



# The sky is the limit

How cloud computing is the key to  
better public services in Ireland



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# Foreword

**There is no bigger buzz-word in the world of technology and business than “cloud”. And for good reason. The technology is revolutionising the way that firms – big, small and everything in between – operate. It is allowing them to digitalise, innovate and scale at a rate of knots, with their customers the biggest beneficiaries.**

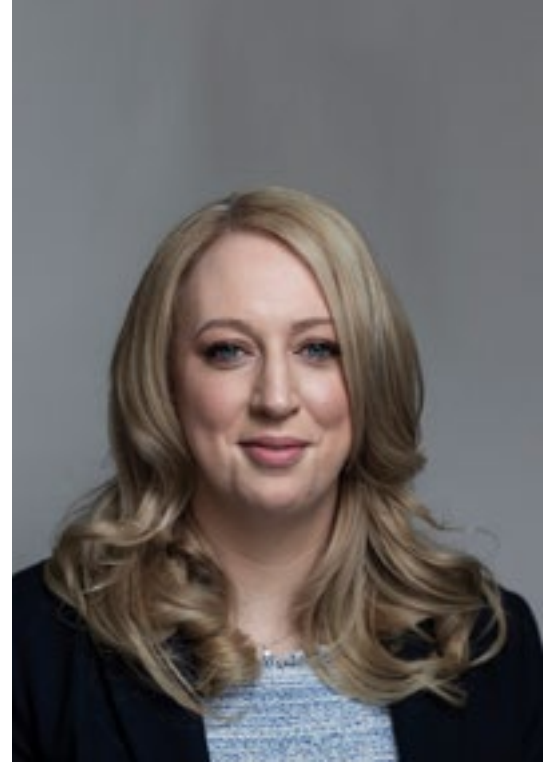
With all the focus on the cloud as an enabler of enterprise, the transformative effect it can have on public services can sometimes be overlooked. That really shouldn't be the case. The cloud is just as powerful a tool – if not even more so – for Governments and public sector bodies than for the private sector. The evidence from across the globe is indisputable: cloud use helps public services be delivered more efficiently, more securely and more sustainably. Cloud adoption is also key to achieving wider digitalisation ambitions, including such as those set out in the Irish Government's two recent headline digital strategies, *Harnessing Digital – The Digital Ireland Framework* and *Connecting Government 2030: A Digital and ICT Strategy for Ireland's Public Service*.

This report on the benefits of cloud for the public sector in Ireland, undertaken by Frontier Economics and commissioned by Technology Ireland, could therefore not be more timely. The study distils the many benefits of the technology and the rich value it generates. It also pinpoints the barriers that are currently preventing Irish public sector bodies from making greater use of the cloud. Most critically, recommendations are made for how those same hurdles can be addressed and overcome. Their implementation would unlock the full potential of the technology – both for public sector bodies themselves and for the people they serve.

Frontier's findings are underpinned by exhaustive research. This included an examination of how public sector cloud adoption is currently approached in Ireland as well as internationally. Leading authorities on the subject, from both Government and industry, were also interviewed by the authors.

It is important to recognise, as highlighted in the pages that follow, that there are already cutting-edge examples of cloud use by the Irish public sector. Some of the most ingenious were in response to the pandemic, with the technology being harnessed creatively by quick-thinking Irish public sector bodies to meet challenges posed by COVID-19. These are successes for which those involved should be justifiably proud. But they offer just a glimpse of the cloud's wider potential when it comes to enhancing public services in Ireland, with its true vast potential of the technology remaining largely untapped.

Readers will note that much comparison is made to other jurisdictions – including Australia, Canada, Germany and the UK – where far-thinking Governments have put structures in place to ensure their citizenry can reap the benefits of cloud. Most crucially, each of these countries have designed and constructed central procurement vehicles that have allowed their respective public organisations to acquire, and thereby deploy, cloud services. Those international precedents – whether it's in the area of public purchasing or cloud-first national strategies – offer a well-forged path that Ireland can now follow so that our public sector can too become a leader in cloud usage.



And there is definitely no reason why Ireland should lag behind when it comes to public sector cloud usage. After all, this country is an undisputed global technology leader. It already has ambitious digitalisation strategies in place with cloud ambitions at their heart. It has extensive cloud infrastructure, developed by leading global companies, on its doorstep and ready to be utilised. And it has a public sector with the skills, expertise and vision to bring big ideas, like wide-scale cloud adoption, fully to fruition.

Technology Ireland hopes this important study will be another piece in that puzzle. Together with our members, we are proud to have worked with Frontier Economics in producing it and look forward to supporting both the cloud and wider digital ambitions of the Government in the years ahead.

**Una Fitzpatrick**  
**Director, Technology Ireland**

“ There are already cutting-edge examples of cloud use by the Irish public sector. But they only offer just a glimpse of the cloud’s wider potential, with its true vast potential of the technology remaining largely untapped.”

# Executive summary

In 2021, the Department of Public Expenditure and Reform announced that by 2030, 90% of applicable public services should be delivered online. More recently, *Harnessing Digital: Digital Ireland Framework*<sup>1</sup>, seen as Ireland's national digital strategy, and *Connecting Government 2030*<sup>2</sup>, the new public sector ICT strategy, indicated that this goal would be reached by “taking a cloud-first approach to delivery of all services”. This strategy recognises that cloud computing has the potential to generate significant benefits for the public sector.

To support the government in its objective to put digital solutions underpinned by cloud at the forefront of innovation in public service provision, Technology Ireland has commissioned Frontier Economics to:

- Identify the current barriers to adoption of cloud computing in the public sector, and explore how these can be overcome; and
- Assess the potential benefits to the public sector of prioritising and accelerating the adoption of cloud computing and storage solutions.

To achieve these objectives, we rely on a literature review and a series of interviews with public sector stakeholders, cloud providers and cloud technology experts based in Ireland and other European countries, including the UK and France.

## What is Cloud Computing?

In this report, we define cloud computing as “the practice of using a network of remote servers accessed via the internet to store, manage and process data, and deliver IT applications, rather than a local server or a personal computer”. In other words, cloud computing is the on-demand provision of IT resources over the internet with pay-as-you-go pricing. Instead of buying, owning and maintaining physical data centres and servers, users can access technology services, such as computing power, storage and databases, on an as-needed basis from a cloud provider. Cloud computing has three service models (depending on what service is being provided), and three deployment models (depending on the location of the infrastructure).<sup>3</sup>

The focus of this report is the public cloud deployment model. In this model, computing resources are owned and operated by a provider and shared by multiple tenants via the internet. We will also consider the hybrid cloud model, which is a mix of on-premises infrastructure, private cloud services and public cloud provision. To assess the benefits of cloud, we compare accelerated cloud adoption against the status quo, i.e. a counterfactual in which the public sector continues to use

1. <https://www.gov.ie/en/press-release/3a922-online-launch-of-harnessing-digital-the-digital-ireland-framework/>  
2. <https://www.gov.ie/en/publication/136b9-connecting-government-2030-a-digital-and-ict-strategy-for-irelands-public-service/>  
3. The service models are: Infrastructure as a service (IaaS), Platform as a service (PaaS) and Software as a service (SaaS); the deployment models are: Private, Public, and Hybrid Cloud

existing infrastructure and computing approaches, involving relatively limited cloud usage. This report does not assess the relative advantages and disadvantages of different cloud services and deployment models. Such an evaluation was beyond the scope of this project.

## Barriers to increased cloud adoption

We have identified three main categories of barriers to increased adoption of cloud computing.

### **Lack of cloud-oriented organisational policies, strategies and culture**

The Irish government has declared that public services should be delivered using a “cloud-first” approach. However, publicly available documents and statements have not set out a strategic case for this vision that outlines why the transition to cloud will be beneficial. Nor has the government put forward policies and guidance that describe a clear implementation plan for cloud adoption, including how and when cloud should be used.

A high-level cloud-first vision is useful to set expectations, but effective adoption requires vision, strategic case, policies and guidance to be aligned within a cloud-oriented culture. Even in countries that have implemented a clear top-down cloud-first vision (e.g. the UK, Australia, Germany, Greece, Poland and Bahrain), experience has shown that the buy-in of senior leaders and decision makers, IT departments and procurement officials is key to a successful transition.

Furthermore, it is important that organisational leaders clearly and transparently address any misperceptions about costs, security, integrity and availability of critical government systems by, for example, sharing success stories.

### **Lack of streamlined procurement processes and guidance**

It is difficult for public bodies to procure cloud services due to fragmented and complex processes, and lack of guidance for both procuring authorities and service providers. We understand that public bodies that want to purchase cloud must conduct their own individual procurement exercises. While the Cloud Services Procurement Guidance Note<sup>4</sup>, published by the Office of Government Procurement (OGP), offers practical advice, it is no substitute for a specialised cloud procurement vehicle.

The establishment of such a standardised digital marketplace, where different procuring authorities can purchase cloud services, has been effective in driving digitalisation of public services in many countries. Notable examples are the G-Cloud framework<sup>5</sup> in the UK, the European Commission’s Cloud II and the Cloud Marketplace<sup>6</sup> in Australia. Here procurement processes are sufficiently standardised to improve efficiency and generate economies of scale but also flexible enough to meet the specific needs of different procuring organisations.

### **Limited access to skills, time and resources**

Establishing the culture, policies, procurement processes and guidance described above requires appropriate skills in IT and procurement teams and, more broadly, across adopting organisations. Skills in this domain are scarce and competition from the private sector is fierce. In addition, IT departments and procurement officials need time to plan in advance and obtain guidance on how to effect the transition.

4. <https://assets.gov.ie/135678/dfc88c52-108e-4d10-aeee-408d15f92c03.pdf>

5. <https://www.crowncommercial.gov.uk/agreements/RM1557.13>

6. <https://www.dta.gov.au/news/dta-launches-new-cloud-marketplace>

# Benefits of increased cloud adoption

Understanding the benefits of using cloud is a prerequisite for building the economic and strategic case for increasing cloud adoption. We have identified four types of potential long-term impacts of cloud adoption:

- (a) increasing the efficiency and effectiveness of public services;
- (b) increasing access to public services;
- (c) magnifying the economic and social benefits of public services; and
- (d) reducing carbon emissions per megabit of data.

Quantifying the impacts of cloud adoption in the public sector is challenging. However, focusing on gains in the efficiency and effectiveness of public services, our assessment is that a 10% increase in the adoption of cloud in the Irish public sector could generate economic benefits in the order of €473 million in the first year alone.<sup>7</sup> Moreover, existing estimates indicate that cloud adoption can reduce electricity consumption, to the benefit of the environment.<sup>8</sup> For example, a recent study of European enterprise data centres found an 88% reduction in carbon footprint for workloads that moved from on-premises data centres to Amazon Web Services (AWS).<sup>9</sup>

The logic model in Figure 1 illustrates how the ultimate impacts of cloud adoption would result from intermediate short-term and medium-term outcomes. Identifying intermediate outcomes and the causal pathway to the ultimate impacts is important in assessing the effects of cloud adoption.

These impacts are achieved through a variety of shorter-term outcomes from cloud adoption, including the ability to conduct a multi-channel approach to public services (e.g. users can easily access their medical records through their GP, online or via a mobile application); the ability to scale enhanced digital services quickly, as gov.ie did when traffic increased exponentially during the pandemic; and the opportunity to reduce running costs by up to 55%.<sup>10</sup>

7. This estimate relies on the following assumptions:

1. Informed by research on the benefits of cloud in the private sector (Gal et al. 2019), we have assumed a 0.45% increase in productivity associated with a 10% increase in cloud adoption.
2. In the economic literature, productivity gains are translated into associated monetary benefits by multiplying the increase in productivity growth by firms' sales. No such measure exists for the public sector, so we have used government spending as a proxy of public sector revenue. According to the CSO, the Irish government's expenditure in 2021 amounted to €105 billion.

Gal et al. (2019) also quantifies the benefits of cloud adoption in the private sector beyond the first year. However, the profile of benefits over time in the public sector may be significantly different. Therefore, we take the conservative approach of using evidence on benefits in the first year only.

