/sites/default/files/inline-files/SC272_D05.01_Community_Success_Factors_vFINAL_3.pdf

We don't recommend embedding specific technology choices (open or proprietary) within legislation due to the pace of change in the technology landscape, and the evolving nature of the services governments provide. But, we do recommend reviewing whether or not legislation is providing a barrier to the use of open source software – and removing those barriers if needed.

Dispelling myths about open source software.

Leadership and guidance can often play an important role in dispelling myths about open source software. For example, myths suggesting open source software is not secure or of poor quality. In reality open source software is just as secure as other software choices. The importance of good, clear documentation for open source, and the many eyes of a global community of developers (and users) can help identify vulnerabilities and, even more importantly, roll out patches to secure vulnerabilities quickly.

These myths have the potential to scupper an approach or strategy to service delivery that relies on open source software. Education and myth-busting is often important in developing a strategy for using open source software across the government.

Government standards and policy

As a starting point, governments should ensure that policies and regulations do not get in the way of making open source technology choices. Publishing standards and policies that empower officials to make the most from open source software should be the next step.

This could include:

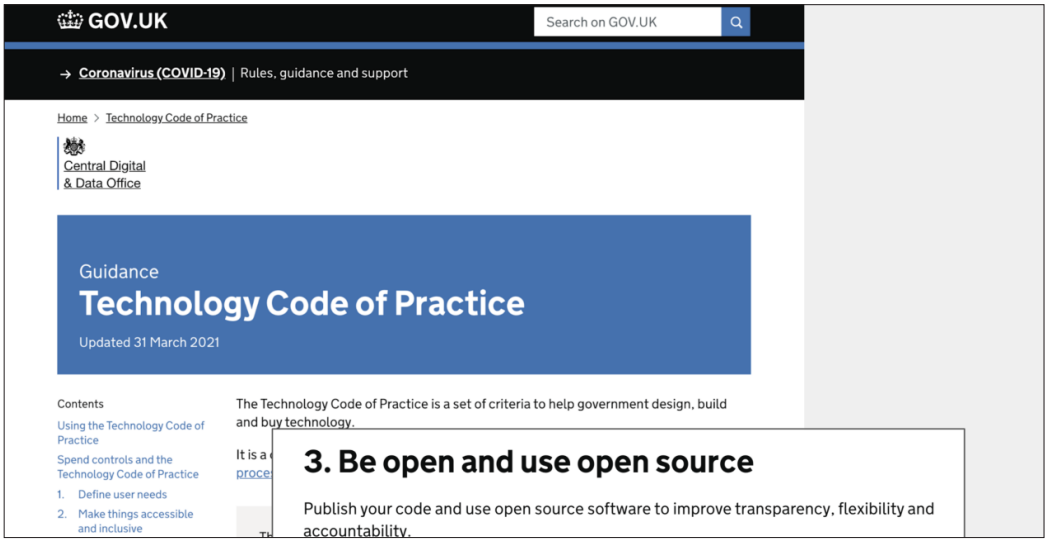
— **A technology strategy that promotes the use of open source software**[16], supports an open architecture approach (building systems from discrete, well-defined components integrated using open standards) and explicitly encourages reuse within a public administration[17]

— **A clear strategy and objectives for adoption of open source software**.[18] For example, an objective could be to improve digital sovereignty and control of data and key infrastructure.

"Open architecture drives open source. We focus on open architecture, trying to make things interoperable internally and breaking down silos. Open source can often follow from this", government official interviewee.

For example, in Portugal, by law, central government bodies must submit their ICT projects and expenses above a certain threshold to a pre-evaluation mechanism, ensuring that ICT public investments and projects are aligned with the country's digital strategy. Criteria for endorsement are, among others, the use of open standards and the option for open-source software. Any contrary acquisition project must be justified and proved – for example, by proving there are no open source software alternatives for the project.

16 See for example https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/85968/uk-government-government-ict-strategy_0.pdf
17 See for example https://docs.italia.it/italia/developers-italia/gl-acquisition-and-reuse-software-for-pa-docs/en/stabile/index.html#
18 See for example https://ec.europa.eu/info/departments/informatics/open-source-software-strategy_en



The UK Government Technology Code of Practice includes guidance to "Be open and use open source".

