Clearing the air

Confronting the costs to cloud adopters of restrictive software licensing practices

Jake Shepherd
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SMF Social Market Foundation

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ABOUT THIS REPORT

This report explores the costs of restrictive cloud software licensing practices across business and the public sector. To understand how people are affected by the current licensing system, we present insights from 15 semi-structured interviews with individuals who oversee the use and management of cloud services.

To quantify the costs of the software licensing practices, we also carried out high-level modelling that estimates the productivity costs associated with certain licensing agreements. These costs are provided for both the private sector and the public sector.

EXECUTIVE SUMMARY

This report explores the costs of restrictive software licensing practices on business and in the public sector. It reviews existing literature on the cloud, draws upon interviews with IT professionals who oversee usage of cloud services in their daily roles, and quantifies the potential economic harm resulting from these practices.

What is cloud computing?

- Cloud provides online access to services without the need for specialised hardware or software.
- It offers numerous potential business benefits such as agility, scalability, efficiency, and cost savings – a significant opportunity for public sector productivity.
- It provides different deployment options, including multi-cloud. However, due to licensing practices, users may find themselves restricted in choices between those options.
- Cloud stack layers – IaaS, PaaS, and SaaS – are used for different kinds of services, which can be leveraged by companies for increased market influence.

The cloud sector is growing rapidly

- The worldwide size of the cloud computing sector continues to increase year-on-year. In 2023, its size increased to £469.6 billion.[1]
- Global revenue in the public cloud sector is forecast to increase, reaching almost £1 trillion in 2028.[2]
- Amazon, Microsoft, and Google are the largest cloud service providers and are present through the entire cloud supply chain,[3] making up 65% of the sector globally.[4]

UK cloud spend is also increasing, including in the public sector

- Revenue for the UK public cloud sector was £18.8 billion in 2023, growing by 214% since 2016. This is forecast to continuously increase in the years to come, reaching £26.6 billion in 2028.[5]
- The government's 'G-Cloud' procurement framework mandates that central departments adopt cloud services and encourages them among wider public sector organisations.
    - From 2012/13 to 2023/24, total G-Cloud spend, which includes spending across multiple entities, including charities, was £17.3 billion.[6]

There are concerns that restrictive licensing practices distort competition

- Software licensing refers to the legal rights, restrictions, and terms and conditions of on-premises software, which users might seek to use on cloud infrastructure.

- One issue is the potential accumulation of costs when transitioning to new cloud providers, particularly from legacy on-premises solutions, which can lead to overspending.
- There are concerns around anti-competitive practices in Europe, with legacy software vendors allegedly imposing restrictive terms on users.[7]
- These practices may also affect UK customers. In late 2023, the Competition and Markets Authority launched an investigation into cloud services.[8]

Cloud professionals reveal several software licensing concerns

- Interviews with IT professionals, predominantly from the public sector, unveiled various potential costs and complications associated with software licensing.
  - Some cloud providers are seen as leveraging shares in legacy software to entrench their positions in the cloud sector.
  - Software licensing practices can restrict the freedom of choice of users, and may result in lock-in. This is said to involve tie-in practices, limited integration options, and proprietary features.
  - These practices may lead to additional or inflated costs, including hiked up renewal fees.
- Overall, many said they had encountered or were aware of restrictive software licensing practices, fewer reported outright 'lock-in'.

There may be a significant amount of wasted expenditure on software licensing

- We also quantified the economic harm inflicted by restrictive licensing practices in the UK. We use two Microsoft policies as illustrative examples:
  - Examining the possible cost of restrictions to users' ability to freely use Office 365, we estimate additional public sector harm worth £56.1 million. This figure is less than that of the private sector (£586 million).
  - Concerning the overcharge potential of using SQL Server on third-party infrastructure, our analysis suggests additional costs of £7.8 million. This is also lower than estimates produced for the private sector (£300 million).
- Such wastage may represent indirect opportunity costs. With fewer available resources, such practices risk stifling competition and innovation – preventing the UK from reaching its technological, economic, and security goals.
- Purely for the two illustrative examples we have identified, restrictive licensing practices may incur direct costs to the public sector worth £300 million over the next parliament.
- When considering the costs associated with other alleged harmful commercial practices in the sector, such as those related to Windows Server,[9] the total cost of restrictive licensing practices is likely to be significantly higher.