8. Park, Jiyong and Han, Kunsoo and Lee, Byungtae, Green Cloud? An Empirical Analysis of Cloud Computing and Energy Efficiency (March 28, 2022). Management Science (Forthcoming), Available at SSRN: <https://ssrn.com/abstract=4068114>
9. <https://www.aboutamazon.eu/news/aws/eu-businesses-that-move-to-aws-cloud-can-improve-energy-efficiency-and-reduce-carbon-emissions>
10. According to Gartner, after a transition period of three years the running cost of cloud versus on-premises data centres will drop by up to 55%. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership).

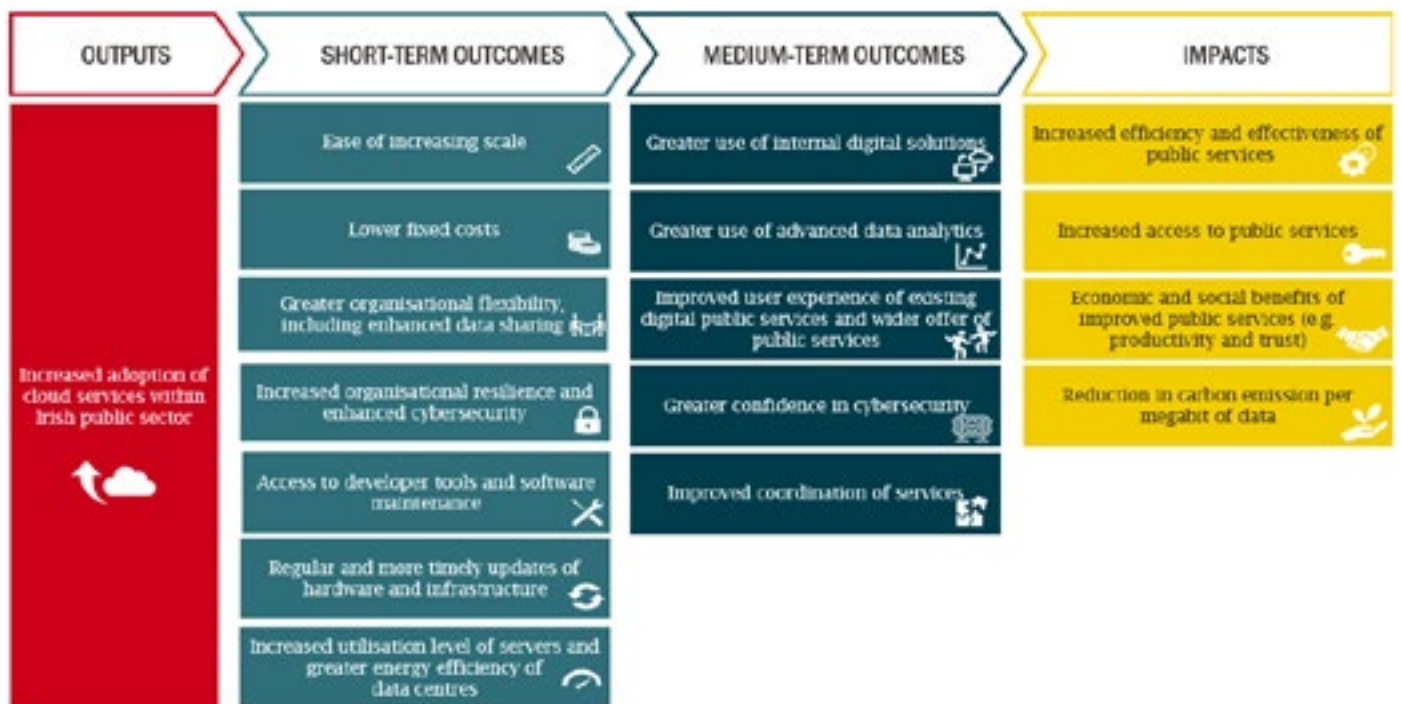


Another important benefit from increased adoption of cloud is greater flexibility in accessing data. Not only might this occur between departments or organisations (e.g. sharing earnings data between the tax authority and the department for employment and social protection), but using the cloud is also an efficient way to allow civil servants to access their work from anywhere. This is particularly important in today’s hybrid working world.<sup>11</sup>

Finally, the adoption of cloud can help bolster organisational resilience by means of additional security support, offered through dedicated staff, and infrastructure support. The latter is a particular focus for hyperscale providers because of their economies of scale. Furthermore, cloud’s back-up capabilities can offer protection against disruption caused by shock events or cybersecurity threats. For example, in a recent cyberattack on the systems of the Health Service Executive (HSE), the only elements that were not affected were those based on the public cloud.

There may be other spillover benefits of cloud adoption in the public sector, in particular stimulating the private sector to follow suit or helping SMEs access public sector work by using cloud. These additional benefits are beyond the scope of this report.

Figure 1: Benefits of increased adoption



Source: Frontier Economics

11. The International Labour Organization says that pre-pandemic only 5% of Irish workers were working from home regularly. It sees considerable benefits from supporting increased capacity for home working. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership)

# Recommendations to increase adoption of cloud

We have identified a number of actions that should be taken by central government and departments seeking to increase cloud adoption in the public sector. These recommendations are linked to overcoming the barriers to cloud adoption.

## 1. Adopt a clear top-down cloud-first policy that moves beyond a high-level vision.

This policy should outline (i) the strategic case for **why** the transition to cloud is beneficial and (ii) **how** the transition should happen through a series of policies and guidance. These two fundamental elements should be presented clearly by the government and could also be incorporated in wider digital policies and codes of practice.<sup>12</sup>

- i. **Strategic case.** It is important to remember that cloud is not the ultimate goal. Rather it is an instrument to achieve broader aims. A clear identification of the objective that an organisation wants to attain with cloud adoption can accelerate the shift to cloud and help maximise the benefits of the transition. The government's Cloud Computing Advice<sup>13</sup> note states that "organisations should no longer decide on whether to move to cloud for new or existing systems; the decision to be made now is what, how and when to move to cloud and which particular systems are suitable for cloud". But in order to answer these questions, organisations need to first discuss the "why", by understanding what it is that cloud solutions can help to achieve. Central government can take the lead on this task, but each department or public body will need to apply the findings to their own strategic and operational objectives.
- ii. **Policies and guidance.** This would cover topics such as operational aspects of cloud usage (e.g. licence management), services that are suitable to be moved to cloud, accounting decisions, security issues and transition timings. The examples from Australia, Canada and the UK discussed in the main body of this report are particularly relevant in this context. Alongside these, establishing systems to monitor and evaluate usage will contribute to the effective adoption of cloud.

## 2. Engage with senior decision makers when developing implementation strategy:

Top-down policy on its own is not sufficient. In order to facilitate widespread cloud adoption it is fundamental to involve, inform and engage senior decision makers, procurement officials and IT staff. Their concerns in relation to costs, security and resources need to be addressed directly

12. The UK for example has included "use cloud first" in its [Technology Code of Practice](#). Similarly the US underlines the importance of "allowing the flexibility to purchase cloud computing resources" in its [Digital Services Playbook](#).

13. <https://www.gov.ie/en/publication/078d54-cloud-computing-advice-note-october-2019/>

to mitigate any nervousness about implementation. Hence, for example, developing the policies for operating in the public cloud, especially risk-sharing arrangements, should be a joint effort. This should also form part of the implementation strategy and could be communicated effectively by using success stories such as Open Assessment Technologies<sup>14</sup> (in relation to costs) and the HSE in Ireland (in relation to security).

**3. Develop an agile and effective procurement framework fit for cloud services.**

The experience of other countries with procurement arrangements that have successfully enabled public sector cloud adoption offers a pathway that Ireland can emulate. Key steps are: i) implement a digital marketplace where standardised cloud services and products can be procured; ii) update risk assessment and audit processes to reflect the nature of cloud infrastructure; iii) shift funding from capital budgets to operating budgets in sustainable ways in order to promote the optimisation of cloud resources.

**4. Ensure that government departments start to plan migration to the cloud early.**

The process for implementing clear cloud-oriented organisational policies, strategies and culture can begin almost immediately. However, follow-up implementation steps will require additional planning. These include recruitment and deployment of skilled staff; updating applications to ensure they work as effectively as possible once migrated to the cloud; and making complementary organisational changes (e.g. ensuring the legal arrangements are in place for cloud-enabled data sharing across departments). Moreover, the cultural shift required to underpin and maintain the shift to cloud will not happen overnight but will likely take some time to develop.



14. A leading provider of open-source assessment for schools based in Luxembourg has been able to control infrastructure costs by exploiting AWS scaling capacity [https://aws.amazon.com/solutions/case-studies/open-assessment-technologies-case-study/?did=cr\\_card&trk=cr\\_card](https://aws.amazon.com/solutions/case-studies/open-assessment-technologies-case-study/?did=cr_card&trk=cr_card)



# 01 Introduction

## 1.1 The objectives of this report

In 2021, the Department for Public Expenditure and Reform announced that by 2030, 90% of applicable public services should be delivered online. More recently, *Harnessing Digital: Digital Ireland Framework*, effectively Ireland's digital strategy,<sup>15</sup> and the new Public Sector ICT strategy (Connecting Government 2030<sup>16</sup>) indicated that this goal would be achieved by “taking a cloud-first approach to delivery of all services”.

To support the Irish government in its objective to put digital solutions underpinned by cloud at the forefront of innovation in public service delivery, Technology Ireland commissioned Frontier Economics to:

- Identify the current barriers to adoption of cloud computing in the public sector, and explore how these can be overcome; and
- Demonstrate the potential benefits to the public sector of prioritising and accelerating the adoption of cloud computing and storage solutions.

## 1.2 What is cloud computing?

In this report, we define cloud computing as “the practice of using a network of remote servers hosted on the internet to store, manage, process data, and deliver IT applications, rather than a local server or a personal computer”. In other words, cloud computing is the on-demand delivery of IT resources over the internet with pay-as-you-go pricing. Instead of buying, owning and maintaining physical data centres and servers, users can access technology services, such as computing power, storage and databases, on an as-needed basis from a cloud provider.

Cloud computing has three service models (depending on what service is being provided) and three deployment models (depending on where the infrastructure is located). Any combination of service and deployment models is possible:

The **service models** include:

- Infrastructure as a service (IaaS)** is the most basic cloud service model. Customers can acquire computing capabilities on demand and over the web from cloud service providers (CSPs) without having to buy and maintain their own infrastructure (servers, storage and other equipment).
- Platform as a service (PaaS)** encompasses not only infrastructure, such as servers, but also middleware, which acts as a bridge between a database or operating system and an application. This includes development tools that can help developers write, deploy and debug applications; business intelligence (BI) services; and database management systems.

15. <https://www.gov.ie/en/press-release/3a922-online-launch-of-harnessing-digital-the-digital-ireland-framework/>

16. <https://www.gov.ie/en/publication/136b9-connecting-government-2030-a-digital-and-ict-strategy-for-irelands-public-service/>

iii. **Software as a service (SaaS)** offers applications that are accessed over the web and maintained by software providers rather than managed internally within the company. Common examples of SaaS applications are Microsoft Office software, web-based email and payroll processing software. With SaaS, the functions of each application can be used without having to manage feature additions or maintain the servers.

**Deployment models** through which cloud can be adopted include:

- i. **Private Cloud:** in this model, computing resources form an environment dedicated to a single organisation. Private Cloud can be situated on premises or hosted in a third party's data centre. Private cloud is typically used when processing highly confidential information that has particular requirements, for example low latency, which might be essential for a defence ministry. Note that when the private cloud is situated on premises, the full stack of SaaS software is installed there by the vendor and any updates or troubleshooting require the SaaS employees to use a VPN.
- ii. **Public Cloud:** in this model, computing resources are owned and operated by a CSP and are available, via the internet, to anyone who wants to use or purchase them. Public Cloud allows organisations to adopt a pay-per-use model, flex their computing and storage capacity, and have access to a suite of regularly updated resources. Organisations that opt for public cloud may use multiple CSPs.
- iii. **Hybrid Cloud:** in this model, on-premises infrastructure is connected to cloud-based infrastructure. This allows some of the benefits of public cloud to be harnessed. For example, when demand spikes organisations can tap into additional computing resources in the cloud. This is sometimes call cloud bursting.