Building good practice into making technology decisions in government, and using published guidance and standards as a way to evaluate vendors and potential solutions, will likely lead to improved adoption of open source software.

Considerations for governments

1. Build political consensus and support for open source software adoption, to strengthen long-term sustainability.

a. Are there ministers and/or senior officials willing to be champions for open source software both inside and outside the government?
b. Can consensus be found in the strategic objectives for adopting open source?
c. Would developing – or amending – a decree, policy or law encourage use of open source software in government? If yes, how feasible is this, and in what timeframe?

2. Publish and promote a technology strategy for use across government, including clear objectives for open source software.

a. If you have a policy, consider how the policy will be enforced, and is the use of open source monitored?

01.
In-house skills and capabilities

Governments' in-house capacity was cited as a critical condition for success by almost every interviewee. Over time, open source skills and capabilities should be embedded from leadership to delivery: from an identified team responsible for guiding policy, to access to good technical skills. At minimum, there should be in-house leadership of a government's technology strategy, including their approach to open source.

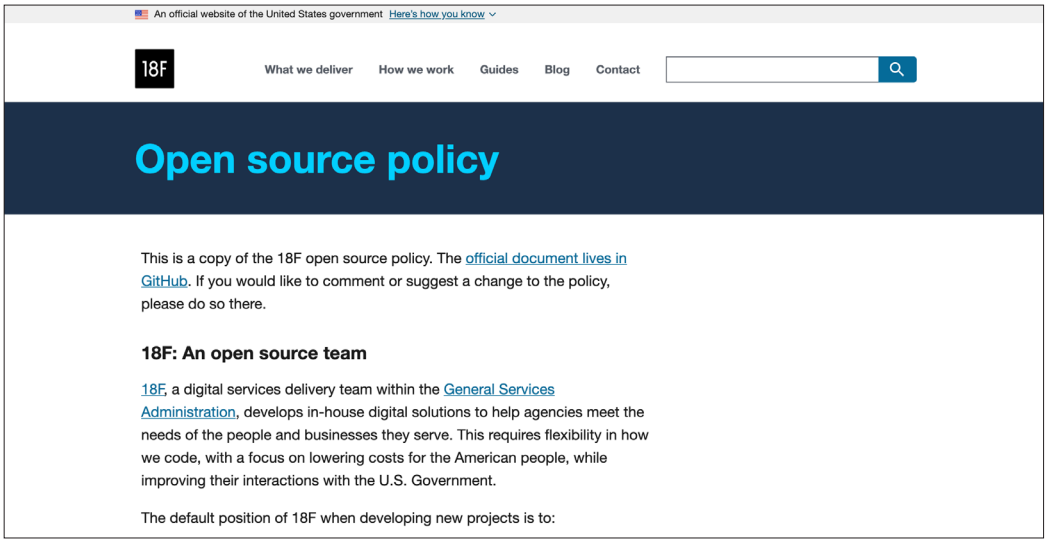
Open source leadership and coordination

In the cases we researched, the role of a central team responsible for support and guidance on the use of open source software was often cited as a core factor in successful implementations. This central team should set policies, guide other parts of government and promote best practices.

For example, in Sierra Leone, UK, Uruguay and Bangladesh there is a strong central team leading the move towards modern, internet-era ways of working, including the use and creation of open source software.

Even in very small governments, or governments with limited technical capacity, there should be a leader accountable for the government's technology strategy (including open source), and a specialist able to make technology decisions during the adoption of open source software, and manage vendors effectively. Without such a leader, governments' strategic choices will be beholden to their vendors, limiting their options for how and when they meet citizens' needs.

In settings with significant capacity to direct open source policy, or where it is a political priority, it might be appropriate to set up an Open Source Programme Office, or OSPO. This practice, taken from the private sector, is gaining popularity as a way to institutionalise use of open source in the academic and public sectors[19].



18F, part of the US Federal Government, is a visible, active unit who model good practice in open source and share what they learn.