The wider organisational implications of these practices are significant

- Restrictive software licensing practices can have far-reaching organisational implications. These issues appear to occur across various services and departments, indicating systemic challenges.
- Across an entire organisation, harmful costs can quickly accumulate. This can lead to difficult decisions – such as streamlining staff or software.
- Other consequences include squandered resources and poorer services, as well as the opportunity costs that may arise from lock-in effects, such as slower service modernisation.

There are some potential interventions that could help to mitigate the impact of restrictive licensing practices

- In light of these concerns, we make suggestions for ensuring the cloud sector operates more smoothly, minimising harm to customers and improving efficiency within the public sector.
- To address possible harmful practices, there are principles for fair software licensing in cloud that providers can adhere to, including the freedom to bring previously purchased software to the cloud.[10]
- With specific regard to the public sector, one remedy may be to centralise the procurement of cloud contracts, negotiating terms with software suppliers to help accommodate smaller organisations and circumvent lock-in.

CHAPTER ONE – INTRODUCTION

Software licensing refers to the legal rights, restrictions, and terms and conditions of on-premises software, which users may seek to use on cloud infrastructure. At its core a revenue model, licensing directly influences vendor profit – and customer costs.

A large part of a lucrative cloud services sector, major technology companies are vying for a bigger slice of cloud software revenue. However, potential competition concerns have attracted attention from global competition regulators.

This includes a formal complaint to the European Commission[11] and market investigations by competition and consumer protection authorities in France,[12] The Netherlands,[13] the United States,[14] Japan,[15] and South Africa[16]. In the UK, Ofcom has referred cloud services to the Competition and Markets Authority (CMA),[17] which launched an independent investigation into the domestic cloud sector in October 2023.[18]

In light of these concerns, this report aims to deepen understanding of competition in the UK cloud sector, particularly the impact of restrictive software licensing, which can limit the ability of alternative providers to compete, reduce customer choice, and make switching between different cloud providers difficult.

To bring to life the harms associated with these agreements, highlighting the 'real' costs and inefficiencies they may cause, we present insights from interviews with individuals who oversee the use of cloud services as part of their day-to-day work. We also provide high-level quantitative modelling that estimates the productivity costs associated with certain software, illustrating the potential economic harm posed by restrictive cloud licensing behaviour.

A specific focus of this research is on the public sector. Central government and wider public services organisations, including those in health, policing, and local councils, have invested billions of pounds in cloud services in recent years.[19] In the context of worsening public sector efficiency and ever-tightening budgets,[20] there is an economic and social imperative to ensure taxpayers' money and public resources are not squandered on unnecessary additional costs. Ultimately, we make suggestions for enhancing the supply of cloud software, so as to prevent further wastage in the future.

The structure of this report is as follows:

- **Chapter Two** provides a brief overview of cloud services, including how they work and why they are relevant to the debate around competition.
- **Chapter Three** explores recent trends in the cloud sector, highlighting its rapid growth trajectory and economic significance.
- **Chapter Four** discusses restrictive software licensing practices and their business implications.
- **Chapter Five** weighs up the views of IT professionals, deep diving into the potential consequences of restrictive licensing behaviour in the public sector.

- **Chapter Six** makes suggestions for enhancing the supply of cloud software services and ensuring the market operates more smoothly.

CHAPTER TWO – UNDERSTANDING CLOUD SERVICES

This chapter aims to define cloud computing, providing a brief overview of its characteristics. This not only helps to establish a basic understanding of cloud services and how they work, but it also lays the groundwork for exploring more technical aspects of the cloud competition debate, including the role of software licensing practices.

What is cloud computing?

Cloud computing is a form of internet-based digital technology whereby centralised resources are networked to users on-demand, providing shared online access to services without the need for specialised hardware or software.[21]

Put simply, using cloud services is like renting digital space and tools online instead of owning and managing them on your own computer. A main server manages communication between all renter-end users in order to share data, while keeping information safe and secure.