The focus of this report is on public cloud and hybrid cloud. The benefits of cloud discussed in Section 3 are described in comparison with the status quo, i.e. a counterfactual where the public sector in Ireland will continue to rely on existing infrastructure and computing approaches that involve relatively limited cloud usage<sup>17</sup>. This report does not conduct a comparison and review of each of these cloud service and deployment models. Further work could consider the specifics of each model for different organisations and activities within the public sector.

### 1.3 Current use of cloud in the irish public sector

Several public sector bodies have started embracing cloud computing. Notably, Covid-19 accelerated the HSE's transition to digital technologies. Examples of the HSE's technological response to the pandemic include<sup>18</sup>:

- **The Covid tracker application:** At the start of the pandemic the HSE developed a Covid tracker application using AWS. Cloud technology enabled the app to be developed and tested and the first prototype to be made available in just two days.<sup>19</sup> After its release in July 2020, the app was downloaded 1 million times in the first 36 hours and a further 500,000 times in the next four weeks.
- **A portal for Covid testing centres:** A portal was developed using the Microsoft Power App to allow laboratories testing for Covid-19 to report tests and case numbers.

17. This is based on our findings from interviews. To the best of our knowledge there isn't data that quantifies the level of cloud usage in the Irish public sector.

18. ESRI (2021), *Developments in healthcare information systems in Ireland and internationally*

19. <https://www.eolasmagazine.ie/how-healthcare-is-scaling-and-innovating-to-meet-demand/>

- **A cloud-based data lake platform:** A data lake developed on Microsoft Azure enabled the collation of health data from over 30 different sources. The information was then analysed in real time and synthesised through dashboards to inform stakeholders about Covid-19 incidence, critical-care bed capacity and resource planning.
- **An AI Health Chatbot:** A health chatbot was developed using AI technology to let people ask triage types of questions. The chatbot helped reduce strains on HSE staff.

More broadly, the Covid-19 pandemic and the need for agile and flexible policy responses in some sectors (e.g. contact tracing, income support) are perceived as accelerators of the transition to cloud.

Other specific examples of effective cloud usage in the public sector include the digital covid certificate<sup>20</sup> and the gov.ie website. Public sector organisations currently using cloud include Ordnance Survey Ireland<sup>21</sup>, the Department of Health<sup>22</sup>, Tallaght University hospital<sup>23</sup>, the Department of Public Expenditure and Reform<sup>24</sup>, and An Post, Ireland's postal provider.<sup>25</sup> The use of Oracle Cloud Analytics has helped An Post collate and analyse data in close to real time and improve its anti-fraud system.<sup>26</sup>

Despite these examples, a public sector interviewee involved in implementing the sector's ICT strategy said public bodies in Ireland are adopting cloud more slowly than the private sector. A recent survey of Irish business and technology leaders corroborated this judgment.<sup>27</sup> Senior stakeholders in the Office of the Government Chief Information Officer (OGCIO) acknowledge that, while public sector adoption of cloud is accelerating, usage is still immature in comparison to private firms. Indeed, Irish public sector technology leaders are almost twice as likely as their private sector counterparts to say they use hardly any cloud services (26%)<sup>28</sup>.

Ireland also lags other European countries in public sector cloud adoption, including the UK, Finland and France, as well as non-European countries such as Australia and Canada. Unfortunately, data on the Irish public sector's use of cloud is unavailable, making a quantitative international comparison impossible.

## 1.4 Our approach and the structure of this report

To achieve the objectives of our study, we used the following approach to gather evidence on the use of cloud in the public sector:

- We reviewed the existing evidence base on the adoption, benefits and costs of cloud as well as guidance on the adoption of cloud in the public sector in Ireland and elsewhere, including the UK, Australia, the US, Canada and France. We examined:
  - All relevant Irish policies and procurement processes and compared them with their equivalents in other jurisdictions.

20. <https://www.eolasmagazine.ie/collaboration-makes-digital-covid-certificate-a-success/>

21. <https://www.monsoonconsulting.com/en/case-study/magento/ordnance-survey-ireland>

22. [https://d1.awsstatic.com/institute/210604\\_%20Adopting%20Cloud%20Technology\\_Ireland\\_Final.pdf](https://d1.awsstatic.com/institute/210604_%20Adopting%20Cloud%20Technology_Ireland_Final.pdf)

23. <https://www.digitalhealth.net/2022/03/tallaght-university-hospital-epr-go-live/>

24. [https://d1.awsstatic.com/institute/210604\\_%20Adopting%20Cloud%20Technology\\_Ireland\\_Final.pdf](https://d1.awsstatic.com/institute/210604_%20Adopting%20Cloud%20Technology_Ireland_Final.pdf)

25. [https://d1.awsstatic.com/institute/210604\\_%20Adopting%20Cloud%20Technology\\_Ireland\\_Final.pdf](https://d1.awsstatic.com/institute/210604_%20Adopting%20Cloud%20Technology_Ireland_Final.pdf)

26. <https://blogs.oracle.com/analytics/post/oracle-analytics-cloud-helps-irelands-an-post-deliver>

27. Digital Ireland - Inclusive Recovery: The Economic and Transformational Impact of Digital Technology in Ireland, accessible here: [https://info.microsoft.com/WE-TRNS-CNTNT-FY22-09Sep-07-Digital-Ireland-Inclusive-Recovery-The-Economic-and-Transformational-Impact-of-Digital-Technology-in-Ireland-SRGC4937\\_LP01-Registration---Form-in-Body.html?wt.mc\\_id=AID3039896\\_QSG\\_BLOG\\_567314](https://info.microsoft.com/WE-TRNS-CNTNT-FY22-09Sep-07-Digital-Ireland-Inclusive-Recovery-The-Economic-and-Transformational-Impact-of-Digital-Technology-in-Ireland-SRGC4937_LP01-Registration---Form-in-Body.html?wt.mc_id=AID3039896_QSG_BLOG_567314)

28. Recent research conducted by Amárach in collaboration with Microsoft.

- Twenty-four reports produced by international bodies such as the OECD, consultancies, market research companies and academics. These included case studies of approaches to increase cloud adoption and success stories in other jurisdictions.
- We conducted a series of interviews with public sector stakeholders working for the OGCIO, government departments in the UK, CSPs that offer both public and hybrid deployment models around Europe, and cloud technology experts based in Ireland and in the UK.

Relying on this evidence, we:

- Identified a set of barriers to increased cloud adoption in the Irish public sector and how other countries have overcome similar obstacles. These are summarised in Section 2.
- Developed a logic model to capture the expected benefits of increased cloud adoption and the inputs required to realise them. The logic model can help government departments build their economic cases for using cloud. This is found in **Section 3**.
- Defined a set of recommendations in Section 4 which outline actions that could be taken by central government and departments seeking to increase cloud adoption.

“ Indeed, Irish public sector technology leaders are almost twice as likely as their private sector counterparts to say they use hardly any cloud services (26%).”





# 02 Barriers to increased cloud adoption

## Summary of findings

We have identified three main categories of barriers to increased adoption of cloud solutions.

### **Lack of cloud-oriented organisational policies, strategies and culture**

The Irish government has developed a cloud-first vision for the delivery of public services. However, publicly available documents and statements have not made the **strategic case** outlining why the transition to cloud will be beneficial. Nor do they set out **policies and guidance** that describe a clear implementation plan for cloud adoption, including how and when cloud should be used.

Moreover, our research suggests that, while parts of the public sector understand the benefits of cloud, a cloud-oriented culture has yet to be embraced. Organisational culture is of fundamental importance in this context. Even in countries that implemented a clear, top-down cloud-first vision (e.g. the UK, Australia, Germany, Greece, Poland and Bahrain), experience has shown that the buy-in of senior leaders and decision makers, IT departments and procurement officials was key to a successful transition.

Lastly, in order to promote a cloud-oriented culture, we believe it is important that organisational leaders clearly and transparently address any misperceptions about costs, security, integrity and availability of critical government systems (e.g. by sharing success stories).

### **Lack of streamlined procurement processes and guidance**

It is difficult for public bodies to purchase cloud services due to complex, fragmented procurement processes and lack of guidance for both procuring authorities and service providers. We understand that public bodies that want to purchase cloud must conduct their own procurement exercises. While the Cloud Services Procurement Guidance Note,<sup>29</sup> published by the Office of Government Procurement, offers practical advice, it is no substitute for a specialised cloud procurement vehicle.

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29. <https://assets.gov.ie/135678/dfc88c52-108e-4d10-aeee-408d15f92c03.pdf>

The presence of a standardised digital marketplace where different procuring authorities can purchase cloud services has been effective in many countries. Notable examples are the G-Cloud framework<sup>30</sup> in the UK, the European Commission’s Cloud II framework and the Cloud Marketplace<sup>31</sup> in Australia. Here procurement processes are sufficiently standardised to improve efficiency and generate economies of scale but also flexible enough to meet the specific needs of different procuring organisations.

**Limited access to skills, time and resources**

Establishing the culture, policies, procurement processes and guidance described above requires appropriate skills in IT and procurement teams and across adopting organisations more broadly. Skills in this domain are scarce and competition from the private sector is fierce. In addition, IT departments and procurement officials need time to plan in advance and give guidance on how to effect the transition.

Existing literature has identified a range of barriers inhibiting the adoption of cloud solutions in the public sector. This section, using insights gained from the literature and from our interviews with stakeholders, summarises the three main categories of barriers we have pinpointed as relevant in the Irish context.

## 2.1 Barriers to cloud adoption in the Irish public sector

Starting from the published literature on the topic, we have used experience and insights gathered in our interviews with key stakeholders to identify three main sets of barriers to increased adoption of cloud computing. These are shown in the figure below.

**Figure 2: Barriers to cloud adoption in the Irish public sector**



Source: Frontier Economics

In the following sub-sections, we summarise the existing literature and examine each of the barriers.

30. <https://www.crowncommercial.gov.uk/agreements/RM1557.13>

31. <https://www.dta.gov.au/news/dta-launches-new-cloud-marketplace>



## 2.2 Summary of existing literature

A 2019 report by Deloitte<sup>32</sup> described five categories of barriers to government sector use of public cloud and used them to structure a series of survey questions put to Australian government officials. Despite the different context, this taxonomy appears helpful to analyse the Irish context too. In particular:

- (i) Understanding and skills gap;
- (ii) Risks with a focus on data privacy and sovereignty;
- (iii) Procurement policies;
- (iv) Budgeting;
- (v) Organisational culture.

Similarly, a recent study by Gartner<sup>33</sup> on US federal organisations identified five main groups of barriers to cloud adoption. These were reflected in the consultancy's main recommendations:

- (i) Lack of clarity in terms of intent, direction and roadmap of cloud adoption;
- (ii) Lack of a centre of excellence sharing lessons learnt and best practices;
- (iii) Lack of skills and knowledge across organisations;
- (iv) Lack of user-friendly controls to expand SaaS use;
- (v) Lack of involvement of officials and senior managers beyond IT personnel.

PwC<sup>34</sup>, in a report on the Qatari public sector, has also picked out five main sets of barriers: data sovereignty, security, vendor lock-in, skill gaps and existing investments in data centres. Once again, this high-level taxonomy can be applied to other countries, including Ireland.

32. <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-value-public-cloud-services-australia-220319.pdf>

33. <https://www.gartner.com/smarterwithgartner/how-can-governments-scale-up-cloud-adoption>

34. <https://www.pwc.com/m1/en/publications/five-challenges-cloud-adoption-how-overcome-them.html>

## 2.3 Lack of cloud-oriented organisational policies, strategies and culture

One of the main areas of consensus among all the interviewees involved in our research is the fundamental importance of a cloud-oriented organisational culture. We have identified three drivers of such a culture, based on the literature we reviewed and on inputs gathered from stakeholders.