19 For more discussion on this topic, see the OFE Open Source Policy Series 2021 "The case of OSPSs in Government and Universities" https://openforumeurope.org/the-ofe-open-source-summit-series-2021/ =

Technical skills or experience in implementing open source software

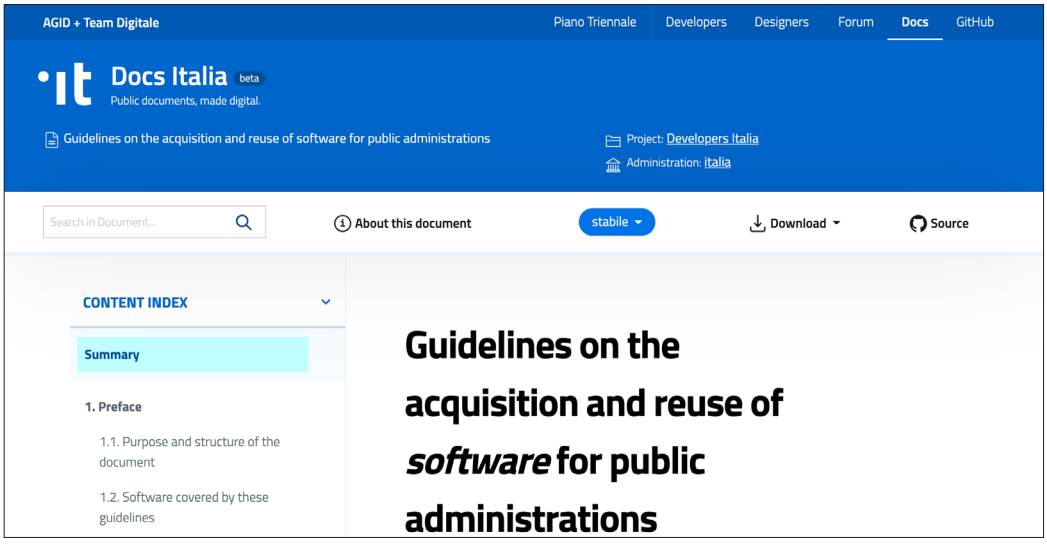
Having the right skills to implement open source software does not necessarily mean having teams of in-house developers and significant technical capacity within the government itself.

For those administrations with a low level of in-house technical capacity, a good place to start is ensuring the government has the right technical leadership, whether that be a Chief Technical Officer, Chief Information Officer, Head of IT. There needs to be at least one person (though hopefully more) who can choose an appropriate software solution, know how to evaluate vendors, and be able to evaluate an open source solution (for example, features, funding, codebase etc).

Once the government has that leadership in place, a good way to build experience with open source software is to use a solution where there is already a set of vendors offering supported versions of the software (as compared to a solution which requires extensive customisation).

It is common for governments promoting the use of open source software to encourage reuse, and to release publicly-funded software into public repositories. It is not vital, but contributing to the open source community will help build better understanding and experience.

[When using open source] "it's easier to find developers. There are more people available with the right skills than if we use licensed software" government official interviewee



The Italian government publishes clear, practical guidance on how to reuse software in government.

Some governments have found that an additional longer term benefit to adopting open source software languages (such as php or python), and the software built in those languages, is that they can more easily find good developers. One reason for this is that the barriers to learning proprietary systems (languages, databases, etc) are high. A developer or their organisation needs to be able to afford the licenses, and training materials are often expensive. The barriers to learning open source software are much lower. For trainee developers the only costs are access to a computer, the internet, and time.

Considerations for governments

1. Make a central official or team responsible for setting open source standards and policy, to support and guide its use in government.

a. What is best practice across government? Is it possible to openly share the experience using open source, for example through blogs, news articles and events?
b. What technical skills do teams have in-house? Which are missing?

2. Find champions and develop the governments' internal community around open source.

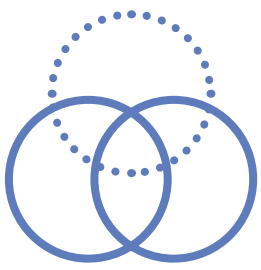
a. Who is already using open source in government? What best practices can be used and developed further for wider good?