Box 1: Defining cloud computing

> *"Cloud computing is the use of pooled, centralised computing resources (including data storage and processing) that are provided to users (who may be organisations or individuals) on-demand, often over the internet."* – **Parliamentary Office of Science and Technology**[22]

Today, cloud services are used across all areas of the economy. Businesses adopt it for a wide range of reasons, such as storing data, running software, and making applications. This includes household names like Netflix and YouTube, which rely on cloud computing to provide widely shared content. Dropbox and Google Drive use the cloud for file storage. Social networks such as Facebook and Skype also depend on cloud services.[23]

Beyond the entertainment and software sectors, cloud computing has many other applications. Banks use it to detect fraud.[24] Hospitals use it to create treatments for patients.[25] An explicit interest of this report, governments also draw on cloud services, and actively encourage its adoption within the public sector.[26] In the UK, critical infrastructure such as healthcare, finance, and transport are now reliant on cloud-enabled products.[27]

As well as in workplaces, cloud computing plays a significant role in technological innovation, including the development of artificial intelligence,[28] big data analytics, and Internet of Things services,[29] and it is expected to facilitate the development of these exciting technologies in the years to come.[30]

Across so many sectors and uses, cloud services are now integral to the contemporary information economy, and are interdependent on other industries and infrastructure. For example, data centres are needed to house server systems and backup equipment. Cloud data needs to be connected to the internet, and is

therefore dependent on the connectivity of broadband networks.[31] Meanwhile, businesses themselves rely heavily on cloud services for their day-to-day operations.

Cloud services can offer numerous business benefits, including agility, scalability, efficiency, and cost savings

The cloud offers a broad range of potential benefits, making it a valuable asset for businesses. As we discuss later in this report, these benefits often involve trade-offs and other costs and considerations, particularly with regard to licensing practices. Nevertheless, there are some essential characteristics that set cloud computing apart as a significant technology, particularly when compared with traditional, on-premises infrastructure.

The main advantage is that, instead of firms having to invest in their own IT infrastructure – resources, hardware, software – they can rent a pre-packaged service from the provider. This means businesses can focus on their core tasks without the burden of IT concerns, and can lead to cost savings, reducing upfront investment costs and maintenance expenses, with businesses only paying for the resources they use. Additionally, it provides scalability, allowing firms to adjust resources according to demand. Cloud services also provide inherent accessibility, enabling remote access from anywhere with internet connection.[32]

Taken together, these benefits can enhance productivity and flexibility for greater business efficiency. Evidence highlighted by the British Business Bank has found that nearly half (48%) of businesses using cloud services reported increase efficiency.[33] Furthermore, cloud adoption may even contribute to sustainability efforts, as reduced hardware usage can lower electricity consumption. Table 1 below displays a more detailed list of cloud business benefits.[34]

Table 1: Potential benefits of adopting cloud computing

	Summary
Cost savings	Cloud services operate on a pay-as-you go basis, significantly reducing costs compared to installing and operating infrastructure independently.
Scalability	Cloud providers offer scalable resources that can be adjusted on demand, eliminating the need for the setup of new equipment. Firms face no risk of under- or over-utilised computing capacity when demand fluctuates.
Accessibility	Businesses can access cloud services from anywhere, facilitating seamless collaboration among employees regardless of their location. Built-in backup capabilities also ensure reliability.
Efficiency	Cloud usage streamlines management tasks, saving time and money. Reduced need for IT personnel in maintenance tasks allows resources to be redirected to core business activities. Centralised data access further improves efficiency.
Innovation	Cloud computing accelerates app and service deployment, allowing businesses to innovate products rapidly and respond to customer needs. It may also free financial resources for innovation initiatives.
Sustainability	Though they can require huge amounts of energy, cloud services often consume less energy than independently operated IT systems. Many organisations now invest in powering the cloud with renewable energy.
Data security	While some security risks exist, data stored in large, well-invested data centers often ensures stronger expertise and security than firm-owned systems, and are less likely to be affected by business disasters such as fires. There have been very few reports of cloud security failures.

Source: SMF analysis of multiple sources

There are various ways of providing cloud services, with distinct implications for service delivery and competition

The cloud service that a business chooses depends on its specific requirements. These delivery models are comprised of different types of infrastructure, each with their advantages and disadvantages. While it is not within the scope of this report to unpack cloud computing in all of its technical complexity, it is important to provide an overview of its key concepts.