First, a **vision**: a statement which sets out clearly, but necessarily at a high level, the ultimate goal of cloud adoption across the public sector. The cloud-first approach is such a vision: a well-defined ambition that can inspire the action of all stakeholders directly or indirectly involved in the cloud adoption process.

Second, the **strategic (or business) case**: this sets out the rationale underpinning the vision, the problems that it is expected to solve and the benefits that it is expected to generate. Once a cloud-first vision has been established, it needs to be underpinned by details of the improvements it aims to bring about across the public sector.

Third, **policies and guidance**: these set out how a cloud-first vision can be implemented in order to realise the benefits and solve the problems identified in the strategic case. Guidance/policy can be offered, among other things, on:

- how operational aspects of cloud usage should be handled (for example, licence management);
- which services are more or less suited to be moved to cloud;
- possible concerns/misperceptions in relation to costs, security and flexibility;
- how and when the transition to cloud should occur and what to do in the transitional period.

These three pillars, together with buy-in from senior leaders and decision makers, IT departments and procurement officials create a cloud-oriented organisational culture. This culture is critical to a successful transition, as seen even in countries that implemented a clear top-down cloud-first policy, including the UK, Australia and Germany.

Culture is important because it will not only accelerate adoption but will also lead to better results, potentially ushering in a virtuous cycle whereby early successes create incentives for further adoption.

**Figure 3: Drivers of organisational culture in the context of cloud adoption**



Source: Frontier Economics

Below are some examples from the literature review and interviews with stakeholders on how organisational policies and strategies can facilitate and accelerate the development of a cloud-oriented culture (and ultimately cloud adoption):<sup>35,36</sup>

- Clear policies can help public bodies to deal with regulatory and compliance issues. Data privacy and data sovereignty are often cited as key concerns regarding cloud adoption<sup>37</sup>. A firm sense of direction in relation to which information is suitable for cloud and a uniform approach to data classification across all public departments may help to allay these concerns.
- Cloud computing entails less capital and infrastructure expenditure but higher operational outlays. Organisational policies and strategies need to promote flexible budgets so IT capital spending can be allocated to operational items. Policies are also needed to ease any concerns associated with such a shift.
- Organisational policies and strategies can help increase trust in cloud computing by addressing any misconceptions about costs, security, integrity and availability of critical government systems. These misperceptions are often based on previous generations of cloud technologies or a superficial understanding of cloud systems. It is important to explain why, with the right architecture and strategic vision, any risks can be managed and minimised.

For example, several public and private sector interviewees mentioned cumbersome audit processes and the perceived loss of control over their computing systems as a barrier to cloud adoption in the Irish public sector. These processes need to be streamlined and to reflect the nature of cloud computing (e.g. physical visits to server rooms are less relevant than they used to be).

- A culture of risk aversion and decision inertia can significantly slow down cloud adoption, in particular at public bodies with large legacy systems. A culture that supports innovation can overcome resistance to change.
- Some of the challenges that organisations face when migrating to the cloud are common among many public bodies. These challenges include cloud procurement, data classification and licence management. A culture that promotes collaboration and knowledge sharing across departments may help cut down on the resources needed to migrate to cloud computing.



35. [https://gupea.ub.gu.se/bitstream/handle/2077/65762/gupea\\_2077\\_65762\\_1.pdf;jsessionid=F8D1ABF4FDD6A18CD5C9010339399EE6?sequence=1](https://gupea.ub.gu.se/bitstream/handle/2077/65762/gupea_2077_65762_1.pdf;jsessionid=F8D1ABF4FDD6A18CD5C9010339399EE6?sequence=1)

36. <https://docs.aws.amazon.com/whitepapers/latest/public-sector-cloud-transformation/culture-and-change-management.html>

37. <https://www2.deloitte.com/us/en/insights/industry/public-sector/public-sector-cloud-adoption.html>

### 2.3.1 Status quo in Ireland

With the OGCIO's cloud computing advice, the Irish government has indicated that it will take a cloud-first approach to the public sector. Moreover, *Harnessing Digital: Digital Ireland Framework*<sup>38</sup>, seen as Ireland's national digital strategy, sets the ambitious goal of delivering 90% of public services digitally by 2030.

However, the government has provided limited guidance on what the cloud-first approach means in practice and has not yet given details of how the transition from face-to-face to digital services will happen between now and 2030.

Interviewees said that deciding on a cloud-first strategy and setting ambitious goals is a helpful first step. However, without a clear policy which can be implemented throughout the public sector, and without a shared understanding of the issues that this ambition is expected to solve, fine statements on their own will not help to build the organisational culture that facilitates cloud adoption.

More specifically, we understand that there is often a lack of clarity in relation to the problem(s) that cloud solutions are expected to address and the mechanisms through which benefits can be realised. When clarity on such fundamental aspects is lacking, it affects procurement, engagement between procuring authorities and providers, and the rapidity and effectiveness of the entire implementation process.

### 2.3.2 Examples of success stories

#### *Vision*

In its Cloud Smart Policy<sup>39</sup>, the US government provides public sector agencies with relevant information and actionable recommendations to facilitate the adoption of cloud computing. What is striking in this document is that practical, sometimes technical information is always combined with references to high-level organisational goals and culture.

For example, when introducing the topic of a secure transition to the cloud, the guidance says that *"agencies must cultivate an organizational mindset of constant improvement and learning. Modernization is not a commitment that is sustained solely by interventions once every decade."*

Similarly, the UK government's Cloud Playbook, which offers technical and commercial guidance, makes repeated reference to high-level cultural factors, such as cross-government collaboration, cross-functional cooperation and the importance of learning from the experiences of other teams and departments.<sup>40</sup>

#### *Strategic case*

When CERN, the European Laboratory for Particle Physics, in Geneva decided to transfer its computing activities to the cloud, its aim was in furtherance of a clear, shared objective: to free up the valuable time of scientists and researchers spent on data management so they can focus on core research.<sup>41,42</sup>

38. <https://www.gov.ie/en/press-release/3a922-online-launch-of-harnessing-digital-the-digital-ireland-framework/>

39. <https://cloud.cio.gov/strategy/>

40. <https://technology.blog.gov.uk/2020/03/31/introducing-the-gov-uk-cloud-guide/>

41. <https://go.oracle.com/LP=103794?elqCampaignId=273745&src1=:ow:o:p:po:::&intcmp=WWMK201014P00001:ow:o:p:po>

42. <https://www.oracle.com/customers/infrastructure/cern/>

More specifically, CERN recently made the transition to Oracle Cloud to support the Large Hadron Collider, the world's most powerful particle accelerator. The control systems for the highly complex mix of accelerators, detectors and information-management technologies form one of the most challenging Internet of Things (IoT) environments in the world. The ease of scaling offered by cloud-based computing proved to be of significant benefit for CERN in rising to the challenge.

### ***Policies and guidance***

Similarly, when Canada developed its cloud-first policy, one of its main objectives was to enable new ways of delivering public services digitally, including digitalised tax returns and cross-hospital platforms to store and securely analyse patients' data. As the government implemented the policy, it communicated its goals consistently across public sector organisations at federal, provincial and municipal level.<sup>43</sup>

The government complemented its strategic case with consistent guidance on how to manage the risks of cloud adoption, while still giving departments and agencies the flexibility to act based on their specific risk tolerance. It also provided instructions on how to balance the supply of IT services with the demand for those services. (By adopting cloud, the government can bring IT supply and demand into balance, while IT departments can forecast demand and identify opportunities for using cloud technology.)

## **2.4 Lack of streamlined procurement processes and guidance**

At the time of drafting, Ireland does not have a procurement framework dedicated to cloud services. All interviewees noted that it is often difficult for public bodies to purchase cloud services, due to complex, fragmented processes and the lack of clear guidance for both procuring authorities and service providers. These observations are confirmed by our literature review.<sup>44</sup>

### **2.4.1 Status quo in Ireland**

We understand that public bodies that want to purchase cloud services and products in Ireland have two options. First, they can use the existing Open Clouds for Research Environments (OCRE) framework, which can be accessed only by certain public sector bodies (such as the HSE) and allows for the procurement of cloud.<sup>45</sup> Second, organisations can undertake their own procurement exercise.

#### ***Existing frameworks***

We understand that the only existing framework that explicitly includes cloud services is the "Multi Supplier Framework Agreement for the provision of Business Management and ICT Consultancy Services, Ref PAS097F" (abbreviated to "BMICT"). This scheme was established in 2018 and is due to run until August 2022. It contains two sections, 5 & 11, which refer broadly to the cloud in simple terms.

However, we understand that this framework allows for the procurement of professional services related to cloud but not for cloud services per se. In practice, it appears that this instrument has been rarely used (one interviewee told us that it has been used only once in the past four years).

43. <https://www.canada.ca/en/government/system/digital-government/digital-government-innovations/cloud-services/government-canada-cloud-adoption-strategy.html#toc2>

44. See for example: <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-value-public-cloud-services-australia-220319.pdf>

45. We understand that there are alternative frameworks operated by the OGP which allow customers to purchase cloud consultancy. However, cloud services are outside of the scope.





This basically means that public bodies have little choice but to carry out their own procurement exercise, given that no central framework has been set up to help different public sector bodies buy cloud services.

We understand that the Irish government created a Government Cloud Services Catalogue (GCSC) in the early 2010s but that it was discontinued in 2015.

### ***Stand-alone procurement***

The OGP services contract, used for almost all tender processes in Ireland, has been described by commentators<sup>46</sup> as unsuitable for the procurement of cloud services because of multiple problems with the terms and conditions. These include some intellectual property provisions, the lack of a default liability cap, forced contract lock-ins and rigidity regarding engagement of subcontractors<sup>47</sup>. The upshot is that suppliers often reject these terms and instead propose the use of their own terms and conditions, leading to the breakdown of negotiations.<sup>48</sup>

Cloud is an innovative, evolving industry which requires market engagement and/or dialogue on the part of the customer when seeking a tailor-made solution. For relatively simple, standardised services, dialogue and negotiations between the parties might not be particularly important. However, in more complicated cases, the fact that many tender processes do not allow for negotiations - and only permit post-tender changes that do not affect the commercial terms of the contract - means that cloud computing suppliers face a choice. Often they have to choose between not bidding for a project or hoping to obtain amendments after the tender has been awarded - something which is more problematic when the procuring authority is used to purchasing traditional IT solutions instead of cloud services.

In this context, it is important to note that there are limited examples of good practice for stand-alone procurement procedures in the industry. That is also the case in countries like the UK, where public sector bodies overwhelmingly depend on frameworks to purchase cloud rather than undertaking laborious stand-alone exercises.

### ***Existing guidance documents for own procurement exercises***

The OGCIO published its Cloud Computing Advice Note in October 2019<sup>49</sup>. This document highlighted the advantages of cloud services and set out how public sector bodies should approach adopting them. In February 2021, it was complemented by the Cloud Services Procurement Guidance Note,<sup>50</sup> which focused on the contractual and commercial considerations to take into account when preparing to purchase cloud services. More specifically, the note aimed to support public sector bodies with regards to:

- procuring cloud services in an informed and legally compliant manner, striking the right balance between risks and benefits;
- the general complexity associated with contracting for cloud services; and
- the general differences, from a commercial and contractual perspective, between traditional (legacy) ICT contracts and cloud contracts.