3. Take steps to encourage reuse within government, including finding opportunities to release publicly-funded code in the open.

a. Are government teams actively encouraged to communicate across government, helping to highlight opportunities for reuse?
b. Are teams thinking about sharing code as they develop it? Are they writing good documentation that would help others reuse?

03.
Open source vendor ecosystem

Given that a core benefit of open source is to reduce vendor lock-in, and increase a country's options when delivering a service, a thriving and accessible vendor ecosystem is essential to making this flexibility a reality.



Open source procurement policy

Public procurement policies are often defined by a legal framework that determines procurement processes. This legal framework is often a set of rigid regulations intended to encourage competition, lower costs and impede corruption. In many governments this has led to overly inflexible procurement, that hasn't kept pace with the changing nature of technology, and modern technology delivery models.

A typical procurement for a large-scale government IT system might be a large, multi-year contract to a single vendor, in which the vendor provides, customises and then supports the service. In this context, adopting a particular open source software solution presents an atypical model of acquiring software, requiring a different delivery model and procurement approach.

Best practice is for a government to have a range of flexible procurement options for buying software and related services[20], including the ability to bring in partners to run lightweight discoveries, build prototypes and run pilots.

Alongside flexible procurement options, greater transparency and openness in procurement processes will help a wider range of companies compete. This is particularly important for SMEs with expertise in open source software who may otherwise feel unable to compete for government technology contracts, where opportunities are skewed towards maintaining the status quo[21].

A government should start by reviewing whether or not procurement practices and rules are inadvertently blocking open source software. In the longer term, a government should develop a range of options for procurement, by designing procurement processes around service outcomes, with options to buy commodity technology in a different way to custom technology.

20 Sahay, S. (2019) 'Free and open source software as global public goods? What are the distortions and how do we address them?', The Electronic Journal of Information Systems in Developing Countries, 85(4), e12080. https://doi.org/10.1002/isd2.12080

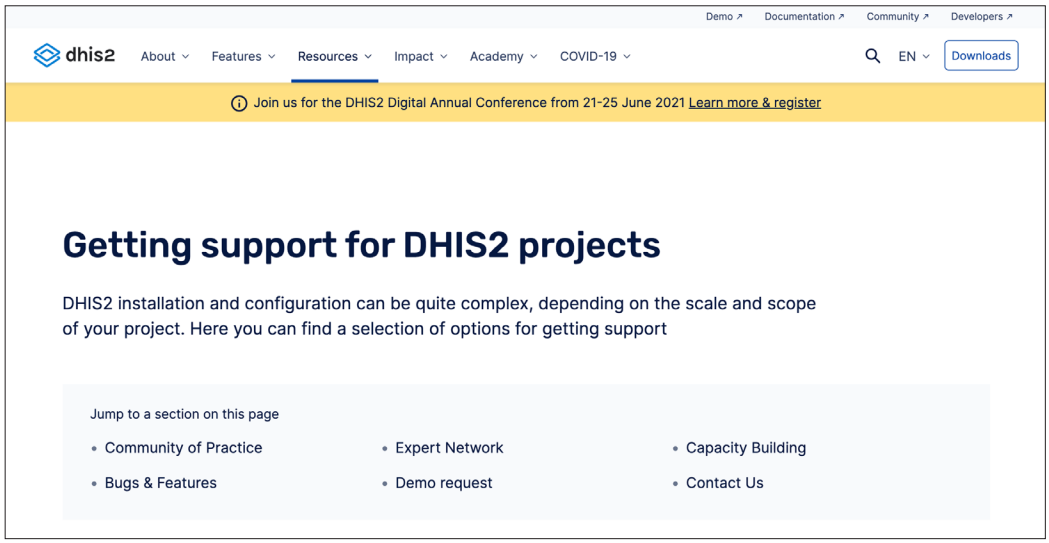
21 World Bank (2020), Enhancing Government Effectiveness and Transparency: The Fight Against Corruption. Available at https://www.worldbank.org/en/topic/governance/publication/enhancing-government-effectiveness-and-transparency-the-fight-against-corruption

Ecosystem of vendors (national, regional or international)

Successful use of open source software usually requires the presence of a community of developers behind the service or product, and the existence of vendors (ideally in-country) that can support both implementation and maintenance.