Cloud computing offers different deployment options, yet users may find themselves restricted to a single model

A cloud deployment model is defined according to where the infrastructure for the deployment resides and who has control over that infrastructure.[35] There are generally three main types of cloud deployment:

- **A public cloud** is run by a third-party company that owns and manages all hardware and software, and is open to all customers. Public cloud is the most popular deployment option, accounting for 48% of UK spending.[36]
- **A private cloud** is built, managed, and owned by just one organisation. It is located in their own data centres, giving them more control and security, though it tends to be more resource-consuming. Private clouds make up 22% of UK cloud spending.[37]
- **A hybrid cloud** is a mix of public and private clouds, where some data can be stored in the public cloud for easy access and other data can be placed in the private cloud for added security. Hybrid clouds make up 30% of UK cloud spending.[38]
- **Multi-cloud** is a combination of some or all of the above models, whereby users take multiple public or private clouds from different providers. Multi-cloud is used to optimise each service for a specific task, or it is chosen to prevent dependency on a single provider. 75% of large UK organisations say they use more than one cloud service, suggesting a general preference for multi-cloud.[39]

Multi-cloud is an important concept in this research precisely because of this flexibility. Fundamentally, multi-cloud is a strategy against provider lock-in, yet due to technical barriers and the licensing practices of some legacy software vendors, some users are restricted to a single deployment model, making it difficult or costly to choose alternatives. We discuss these restrictions in greater detail throughout this report.

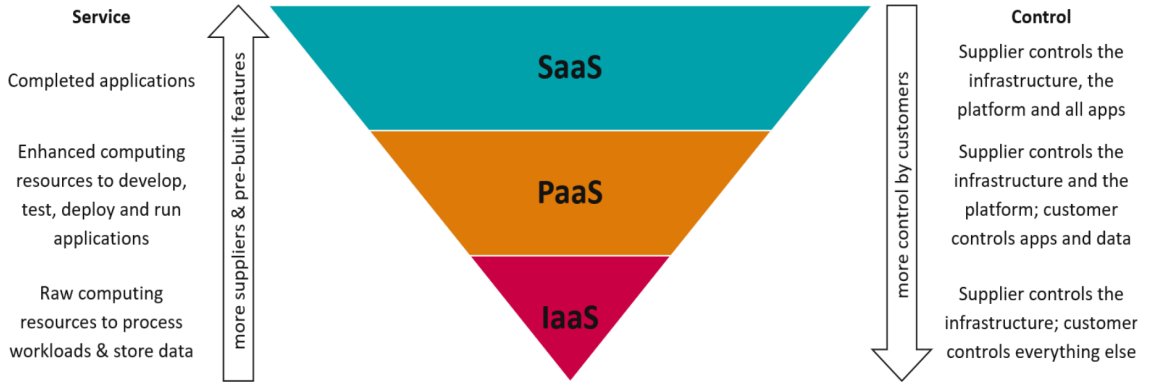
Cloud stack layers are used for different kinds of services, which can be leveraged for increased influence in the sector

There are also different kinds of cloud service models, each constituting a different part of the cloud computing stack. These models are not mutually exclusive. As mentioned above, organisations tend to use more than one cloud approach depending on their size and business requirements. There are three main types of cloud service offerings:

- **Infrastructure as a Service (IaaS)** offers end-users with access to remote computing infrastructure, such as operating systems, applications, data storage, servers, and networks. IaaS is advantageous for organisations with strong IT capabilities that want straightforward access to powerful computing resources. Airbnb is built on IaaS from Amazon, for example. IaaS makes up 28% of UK spending.[40]
- **Platform as a Service (PaaS)** provides users with the tools and resources they need to allow them to develop and deploy their own software applications, without worrying about the underlying infrastructure. Everything is set up to help developers focus solely on building apps, creating new features, and scaling their platforms. PaaS makes up 9% of UK spending.[41]
- **Software as a Service (SaaS)** gives users access to fully functional applications over the internet, allowing them to perform specific tasks without having to install or manage anything. One example is productivity software like Microsoft Office and Google Workspace, which delivers email, storage, word

processors, and spreadsheets all through SaaS. SaaS accounts for the majority (63%) of UK spending.[42]

Diagram 1: The cloud computing stack



Source: Ofcom

Understanding the cloud computing stack is useful for addressing concerns related to anti-competitive practices. As we highlight in Chapter Four, some IaaS and PaaS infrastructure services are mostly provided by a relatively small number of market participants, which has led to interest in the policy implications including resilience and potential barriers to competition.[43]

As well as accounting for the majority of public cloud infrastructure, these companies also provide a range of SaaS services alongside a diverse range of other providers.[44] We do not wish to get bogged down in the mechanical distinctions between cloud services, but it is important to acknowledge that these layers involve different dynamics and issues, impacting costs, adoption, and fair competition.