46. [philiplee.ie/key-issues-for-contracting-authorities-to-consider-when-procuring-cloud-services/](https://www.philiplee.ie/key-issues-for-contracting-authorities-to-consider-when-procuring-cloud-services/)

47. [https://d1.awsstatic.com/case-studies/digital-marketing/AWS205\\_Procuring\\_Cloud\\_Technology.pdf](https://d1.awsstatic.com/case-studies/digital-marketing/AWS205_Procuring_Cloud_Technology.pdf)

48. <https://www.philiplee.ie/key-issues-for-contracting-authorities-to-consider-when-procuring-cloud-services/>

49. <https://www.gov.ie/en/publication/078d54-cloud-computing-advice-note-october-2019/>

50. <https://assets.gov.ie/135678/dfc88c52-108e-4d10-aaee-408d15f92c03.pdf>

At a high level, this document provides four main types of inputs/guidance for public sector bodies. These are mainly in the form of theoretical principles and do not include examples of appropriate wording, which would give procuring authorities the practical assistance they need to draft a tender document.<sup>51</sup>

From a general perspective, the guidance note appears to recommend including a CSP's standard terms and conditions in the contract tendered by the public body, with the contracting authority's terms and conditions nevertheless taking precedence in the case of a conflict.

It is important to note that this document is explicitly intended to be a reference point only and that expert support and legal advice in drawing up tender documentation and service contracts should be sought when procuring cloud services.

On balance, while the information in the main sections of the reports appears quite abstract and not immediately applicable, the pragmatic checklist included in Appendix 1 seems particularly relevant to aid organisations in their transition to cloud.

The note provides several considerations for the public sector to take into account in preparing cloud service tenders, but it does not recommend any particular positions on key issues that frequently cause conflict between the public sector and CSPs (e.g. indemnification and liability caps, risk-sharing agreements, etc.).<sup>52</sup> This means that every procuring authority ends up writing its own Request for Proposal (or RFX/RFI), making it impossible to achieve economies of scale.

### 2.4.2 Examples of success stories

#### *Procurement Frameworks*

The presence of a standardised, digital marketplace where different procuring authorities can purchase cloud services through simple, streamlined processes has been effective in many countries.

For example, the G-Cloud framework<sup>53</sup> in the UK<sup>54</sup> is an initiative aimed at easing public sector procurement of commodity information technology services that use cloud computing.<sup>55</sup> The G-Cloud consists of:

- A series of framework agreements with suppliers from which public sector organisations can buy services without needing to run a full tender or competitive procurement process;
- An online store – the Digital Marketplace (previously “CloudStore”) - which allows public sector bodies to search for services that are covered by G-Cloud.

51. In summary, this guidance document included (1) a series of recommendations in relation to pre-market engagements (section 2.4), including indications on how to use public RFIs to determine the right type of solution to meet the requirements of specific organisation; how to conduct a data protection impact assessment, including the impact of a data breach; and how to gather information for risk-benefit analyses and to draft contractual and commercial terms. (2) an overview (section 3.1) of the types of provisions that apply to cloud service contracts and how IaaS, PaaS and SaaS contracts differ. (3) an introduction to key contractual and commercial terms (section 3.2), including contract term and duration; contract termination; exit management; security; data protection; suspension of services by the provider; pricing models; in-life service; and relationship management. (4) a checklist (section 4 and Appendix 1) listing the main differences between procuring and contracting for cloud services compared to on-premises ICT solutions as well as the key contractual and commercial considerations regarding those differences. The checklist also serves as a toolkit to assist in drafting tender documentation for the procurement of cloud services.

52. <https://www.philiplee.ie/key-issues-for-contracting-authorities-to-consider-when-procuring-cloud-services/>

53. <https://www.crowncommercial.gov.uk/agreements/RM1557.13>

54. [https://en.wikipedia.org/wiki/UK\\_Government\\_G-Cloud](https://en.wikipedia.org/wiki/UK_Government_G-Cloud)

55. The service began in 2012 and had several calls for contracts. By May 2013 there were over 700 suppliers and the 12th iteration of the UK government's G-Cloud procurement framework launched in September 2020 with over 5,200 suppliers – over 90% of which were small and medium sized enterprises. More than £6bn of cloud and digital services had been procured by public bodies through G-Cloud, with almost 42% percent of that spend going directly to SMEs. Source: <https://www.crowncommercial.gov.uk/news/g-cloud-12-framework-goes-live>

Similarly, the European Commission's Cloud II<sup>56</sup> is a highly structured public procurement framework, within which the Commission and in particular the Directorate-General for Informatics (DIGIT) can use dynamic procurement models to tap into a fast-evolving cloud computing market.

Building on the experience of the first cloud framework contract (Cloud I), DIGIT now plays a more centralised, coordinating role in Cloud II to give European institutions access to the global market of cloud providers, while maintaining consistency in terms of quality and service specifications.

Lastly, the Cloud Marketplace<sup>57</sup> (previously known as Cloud Services Panel) in Australia includes more than 300 providers selected as cloud-capable sellers to the government. Its catalogue lists SMEs and start-up companies as well as national and global providers. This arrangement has been designed to meet the complex needs of government agencies that are looking to easily source value-for-money cloud solutions.

### **Guidance**

As mentioned above, streamlined procurement processes are more effective when they are accompanied by clear, easy-to-navigate guidance on which cloud services are best suited to each use case and on the costs, risks and benefits of adopting cloud solutions in different contexts.

For example, the Canadian government's Right Cloud Selection Guidance<sup>58</sup> recognises that, given the diversity of the IT landscape, a one-cloud-fits-all approach will not serve all needs. It suggests a series of practical steps to understand how the business context should be considered when selecting a cloud deployment model.

Likewise, PICSE<sup>59</sup>, or Procurement Innovation for Cloud Services in Europe, has produced a roadmap that serves as a checklist for all public sector bodies involved in the procurement of cloud services, including customers, operational staff, contract advisers and suppliers. The purpose of the roadmap is to establish the extent to which their procurement practices are a suitable fit for migration to the cloud.

Similarly pragmatic assistance from the industry body Cloud Infrastructure Services Providers in Europe (CIPSE) - published in 2019 and updated in 2022 – is a good example of how the OGCIO's Cloud Services Procurement Guidance Note<sup>60</sup> could be improved.<sup>61</sup> As discussed above, the note is a good starting point, but more could be done to make it even more practical, for example by providing answers to some of the questions that public bodies will typically face when procuring cloud services.

56. <https://www.ingentaconnect.com/content/hsp/jcs/2019/00000003/00000003/art00004>

57. <https://www.dta.gov.au/news/dta-launches-new-cloud-marketplace>

58. <https://www.canada.ca/en/government/system/digital-government/digital-government-innovations/cloud-services/government-canada-right-cloud-selection-guidance.html>

59. [http://picse.eu/sites/default/files/Annex1\\_Guidetocloudprocurement\\_webversion.pdf](http://picse.eu/sites/default/files/Annex1_Guidetocloudprocurement_webversion.pdf)

60. <https://assets.gov.ie/135678/dfc88c52-108e-4d10-aaee-408d15f92c03.pdf>

61. <https://cispe.cloud/buying-cloud-services-in-public-sector-handbook/>

## 2.5 Limited access to skills, time and resources

### 2.5.1 Status quo in Ireland

We understand from our interviews that the skills and competencies needed to effectively implement a transition to cloud computing are particularly scarce in developed economies. This makes it difficult to recruit and retain personnel with the right expertise and pushes up salaries in this segment of the job market.

The challenge is even more pronounced for public institutions as the same skills are also in high demand in the private sector. Even if public bodies were able to train or attract the talent they need, those workers could be tempted away by higher salaries in commercial industries.

However, the private sector does not necessarily need to be considered a threat. The significant number of skilled cloud professionals in the private sector is a resource that the public sector can tap into. If they look through the lens of collaboration instead of competition, government organisations can draw on the private sector's broader array of skills and experience.

We understand that major providers of cloud services offer a wide variety of training opportunities, for example AWS Cloud Academy, Google Cloud Training (GCP), VMWare Learning, IBM Skills and Oracle University's digital cloud learning subscriptions. However, private sector stakeholders reported a limited response from public sector staff to offers of cloud training. A lack of time and resources is one reason, with urgent day-to-day tasks taking precedence over long-term professional development. Strategic or cultural factors are also at play. For instance, training offered by service providers might be seen as a mechanism to lock in organisations.

A common framework that organisations use when shifting to cloud computing is the "6Rs of cloud migration". The 6Rs are Rehost, Replatform, Repurchase, Refactor, Retain and Retire.<sup>62</sup> They refer to the different decisions that need to be made when migrating to cloud. It should be noted that every cloud migration is unique, and so the relevance of each of the 6Rs will vary.

This highlights the importance of making sure that IT and procurement departments have sufficient time (and not just skills and competencies) to plan in advance and implement the transition to cloud effectively.

Establishing a cloud-oriented culture, defining specific policies (e.g. risk assessment) that underpin it, understanding the benefits of cloud, and developing effective procurement processes all require appropriate skills in IT and procurement teams and across adopting organisations more broadly.

Even the best technology risks underdelivering without the right people assigned to its design and deployment. Hence, agencies need to take steps to attract and retain new talent and retrain existing workers.

Cloud adoption requires particular skills and competencies that are different from traditional IT skills needed to implement in-house, on-premises solutions.

For example, advanced network skills are important to design and put in place public and hybrid IT network architectures. These include services such as domain name system (DNS) web services, content delivery network (CDN) and virtual private cloud (VPC) to design cloud networking using public and private subnets, internet access and VPC peering.

62. More can be found about the 6Rs framework here: <https://cloudacademy.com/blog/the-6-rs-of-cloud-migration/>

Moreover, it is fundamental to be able to know when to use different data storage solutions, from simple bucket storage to relational database service (RDS) and full-fledged Hadoop clusters.

### 2.5.2 Examples of success stories

The Digital, Data and Technology Capability Framework<sup>63</sup> developed in the UK as part of the One Government Cloud Strategy provides departments with practical guidance on recruitment and strategic workforce planning by spelling out the skills required to work on cloud adoption programmes at each level in government. More specifically, it describes the job roles in the digital, data and technology (DDaT) profession and details the skills each role demands. It is important to note that this guidance does not focus directly on how to conduct salary/package negotiations.

Similarly, the Secure Cloud Strategy, which was developed in 2017 to help Australian government agencies use cloud services, includes sections on workforce and skills. In particular, it aims to improve government skills and competencies for the cloud by designing training programmes.

Lastly, the Federal Cloud Computing Strategy in the US, commonly referred to as Cloud Smart, includes a pillar aimed at enhancing skills and recruiting key talent for cybersecurity and cloud engineering. Workforce retraining is considered crucial for promoting cloud adoption under the Cloud Smart approach.

The main focus of these three examples is on helping government departments to identify what skills are needed and to provide relevant guidance. Based on the inputs we gathered in our interviews, this support is essential to ensure the right skills are in place.

In this context, we believe that creating a pool of expertise across the public sector that could run central procurement exercises, help deployment in particular organisations and potentially provide training could be an effective accelerator of cloud adoption in the Irish public sector. The pool could include individuals who are paid competitive salaries. They would then be deployed flexibly across the public sector where needs arise and could establish partnerships with existing organisations to fill the skill gaps mentioned above. Examples of successful partnerships of this kind include Accenture at the Department of Health, NearForm at the HSE<sup>64</sup> and Kainos at Tallaght University Hospital (TUH).<sup>65</sup>

63. <https://www.gov.uk/government/collections/digital-data-and-technology-profession-capability-framework>

64. <https://www.nearform.com/work/covid-app-development/>

65. <https://www.kainos.com/insights/success-stories/tallaght-hospital-case-study>

# 03 Benefits of cloud adoption

## Summary of findings

Understanding the benefits of cloud is a prerequisite for building the economic and strategic case for increasing cloud adoption. We have identified four types of potential long-term benefits:

- (a) **increasing the efficiency and effectiveness of public services;**
- (b) **increasing access to public services;**
- (c) **magnifying the economic and social benefits of public services;**  
and
- (d) **reducing carbon emissions** per megabit of data.