Building this ecosystem might mean encouraging existing local vendors to change their approach. Closed, proprietary software, built bespoke, can be a more attractive prospect for a vendor to sell, as they have more control. Governments may need to engage with the local vendor ecosystem to help them move from commercial models where they earn money from licenses, to a model where they earn money from consultancy, service, and support.

"Open source can require a higher level of tech expertise. You have to deeply understand the codebase of the software you're adopting in order to customise it, and accept the decisions developers have made", government official interviewee



District Health Information Software 2 (DHIS2) is an open source, web-based platform most commonly used as a health management information system (HMIS). It is used in 73 low and middle-income countries and has an ecosystem of vendors which support it.

The government's approach to buying, and delivering, technology can have a very positive impact on a country's national digital economy. A recent study conducted by the European Commission found that "a 10% increase in the number of [open source] contributors would increase EU GDP by 0.6%, i.e. Euro 95 billion per year".[22]

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In the long term, if there is a wider pool of vendors and people with the right skills to develop software, ongoing costs should be more competitive.

Furthermore, encouraging local companies and wider communities around open source software can create new markets and open up more options for governments in how they deliver services. One of the best examples of this is in the UK, where the Government Digital Service (GDS) built its new procurement framework around a philosophy of buying either teams to help build a service, or commodities that do not require customisation. This – coupled with the push from within GDS and other parts of the UK Government to use open source software, and code in the open – led to open source being a ~£15bn contributor to the UK economy[23].

Likewise in Sierra Leone, the Directorate of Science, Technology and Innovation (DSTI) is actively promoting, and looking to work with, local SMEs who have open source software skills as part of the government's wider strategy to develop its digital economy.

22 Open Forum Europe (2020), First results: European Commission Open Source Study First results European Commission Open Source Study

23 Open UK (2021) State of Open: The UK in 2021. Available at https://openuk.uk/wp-content/uploads/2021/03/openuk_stateofope2021_report_FINALCHANGES_08.pdf

A wide ecosystem of vendors (including SMEs and large vendors) that the government buys from will encourage competition, lower costs, and spur innovation, raising the quality of software and services available.

Governments can also reach out to developers more directly through local developer communities, or by partnering with education providers.

Considerations for governments

1. Review procurement policies and practices to ensure they aren't inadvertently blocking open source software.

a. Are policies around using only enterprise-approved tools blocking teams from experimentation with open source software?
b. Can policies be changed, or is there an opportunity to develop new policies that remove these blockers?

2. In the longer term, develop a range of appropriate procurement options for buying software and related services.

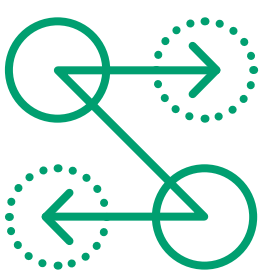
a. Are procurement processes outcome driven?
b. Can procurement processes manage the ambiguity of evolving requirements?

3. Grow and support the local ecosystem of vendors, including promoting new business and delivery models built around open source software.

a. How strong is the local community of developers or vendors?
b. How close is the government's relationship with this community?
c. How can it help grow and support the community, and promote new business and delivery models?

04.
Sustainability

Sustainability is about more than cost: it can be about how software is managed, maintained and improved; about keeping open technology choices rather than being locked-in; the ability to move a service from one supplier to another; and how government contributions to software can help them learn and build on each others' success around the world.



Sustainable funding

Open source software is available to anyone who wants to adopt it, without the need to go through a vendor or pay ongoing expensive licensing costs. There are a couple of ways this can be attractive to governments. If a government has in-house development capability, it means they can quickly adopt and adapt a solution without needing to request funding and undergo a big procurement. For most governments, the low up-front cost can also be very attractive.

Interviewees recognised that while the up-front costs of open source software may be low or zero, open source software implementations will still need long-term funding. This was a concern for governments, but also for the funders and providers of open source platforms we interviewed.