CHAPTER THREE – GROWTH AND COMPETITION IN THE CLOUD SECTOR

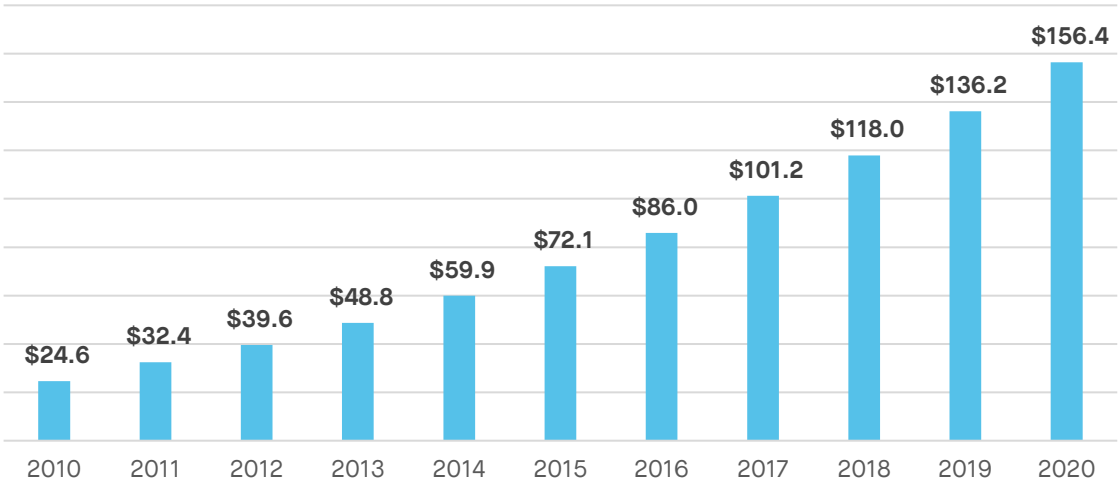
Cloud computing and the benefits it provides to businesses has made it a critical technology in today's economy. As a result, the global cloud sector is quickly maturing, making it a lucrative stream of revenue for suppliers. In this chapter, we offer a brief overview of the cloud sector's growth, highlighting its economic significance.

The cloud computing sector is growing rapidly

Cloud is now integral to organisations' IT infrastructure and the way digital services are delivered to consumers.[45] As such, the worldwide size of the cloud computing sector continues to increase year-on-year, growing 536% from a value of $24.6 billion (£19.6 billion) in 2010 to $156.4 billion (£124.2 billion) in 2020.[46] In 2023, the cloud computing sector's worth reached $589.6 billion (£469.6 billion).[47]

Similarly, the European cloud sector has more than quadrupled in size in recent years, growing from $19.9 billion (£15.9 billion) in 2016 to $90.3 billion (£72.0 billion) in 2022.[48] Driven by increasing digital transformation and the need for better business efficiency, this international growth has also been accelerated, in part, by the COVID-19 pandemic and the business transition to remote working.[49]

Figure 1: Size of the worldwide cloud computing and hosting sector, $bn



Source: Statista

The largest segment of the worldwide cloud computing sector is software applications.[50] In 2023, the SaaS sector was estimated to be worth around $197 billion (£157.5 billion) and is expected to undergo continued growth, reaching $232 billion (£185.5 billion) by 2024.[51]

According to Gartner, worldwide end-user expenditure on public cloud services was $563 billion (£44.8 billion) in 2023. Of this spend, 36% ($205 billion) was for cloud application services; more than IaaS ($144 billion) and PaaS ($145 billion). Total end-

user spending is expected to grow by 20.4% to $679.8 billion (£541.4 billion) in 2024.[52]

Table 2: Worldwide public cloud services end-user spending forecast

	2022	2023	2024
Cloud system infrastructure services (IaaS)	$120.3 billion	$143.9 billion	$182.2 billion
Cloud application infrastructure services (PaaS)	$119.6 billion	$145.3 billion	$176.5 billion
Cloud application services (SaaS)	$174.4 billion	$205.2 billion	$244.0 billion
Cloud business process services (BPaaS)	$61.6 billion	$66.3 billion	$72.9 billion
Cloud desktop as a service (DaaS)	$120.3 billion	$143.9 billion	$182.2 billion
Total spend	**$478.3 billion**	**$563.6 billion**	**$678.8 billion**

Source: Gartner

The cloud sector is set to expand. Global revenue in the public cloud sector, not including private cloud services, is forecast to increase, reaching up to $1.2 trillion in 2028,[53] and European spending is expected to reach $187.2 billion (£149.3 billion) by 2027.[54] With this projected growth trajectory suggesting strong demand for cloud services in the future, the ground seems fertile for increasing competition in the years to come.