Quantifying the impacts of cloud adoption in the public sector is challenging. However, focusing on the increased efficiency and effectiveness of public services, our reading of the economic literature suggests that a 10% increase in the adoption of cloud in the Irish public sector could generate economic benefits in the order of €473 million in the first year alone following adoption.<sup>66</sup> Moreover, existing estimates indicate that cloud adoption can reduce electricity consumption, producing environmental benefits.<sup>67</sup> For example, a recent study of European enterprise data centres by 451 research found an 88% reduction in carbon footprint for workloads that moved from on-premises data centres to AWS.<sup>68</sup>

The logic model in Figure 4 illustrates how the ultimate impacts of cloud adoption would be the result of intermediate short-term and medium-term outcomes. Identifying these intermediate outcomes and the causal pathway to the long-term impacts is useful in planning and monitoring the effects of cloud adoption.

*continued on next page*

66. This estimate relies on the following assumptions:

- 3. Informed by Gal et al. findings, we have assumed a 0.45% gain in productivity associated with a 10% increase in cloud adoption.
- 4. In the economic literature, productivity gains are translated into monetary benefits by multiplying the growth in productivity by firms' sales. Because no such measure exists for the public sector, we have used government spending as a proxy of the public sector's revenue. According to the CSO, the Irish government's expenditure in 2021 amounted to €105 billion.

67. Park, Jiyong and Han, Kunsoo and Lee, Byungtae, Green Cloud? An Empirical Analysis of Cloud Computing and Energy Efficiency (March 28, 2022). Management Science (Forthcoming), Available at SSRN: <https://ssrn.com/abstract=4068114>

68. <https://www.aboutamazon.eu/news/aws/eu-businesses-that-move-to-aws-cloud-can-improve-energy-efficiency-and-reduce-carbon-emissions>

The shorter-term outcomes of cloud adoption include the ability to adopt a multi-channel approach to public services (e.g. users can easily access their medical records through their GP, online or via a mobile application); the ability to scale enhanced digital services quickly, as gov.ie did when traffic increased exponentially during the pandemic; and the opportunity to reduce running costs by up to 55%.<sup>69</sup>

Another benefit is greater flexibility in accessing data. Not only might this occur between departments or organisations (e.g. sharing earnings data between the tax authority and the department for employment and social protection to smooth the payment of benefits), but using the cloud is also an efficient way to allow civil servants to access their work from anywhere. This is particularly important in today's hybrid working world.<sup>70</sup>

Finally, the adoption of cloud can help bolster organisational resilience by means of additional security support, offered through dedicated staff, and infrastructure support. The latter is a particular emphasis of hyperscale providers because of their economies of scale. Furthermore, cloud's back-up capabilities can offer protection against disruption caused by shock events or cybersecurity threats. For example, in a recent cyberattack on the systems of the HSE, the only elements that were not affected were those based on the public cloud.

There may be other spillover benefits of cloud adoption in the public sector, notably stimulating greater private sector interest in cloud or helping SMEs access public sector work. These additional benefits are beyond the scope of this report.

The Irish government has made high-level statements on the importance of cloud for the public sector, but we have not identified any publicly available documents that set out clearly the economic and strategic case for moving to cloud. To help government departments build their economic arguments, this report summarises the benefits of cloud adoption in the logic model in Figure 4.

A logic model provides a visual illustration of the causal pathway of how planned interventions are expected to lead to impacts. Continually referring to the model in the development of a business case will ensure that it contains a logical chain of cause and effect, regardless of whether all the benefits can be quantified. It will help articulate why a particular project is needed and thereby ensure the business case is rooted in the wider rationale for change. It will also help ensure that only benefits that clearly can arise from the investment are considered as part of the case.

We define the components of the logic model as follows:

- **Inputs:** The time and support required to implement cloud in the public sector – See Section 3.1;
- **Outputs:** The observable increase in adoption of cloud services within the public sector;
- **Short-term outcomes:** The benefits that are observed immediately or shortly after the increased adoption of cloud – See Section 3.2;

69. According to Gartner, after a transition period of three years the running cost of cloud versus on-premises data centres will decline by up to 55%. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership).

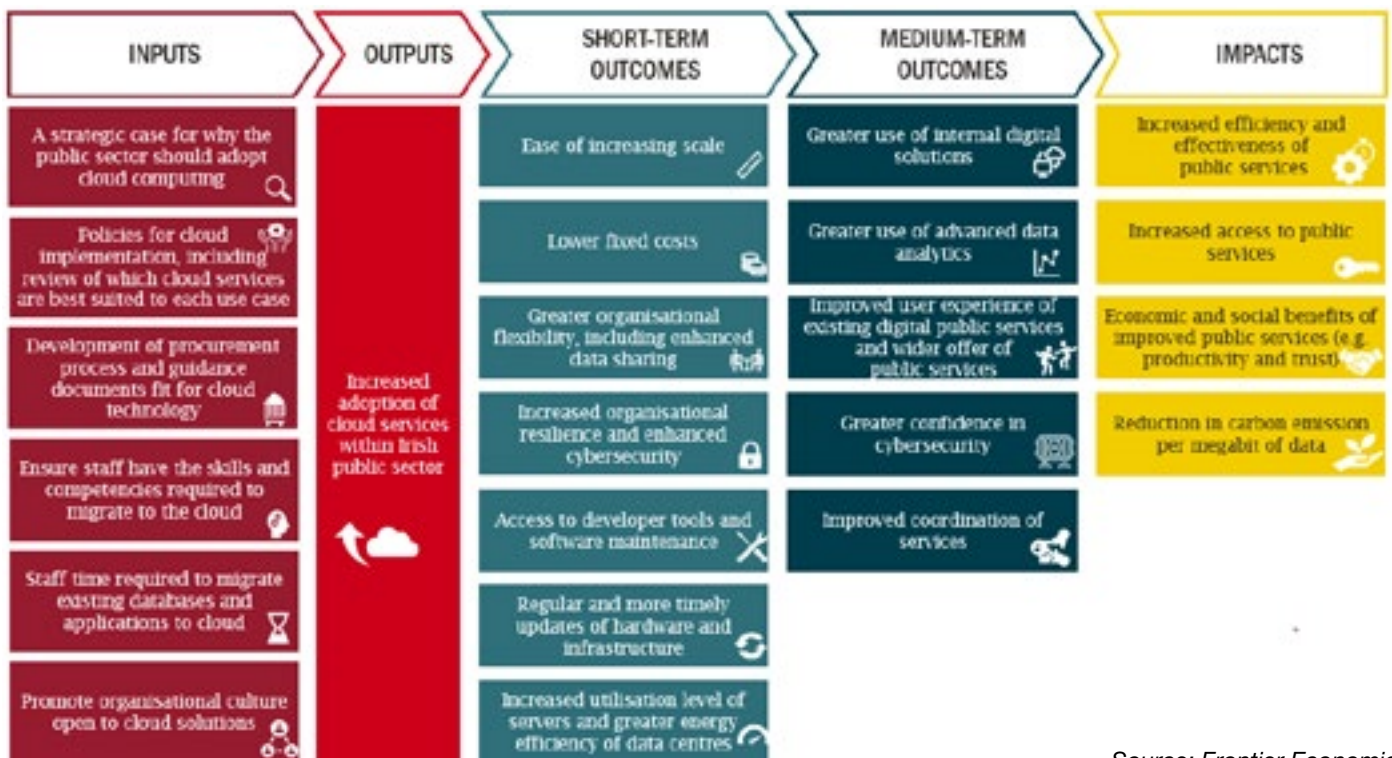
70. The International Labour Organization said that pre-pandemic only 5% of Irish workers were working from home regularly, and it saw considerable benefits in supporting more home working. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership).



- **Medium-term outcomes:** The benefits that start to materialise as a result of the short-term outcomes being realised – See Section 3.3
- **Impacts:** The ultimate objectives of implementing cloud observed at the economy-wide level – See Section 3.4

The benefits of cloud are described in comparison with the status quo, i.e. a counterfactual where the public sector in Ireland will continue to use existing infrastructure and computing approaches for storage, processing capabilities and other functions. As outlined in Section 1.3, this means that – despite some success stories – cloud adoption across the public sector remains immature.

Figure 4: Logic model for cloud adoption



Source: Frontier Economics

There may be other spillover benefits of cloud adoption in the public sector. By serving as a role model or by using cloud to work with suppliers, it might spur the private sector to accelerate the shift to cloud computing. SMEs that use cloud stand in particular to gain. For example, in 2018 SMEs accounted for £602 million of the £1.3 billion that was spent in the UK government’s digital marketplace.<sup>71</sup> Quantifying the spillover benefits is beyond the scope of this report.

71. <https://www.gov.uk/government/news/almost-half-of-government-digital-spend-now-goes-to-smes>



### 3.1 Inputs

The inputs in the logic model can be interpreted as a successful attempt to overcome the barriers described in Section 2.

Firstly, it is important to make a clear **strategic case why the public sector should adopt cloud computing**. This involves setting out, at a high level, what the public sector wants to get from cloud adoption by articulating the expected benefits. The outcomes and impacts in the logic model sketch an outline of the potential benefits, but these should be specified for each use case.

Secondly, a **policy** to implement the adoption of cloud, including in particular a **review of which cloud services are best suited to each use case**, needs to be developed. The different service and deployment models outlined in Section 1.2 clearly have advantages and disadvantages. Once the public sector sets out to increase cloud use it will need to understand the pros and cons in greater detail. Cloud computing is not a one-size-fits-all exercise. This input is linked to overcoming the first two barriers to increased adoption – the lack of appropriate organisational policies and the failure to define a strategic case for making the shift – as it can help cloud adopters define their specific needs and choose the correct model for their use case.

Thirdly, the public sector will also need to **develop procurement processes and guidance documents fit for cloud technology**. As outlined in Section 2.4, all interviewees said that it is often difficult for public bodies to purchase cloud services, due to fragmented and complex processes and lack of clear guidance for both procuring authorities and service providers. Updating these processes and guidance documents along the lines outlined above is needed in order to bring about a step change in the level of cloud adoption. This includes promoting flexible budgeting. Shifting IT spending from the capital budget to the operational budget is not just an accounting adjustment. It marks a change in culture that can help spur the take-up of cloud computing.

Cloud adoption requires **staff to have the necessary skills and competencies**. As outlined in Section 2.5, these are different from traditional IT skills needed to implement in-house, on-premises solutions. For example, advanced networks skills are important to design and install public and hybrid IT network architectures. Securing these competencies in the public sector will call for a combination of training existing staff and hiring individuals with the required skillsets.

The first three inputs discussed above demand a time investment, but **staff time is also required to transfer existing databases and applications to cloud**. Although CSPs seek to make this task as smooth as possible, every cloud migration is unique and so the steps (and time) needed to make sure everything is done efficiently will vary.

The final input required to increase cloud adoption in the public sector is the promotion of an organisational culture that is open to cloud solutions. Section 2.3 outlines some of the initiatives that are required, for example challenging the culture of risk aversion and countering perceptions of risk associated with cloud computing that may no longer be valid .

### 3.2 Short-term outcomes

**Short-term outcomes** are benefits that are observed immediately upon the increased adoption of cloud.

A number of these benefits relate to improving the continuity of services. Firstly, **cloud solutions can be scaled up easier and faster** than traditional IT and server infrastructure. Scaling up services that use traditional infrastructure can be limited by the capacity of existing on-premises servers and the time needed to procure extra ones. And because public sector IT teams have a heavy workload, further delays in setting up the servers are possible. In contrast, cloud providers enable their clients to scale their capacity up and down in real time depending on their needs. This can be done by leveraging the economies of scale associated with centralised hardware to meet peak demand. For example, gov.ie traffic increased exponentially during the pandemic, from 6 million hits to 101 million hits in one year.<sup>72</sup> This surge in demand was met through the cloud. Without it people might have experienced delays in accessing critical information and found it hard to apply for financial support; businesses and households alike could have been at risk of financial distress.