Our interviews highlighted a need to make governments aware of the costs that are required for consultants or staff during implementation and for ongoing support, even when using open source software. Software, just like other pieces of infrastructure that support government services on an ongoing basis, has to be maintained and supported. Governments should expect (but not assume) the costs associated with open source software to be lower than for proprietary software[24]. The key is that these costs need to be planned for, before adoption.

Open source software provides a different model for making these calculations. Rather than having to make Total Cost of Ownership (TCO) calculations based on vendors' promises, open source software allows governments to run experiments or pilots to determine things like:

Does this software do what is needed?

How much customisation is involved?

What are the different scaling options?

24 Sahay, S. (2019) 'Free and open source software as global public goods? What are the distortions and how do we address them?', The Electronic Journal of Information Systems in Developing Countries, 85(4), e12080. https://doi.org/10.1002/isd2.12080.

Traditionally a government would have to commit to licensing (and likely long-lasting implementation and maintenance costs) before being able to confidently explore any of these questions, and could be stung by hidden costs, such as from short-term license discounts.

The costs of implementation, long term maintenance and support are not unique to open source software, but have not always been baked into a country's budgets or calculations for a large scale open source software implementation. We recommend that Total Cost of Ownership calculations for open source software projects are clear and cognisant of these costs, and adhere to the good practice guidance that we discussed earlier in the report **(p.11)**.

It is important for governments to think about tradeoffs for these associated costs. Often the underlying infrastructure and technology that a government chooses will be part of their ecosystem and service delivery for many years to come, so they should carefully weigh the pros and cons of costs vs. lock in, control vs. efficiency, and short term benefits vs. long term investment.

Ability to manage, maintain and support software

A theme we heard from some of our interviewees was the need for clear ownership of the software long term – whether that be the government themselves, vendors or the organisation leading the development of an open source platform – to ensure that an implementation is sustainable in the long term.

Just like proprietary software, open source benefits from a responsible body to take ownership of maintenance and development of software. This could be a commercial organisation, a government, a university, or a specialist foundation. Such an organisation should also invest in cultivating a strong community of developers, and vendors who support it with specific skills and experience. For example, DHIS2 is an open source health information management system. It is funded by a number of donors including NORAD, but its development is coordinated by the University of Oslo.

Arensen (2020)[25] highlights five key factors that are important to long term sustainability:

1. **Fiscal Home:** A host legal entity to hold intellectual property, execute legal contracts, receive funding, and be able to meet the audit requirements of multilateral donors.

2. **A Primary Maintainer:** Responsible for facilitating community management, product roadmaps, community governance, etc., on behalf of the project's stakeholders.

3. **Dedicated Product Team:** Consistent "staffing" (either paid staff or volunteers) to ensure a continuity of quality and efficiency while reducing costs. Generally, a core product team typically comprises a product owner, community manager, technical architect, and one or more software engineers.

4. **Access to Core Funding:** Stable and secure funding – likely a mix of grants and generated revenue, ideally through public-private partnerships – for a baseline budget to maintain core product development, with assurance of ongoing support.

5. **Connection to a Community of Practice:** Collaborating with others solving similar challenges leads to better products through knowledge sharing as well as reduced duplication of effort and greater interoperability between products.

25 Arensen, H. (2020) '5 Things Digital Public Good Software Projects Need to Scale', Digital Impact Alliance. Available at https://digitalimpactalliance.org/5-things-digital-public-good-software-projects-need-to-scale/

How governments prioritise sustainability should depend on the project in question. If it is a small experiment, with few users, then building its own internal capability is likely to be enough. If the project is a country scale implementation, then sustainability and scalability will be essential. This could consist of a strong local vendor ecosystem **(p.33)**, as well as local developer communities and agreements with local universities.

As a government moves from smaller experiments and pilots to scale a service with more users, it will need a defined support model. Usually the bigger, more complex and more critical the service the greater the need for more formalised support mechanisms.

For example:

— **Free support through a mature community** - often through chat forums, this can be enough to support a very simple implementation or small pilot.

— **Software-as-a-service** - for a simple implementation without many custom elements, this could be a support and maintenance service provided by the developer of the open source software, or through a separate vendor. See also, Ecosystem of vendors **(p.23)**.