Another outcome which is observed immediately is a **reduction in fixed costs** for public sector organisations and departments. Cloud solutions require lower upfront capital investment than traditional IT and server infrastructure. This provides an opportunity to improve efficiency (i.e. cost per CPU hour and GB memory) and potentially to lower costs over time. For example, by making the transition to cloud King County (Washington State, US) saved about \$1 million in the first year by not having to replace outdated servers. And it projects annual savings of about \$200,000 by reducing operational costs related to data storage.<sup>73</sup> Similarly, Open Assessment Technology (OAT), a leading provider of open-source assessment for schools based in Luxembourg, has been able to control infrastructure costs by exploiting AWS scaling capacity.<sup>74</sup> Moreover, according to Gartner, after a transition period of three years the running cost of cloud versus on-premises computing will fall by up to 55%.<sup>75</sup> Given the flexibility and capabilities of cloud, adoption may lead to greater use of computing resources such as processing power. Therefore, while cloud computing is often a cost-effective solution and the transition can generate significant savings, total spending may rise as a result of increased usage.

Ease of scalability and lower fixed costs are linked to a third type of outcome: greater organisational flexibility as public sector bodies find they can now experiment more easily with new solutions. For example, CSPs enable new applications to be tested on virtual infrastructure. This allows organisations to work on an application and settle on the appropriate size of an accompanying server before going live. And they have the option of scrapping the initiative without the financial costs they would have incurred if they had invested in hardware to test the application and then discovered it was not fit for purpose. There is also greater organisational flexibility when accessing data through the cloud. Data sharing might take several forms: across locations, e.g. hospitals exchanging patient data; across departments, e.g. the tax authority and the department for employment and social protection swapping earnings data to smooth benefit payments; or even between the public sector and private providers, e.g. between utility companies and regulators, or between transport authorities and private transport operators. Moreover, cloud computing is an efficient way to allow civil servants to access their work from anywhere – an important consideration in today's hybrid working world.<sup>76</sup>

72. Our Public Service 2020 report accessible here: <https://assets.gov.ie/132967/3eaa2e62-608e-4cc0-88ee-52e151d67649.pdf>

73. <https://aws.amazon.com/solutions/case-studies/king-county/>

74. [https://aws.amazon.com/solutions/case-studies/open-assessment-technologies-case-study/?did=cr\\_card&trk=cr\\_card](https://aws.amazon.com/solutions/case-studies/open-assessment-technologies-case-study/?did=cr_card&trk=cr_card)

75. Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership

76. The ILO said that pre-pandemic only 5% of Irish workers were working from home regularly. It saw considerable benefits from helping more people to work from home. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership).

Cloud solutions help **increase organisational resilience and enhance cybersecurity** by means of additional security support, provided by dedicated staff, and infrastructure support. This is a particular emphasis of hyperscale providers due to their economies of scale. Furthermore, cloud's back-up capabilities can offer protection against disruption caused by shock events or cybersecurity threats. A review of the ransomware attack on the HSE in May 2021 recommended further investment in cloud technology and specific cloud-based actions to better manage future risks.<sup>77</sup>

In addition, cloud solutions give **access to developer tools and software maintenance**.<sup>78</sup> These pre-built analytical and operational tools and plug-ins enable IT professionals to accelerate the software development and release cycle. Two examples are the continuous integration and delivery (CI/CD) tools offered by AWS<sup>79</sup> and Azure Load Testing<sup>80</sup>. CI/CD tools allow software developers to merge their code in a central repository, where code changes are automatically built, tested and prepared for release. Azure Load Testing enables developers to generate high-scale load simulation to provide useful insights into the potential performance of applications in various scenarios. Given that organisations can choose to multi-cloud rather than rely on a single system to produce public services or internal digital solutions, the library of tools offered by different cloud providers can be most helpful.

In addition, the adoption of cloud enables organisations to sign up with cloud providers for regular and more timely updates of hardware and infrastructure. One interviewee noted that the latest Annapurna Graviton 3 processor, which performs significantly better than its predecessor,<sup>81</sup> is available to AWS cloud customers earlier than comparable processors would be if the hardware were maintained internally.

The final short-term outcome is the increased utilisation levels of servers and the greater energy efficiency of data centres this makes possible. Organisations are able to shift (completely or partially) from in-house server rooms to a centralised infrastructure where servers run at higher utilisation levels and data centres' power and cooling systems are more efficient. This means that for the same unit of work a reduction in energy consumption and carbon emissions can be expected.<sup>82</sup> Existing estimates indicate that cloud adoption can cut electricity use, benefiting the environment.<sup>83</sup> A recent study of European enterprise data centres by 451 research found AWS data centres to be 3.6 times more energy efficient than the traditional alternative; the carbon footprint of workloads that moved from to AWS from on-premises data centres fell by 88%.<sup>84</sup> One Irish public sector interviewee said some public sector servers use more computing power for security purposes than for running the programmes for which they had been installed. Meanwhile, some servers were considerably underused as departments had allocated large budgets to ICT infrastructure but had not conducted a review of how best to use the servers.

77. This included "Identify documents required to respond to a ransomware attack (e.g., network diagrams, asset list) and secure these in a cloud repository" and "accelerate the move to cloud-based email" under recommendation FA1.KR11. Source: <https://www.hse.ie/eng/services/publications/conti-cyber-attack-on-the-hse-full-report.pdf>

78. For example, using Microsoft Azure provides access to over 260 services and tools, including 50 or more directly linked with AI and Big Data. (Source: Microsoft (2020), Ireland 2025: Inclusive Recovery through Digital Leadership).

79. <https://docs.aws.amazon.com/whitepapers/latest/cicd-for-5g-networks-on-aws/cicd-on-aws.html>

80. <https://azure.microsoft.com/en-us/services/load-testing/>

81. According to AWS, Graviton3 processors provide up to 25% better compute performance, up to 2x higher floating-point performance, and up to 2x faster cryptographic workload performance compared to AWS Graviton2 processors

82. S&P Global Market Intelligence, Saving Energy in Europe by Using Amazon Web Services, 2021

83. Park, Jiyong and Han, Kunsoo and Lee, Byungtae, Green Cloud? An Empirical Analysis of Cloud Computing and Energy Efficiency (March 28, 2022). Management Science (Forthcoming), Available at SSRN: <https://ssrn.com/abstract=4068114>

84. <https://www.aboutamazon.eu/news/aws/eu-businesses-that-move-to-aws-cloud-can-improve-energy-efficiency-and-reduce-carbon-emissions>

### 3.3 Medium-term outcomes

**Medium-term outcomes** are benefits that start to materialise once the short-term outcomes have been realised.

Additional cloud adoption can enable **greater use of internal digital solutions**, which help to improve the processes of public sector departments and organisations. For example, cloud-based enterprise resource planning (ERP) offers an extensive suite of applications and functions which can be implemented quickly. These outcomes are possible as a result of:

- The lower fixed costs and increased flexibility offered by cloud allow for easier experimentation with new solutions.
- Access to developer tools such as the AWS Cloud Development Kit lowers the barriers to entry for innovative digital solutions.
- The availability of off-the-shelf cloud-based software, such as task management applications.

Similarly, **greater use of advanced data analytics** is possible thanks to the faster, easier access to computing power. For example, in the UK the National Health Service is using tools offered by cloud providers to extract insights from clinical records saved in digital form on a cloud platform.<sup>85</sup>

Cloud adoption can also result in **improved coordination of services** due to the greater flexibility that cloud computing makes possible, for example by making it easier to share data across different locations, departments and organisations. Furthermore, this flexibility facilitates a multi-channel approach whereby applications on websites and mobiles are all connected and data is shared between them.

We would also expect to see an improved **user experience of existing digital public services and a wider offer of public services**. This is important in order to achieve the objective set out in *Harnessing Digital: Digital Ireland Framework*<sup>86</sup>, seen as Ireland's National Digital Strategy, of delivering 90% of public service digitally. There are four ways in which increased adoption of cloud would help to reach this goal:

1. Greater collaboration and data sharing between organisations (short-term outcome described above) can improve the user experience of public services that require inputs from different public bodies. For example, parents would need to communicate the birth of a child only once through a portal hosted in the cloud. Currently, several public bodies need to be informed.
2. Cloud better enables a multi-channel approach to public services by seamlessly linking the various channels. For example, users can easily access their medical records through their GP, online or via a mobile application.
3. Cloud solutions simplify and accelerate the introduction of new digital services. This is because, as mentioned in Section 3.2, public bodies do not need to worry about procuring and managing the hardware required to deliver the services. A second reason is that cloud providers give access to developer tools that enable IT professionals to speed up the software development and release cycles.
4. Once new or enhanced digital services have been tested, they can be easily scaled up without the need to go through the process of acquiring and setting up additional hardware to satisfy demand.

85. <https://media.nhsbsa.nhs.uk/blogs/how-were-using-technology-to-aid-healthcare-processing>

86. <https://www.gov.ie/en/press-release/3a922-online-launch-of-harnessing-digital-the-digital-ireland-framework/>

Finally, the increased organisational resilience observed in the short term feeds through to **greater confidence in cybersecurity**. Additional data security support provided by cloud platforms (especially hyperscale providers that have thousands of servers and staff, such as AWS, Microsoft Azure, Google GCP, IBM and Oracle) can help reduce the risk of incidents such as data breaches or ransomware attacks. These organisations have significant resources to invest in strengthening their cybersecurity defences. All three of the biggest cloud providers (AWS, Microsoft Azure and Google GCP) have acquired cybersecurity firms over the past year.<sup>87</sup> In addition, the adoption of cloud can improve security practices, for example by enhancing secure login habits. While passwords can form the first line of defence, cloud can help organisations to establish other authentication methods such as multi-factor authentication using mobiles and other devices.<sup>88</sup>

### 3.4 Impacts

Ultimately additional cloud adoption will **increase the efficiency and effectiveness of public services**. It will allow more to be done with the same or fewer resources while also improving service outcomes. Although quantifying this impact is challenging, this report is able to estimate the potential gain in productivity in section 3.5. Similarly, cloud solutions will **boost access to public services** by increasing the number of access channels and/or improving the user experience. Doing so, for example by ensuring greater reliability, can only encourage the greater use of public services.

These impacts will have an indirect effect on productivity and social welfare. They can also help to improve citizens' trust and confidence in the public sector and their willingness to engage with it. In other words, cloud can help **magnify the economic and social benefits of public services**.

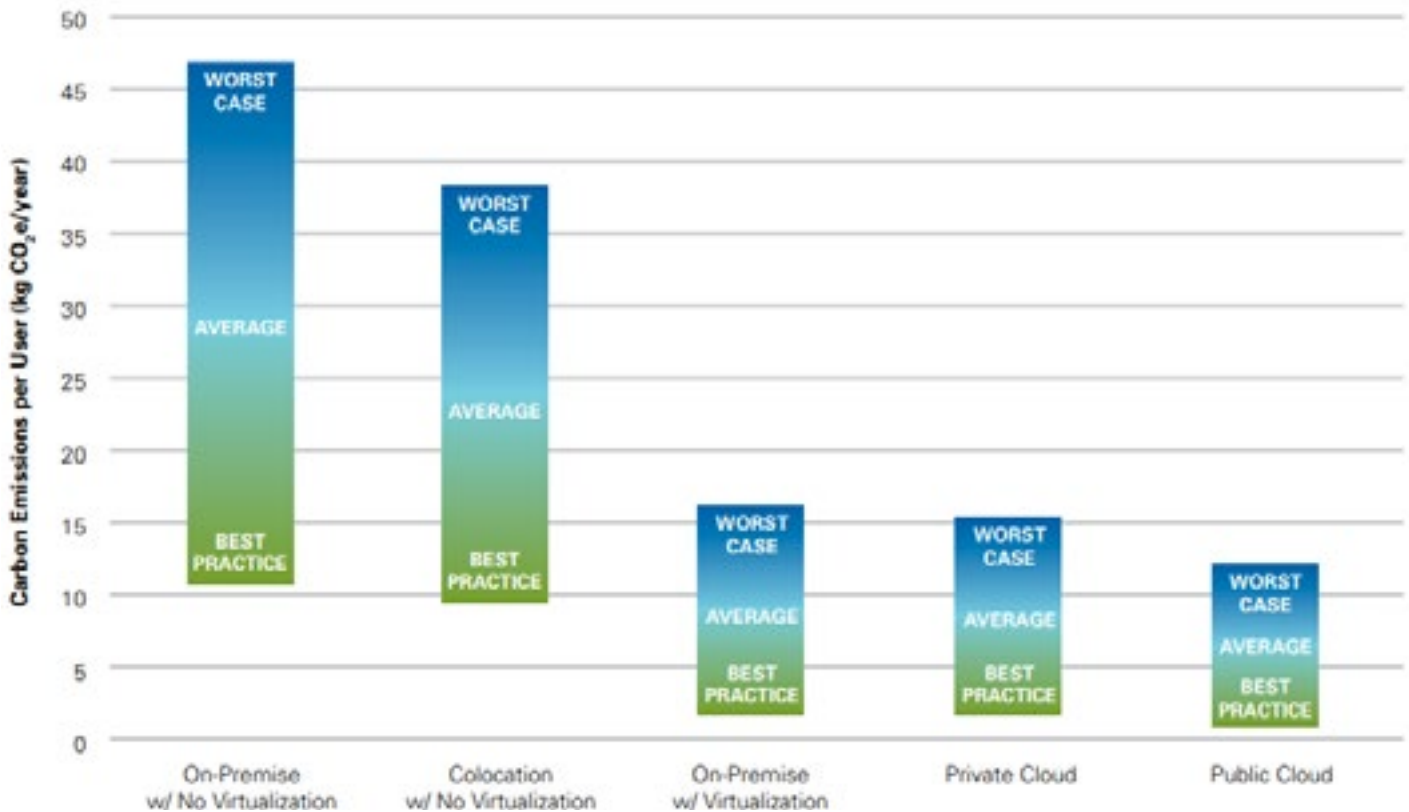
Finally, an improvement in the energy efficiency of hardware and a shift from in-house to centralised infrastructure translate into lower energy consumption. Cloud computing can therefore help the public sector achieve its net-zero goals by **reducing carbon emissions per megabit of data**. One independent study by the Natural Resources Defense Council in the US found that moving server functions to a public cloud can lead to large carbon efficiency gains, as seen in Figure 3. This is due to three factors: (i) increased server utilisation; (ii) the efficiency of the facility housing the servers, including cooling, power distribution and lighting; and (iii) the energy efficiency of the servers, data storage and networking equipment used in the server room and data centre.

“ Cloud computing can therefore help the public sector achieve its net-zero goals by reducing carbon emissions per megabit of data.”

87. Google acquired Mandiant and Siemplify, Microsoft acquired CloudKnox Security and RiskIQ, and AWS acquired Wickr [https://www.cnbc.com/2022/03/29/google-microsoft-ramp-up-cloud-security-as-cyberattacks-increase.html#:~:text=Amazon%20Web%20Services%20\(AWS\)%2C,from%20just%2030%25%20in%202021](https://www.cnbc.com/2022/03/29/google-microsoft-ramp-up-cloud-security-as-cyberattacks-increase.html#:~:text=Amazon%20Web%20Services%20(AWS)%2C,from%20just%2030%25%20in%202021).

88. C. A. Shue and B. Lagesse, “Embracing the cloud for better cyber security,” 2011 IEEE International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops), 2011, pp. 245-250, doi: 10.1109/PERCOMW.2011.5766877

Figure 5: Comparison of carbon efficiency of different server deployment models



Source: NRDC : *Is Cloud Computing Always Greener?*, 2012, <https://www.nrdc.org/sites/default/files/cloud-computing-efficiency-IB.pdf>

### 3.5 Quantifying the impact of cloud

Quantifying the impact of cloud adoption on the efficiency, effectiveness and benefits of public services is harder than it is for the private sector because their value cannot be measured using prices. Even in research into the private sector, assessing the impact of digital technologies is complex, partly because such technologies typically enhance productivity in combination with other factors<sup>89</sup> (Gal et al. 2019<sup>90</sup>). Other technical challenges complicate the analytical identification of productivity effects. For example, a common issue is reverse causality – do digital technologies increase firms’ productivity, or are more productive firms more likely to adopt digital technologies?

Nonetheless, many studies identify a link between the adoption of digital technology and productivity in the private sector. In particular, Gal et al. (2019) show that a 10% increase in the adoption rate of cloud computing is linked with a 0.9%<sup>91</sup> increase in business productivity. If this coefficient is halved, to allow conservatively for the cloud effect to be lower in the private sector,

89. Gal et al, 2019 found that skill and occupational shortages constrain the ability of firms to reap the productivity benefits connected to higher sector-level digital technology adoption rates.

90. Gal, P., et al. (2019), “Digitalisation and productivity: In search of the holy grail – Firm-level empirical evidence from EU countries”, *OECD Economics Department Working Papers*, No. 1533, OECD Publishing, Paris, <https://doi.org/10.1787/5080f4b6-en>.

91. The impact of adopting cloud computing may vary substantially depending on the use cases. For example, when looking at the adoption rate of “complex” cloud computing, Gal et al only find a statistically significant impact of on organisations in sectors with high routine tasks or in manufacturing. We note that the “complex” cloud category as defined by the authors is quite varied. This may explain in part why the coefficient overall is not significant for certain types of firms.



the finding by Gal et al. would suggest that a 10% increase in the adoption of cloud in the Irish public sector could generate benefits in the order of €473 million in the first year alone.<sup>92</sup> This is an indicative figure rather than a robust estimate of the potential benefits. Indeed, our research for this report and the existing literature show that the gains from adopting digital technology can vary substantially. The biggest benefits are realised by businesses that have the relevant skills, as well as the appropriate complementary organisational practices and culture, and are applying digital technology to routine tasks.

“ A 10% increase in the adoption of cloud in the Irish public sector could generate benefits in the order of €473 million in the first year alone.”



92. This estimate relies on the following assumptions:

1. Informed by research on the benefits of cloud in the private sector (Gal et al. 2019) we have assumed a 0.45% increase in productivity associated with a 10% increase in cloud adoption.
2. In the economic literature, productivity gains are translated into associated monetary benefits by multiplying productivity growth by firms' sales. Because no such measure exists for the public sector, we have used government spending as a proxy of the public sector's revenue. According to the [CSO](#), the Irish government's expenditure in 2021 amounted to €105 billion.

Gal et al. (2019) also quantifies the benefits of cloud adoption in the private sector beyond the first year. However, the profile of benefits over time may differ significantly from that of the private sector. Therefore, we take the conservative approach of using evidence on benefits in the first year only.

# 04 Recommendations to increase adoption of cloud

We have identified a number of actions that central government and departments could take to increase cloud adoption in the public sector. These recommendations are linked to overcoming the barriers to cloud adoption.

## 1. Adopt a clear top-down cloud-first policy that moves beyond a high-level vision:

Such a policy will act as a signalling mechanism to both public sector bodies and cloud providers of the intent to adopt cloud. It will outline (i) the strategic case why the transition to cloud is beneficial and (ii) how the transition should happen through a series of policies and procedures. These two fundamental elements should be presented in a revised Cloud First policy document, issued either by the Department of the Public Expenditure and Reform or by the Department of the Taoiseach.

- i. It is important to remember that cloud is not the ultimate goal. Rather it is an instrument for achieving wider aims. A clear identification of the objective that an organisation wants to attain can accelerate the move to cloud and help maximise the benefits of the transition. The government's Cloud Computing Advice<sup>93</sup> note states that "organisations should no longer decide on whether to move to cloud for new or existing systems; the decision to be made now is what, how and when to move to cloud and which particular systems are suitable for cloud". But in order to answer these questions, organisations need to first discuss the "why": what is it that cloud solutions can help to achieve? Central government can take the lead in this task, but each department will need to apply the answers to their own strategic and operational objectives. Our logic model provides an initial way to think about how cloud adoption can contribute to meeting objectives. The government can build on the model. By recognising that cloud is a means to reach other goals, it suggests that the use of cloud as a tool should be embedded in wider digital policies. The UK, for example, has included "use cloud first" in its Technology Code of Practice.<sup>94</sup> The US government's Digital Services Playbook<sup>95</sup> recognises the importance of "allowing the flexibility to purchase cloud computing resources", while Canada's digital playbook is designed to help determine which cloud deployment model is best suited for a given business context.<sup>96</sup>
- ii. Similarly, a clear implementation strategy for cloud adoption is required in order to generate the benefits and solve the problems identified in the strategic case. This strategy can be captured through a series of policies and guidance that address topics such as operational

93. <https://www.gov.ie/en/publication/078d54-cloud-computing-advice-note-october-2019/>

94. <https://www.gov.uk/guidance/the-technology-code-of-practice#use-cloud-first>

95. <https://playbook.cio.gov/>

96. <https://canada-ca.github.io/digital-playbook-guide-numerique/Views-vues/cloud-nuage/en/cloud-decision-tool.html>

aspects of cloud usage (e.g. licence management), services that are suitable for the move to cloud, accounting decisions, security issues and transition timings. The examples from Australia, Canada and the UK discussed in the main body of this report are particularly relevant in this context. Alongside these, establishing systems to monitor and evaluate usage will contribute to the effective adoption of cloud.

### 2. **Engage with senior decision makers when developing the implementation strategy:**

Top-down policy on its own is not sufficient. In order to facilitate widespread adoption of cloud computing it is fundamental to involve, inform and engage senior decision makers, procurement officials and IT staff. Any concerns in relation to costs, security and resources need to be addressed directly to soothe any nerves about cloud adoption. So, for example, developing policies for operating in the public cloud, especially risk-sharing arrangements, should be a common endeavour. This should also form part of the implementation strategy and could be communicated effectively by drawing on success stories such as those of King County<sup>97</sup> in the US (in relation to costs) and the HSE in Ireland (in relation to security).

### 3. **Develop an agile and effective procurement framework fit for cloud services:**

Based on the inputs gathered in our stakeholder engagement exercise, the current procurement environment in Ireland is a major impediment to cloud adoption. To address this problem, lessons should be learnt from other countries that have introduced successful procurement frameworks, thereby smoothing the process of cloud adoption and driving digitalisation of government services. There are a number of steps to this. Firstly, a digital marketplace where standardised cloud services and products can be procured should be launched. Secondly, the risk assessment and audit processes should be designed to reflect the nature of cloud infrastructure. Finally, funding needs to be shifted from capital budgets to operating budgets in sustainable ways in order to promote the optimisation of cloud resources.

“ Organisations should no longer decide on whether to move to cloud for new or existing systems; the decision to be made now is what, how and when to move to cloud and which particular systems are suitable for cloud.”

Government Cloud Computing Advice, October 2019

97. <https://aws.amazon.com/solutions/case-studies/king-county/> See Section 3.2 for more details

**4. Ensure that government departments start to plan migration to the cloud early:**

IT departments and procurement officials need to be given time to plan in advance. They also need guidance on how to effect the transition in terms of workforce and recruitment. The process for implementing a clear top-down cloud-first policy and identifying the objectives that an organisation wants to achieve can start almost immediately. However, there are practical decisions and actions that need to be taken to ensure a smooth migration. Some examples include:

- a Deciding whether the entire application will be migrated at once, or if migration will occur component by component or service by service, and if so in what order.
- b Changing some existing applications and services before they are migrated to ensure they work as effectively and efficiently in the cloud as possible (e.g. by allowing for dynamic scaling).
- c Creating a clear data migration plan. This is particularly important when operating a hybrid cloud model as the location of data can significantly impact the performance of an application.

Moreover, the cultural shift required to underpin the move to cloud will probably take some time. It will not occur overnight .

Finally, many of the benefits of cloud adoption can be realised quickly, including the reduction in fixed costs and the ease and speed with which processing power can be scaled up. But others require complementary changes and investment. For example, cloud can expedite the adoption of advanced data analytics and greater data sharing within and across departments, but these things will not happen without additional input. Therefore, advance planning would help mitigate the risk that the benefits of cloud adoption are held up by the lack of follow-up actions. Steps to be taken might include ensuring the legal arrangements for data sharing across departments are in place and hiring staff with machine learning and data science skills.





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