— **Full commercial support** - for a complex or heavily custom implementation, commercial support could include day-to-day first line support for users, disaster recovery and fixes, as well as senior level points of contact (for big decisions, policy, and changes in needs which might affect a whole service).

Engagement with the global open source community

If governments use open source software solutions, tools and infrastructure, it allows them to access a vast pool of online resources. For example, on the platform Stack Overflow developers can ask questions of other users. About 50 million people visit Stack Overflow each month[26], with 21 million questions asked in 2021. It is very often possible to reuse or adapt a solution that has been developed for a similar problem.

The ability to learn from others and the way they have implemented open source software is a huge benefit to be had from translating this openness to large open source software projects. If code isn't hidden through proprietary contracts and non-disclosure agreements, governments and the developers who support their software and services can learn and build on each others' success around the world.

Furthermore, being a "good citizen" within the open source software community is often a sign of maturity when considering using open source platforms. The Linux Foundation undertook a survey of organisations globally to assess their level of participation in the open source community[27]. To assess their level of participation, respondents considered how much they, if ever, engaged in:

— consuming open source code in products or services
— contributing to upstream open source projects
— collaborating with peers across open source projects and/or foundations
— initiating or releasing open source projects
— influencing open source projects via leadership or maintainer roles

26 Stack Overflow (2020) Developer Survey. Available at https://insights.stackoverflow.com/survey/2020

27 Todo Group, Linux Foundation (2020) Open Source Survey Results. Available at https://github.com/todogroup/survey/tree/master/2020

Considerations for governments

1. Evaluate the short and long term costs of open source software projects, using early experiments and pilots to understand the implementation, maintenance and support costs of the service.

a. How are the costs of long term maintenance and implementation factored into funding bids and government budgets?
b. How will open source software be maintained and supported? Does the support capacity you have (in-house or through accessible vendors) match the complexity of the software? Or, what other open source projects can they start with first?

2. Consider and evaluate what ownership and support model will be needed to support your implementation.

a. If you are building a small experiment with a few users, do you have the internal capability to support it?
b. If you're planning a larger implementation, then how will you develop sustainability and scalability? Could you partner with local developer communities or universities?

3. Contribute to the open source community: share experiences in the open, support the development of local technical expertise and contribute practically by encouraging contributions to open source projects.

a. Is the team able to learn and share experiences in the open with the wider community? Have they considered adopting what other governments are doing?

Conclusion: Invest in the conditions for success

Open source software is rightly attracting interest from governments looking to further their nations' priorities in education, health, civil registration, and financial inclusion. All administrations need to register births, verify identity, track and manage education outcomes, and share data securely between ministries. Open source software offers common solutions to common needs.

Open source software offers common solutions to common needs.

But "open source" is not a technology strategy. To use open source software successfully over the long term, governments must build the appropriate policy environment, skills, vendor ecosystem, and approach to sustainability.

Decision-makers should understand their government's specific strengths and weaknesses with open source software. They should gather stakeholders to agree and prioritise the most critical gaps given their context. The capability framework can help align stakeholders on where investment should be focused.

Investing in the conditions for success will help governments get the most from open source, and in doing so build their ability to strategically harness technology.

We have made a series of recommendations for governments to consider:

1. Policy environment

Build political consensus and support for open source software adoption, to strengthen long-term sustainability.

Publish and promote a technology strategy for use across government, including clear objectives for open source software.

2. In-house skills and capabilities

Make a central official or team responsible for setting open source standards and policy, to support and guide its use in government.

Find champions and develop the government's internal open source community.

Take steps to encourage reuse within government, including finding opportunities to release publicly-funded code in the open.

3. Open source vendor ecosystem

Review procurement policies and practices to ensure they aren't inadvertently blocking open source software.

In the longer term, develop a range of appropriate procurement options for buying software and related services.

Grow and support the local ecosystem of vendors, including promoting new business and delivery models built around open source software.

4. Sustainability

Evaluate the short and long term costs of open source software projects, using early experiments and pilots to understand the implementation, maintenance and support costs of the service.

Consider and evaluate what ownership and support model will be needed to support your implementation

Contribute to the open source community: share experiences in the open, support the development of local technical expertise and contribute practically by encouraging contributions to open source projects.