As we have discussed, cloud services are layered with a range of other technologies, creating value across hardware, software, and AI. Put forward by *The Economist*, cloud is now crucial to tech companies' profits, and all parts of the stack are "responsible for its computing oomph".[55] With so much revenue – or 'cloud capital'[56] – at stake, the world's biggest technology companies are vying to attract new cloud customers.

Indeed, multinational corporations such as Amazon, Microsoft, and Google – collectively known as 'hyperscalers' – are present through the entire cloud supply chain and offer a wide range of services across the stack,[57] making up 65% of the global cloud sector overall.[58]

In particular, IaaS and PaaS is led by Amazon Web Services and Microsoft Azure, while SaaS is mostly held by Microsoft and Salesforce.[59] These hyperscalers continue

to increase their investment into the cloud,[60] which has led to regulator interest in the role of large providers operating in the UK (see Chapter Four).

Figure 2: Annual revenue of large cloud services providers, 2022, $bn

Source: Statista

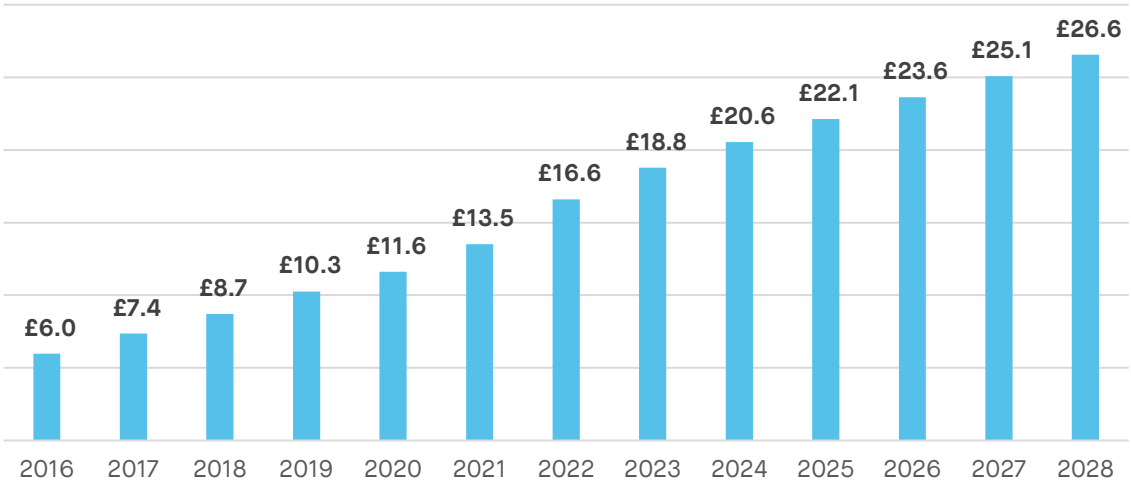
The UK cloud sector is also expanding, including in the public sector

Cloud computing has become widely adopted among UK businesses. From social media to streaming, communications to healthcare, it is essential to delivering digital services to consumers.[61] In 2020 cloud computing was used by 75% of the population, increasing from 54% in 2015.[62]

Reflecting this upward trend in adoption is burgeoning revenue. According to data provided by Statista, takings for the UK public cloud sector was £18.8 billion in 2023, growing by 214% since 2016. This is forecast to continuously increase in the years to come, eventually reaching £26.6 billion in 2028, with a compound annual growth rate of 7%.[63]

Displayed in Figure 3 below, SaaS an important segment and in 2023 was worth £9.6 billion, more than IaaS (£2.3 billion) and PaaS (£3.3 billion) combined.[64] Ofcom has offered slightly higher estimates for cloud infrastructure services, suggesting revenues of £7 billion to £7.5 billion.[65]

Figure 3: Public cloud revenue in the UK, £bn

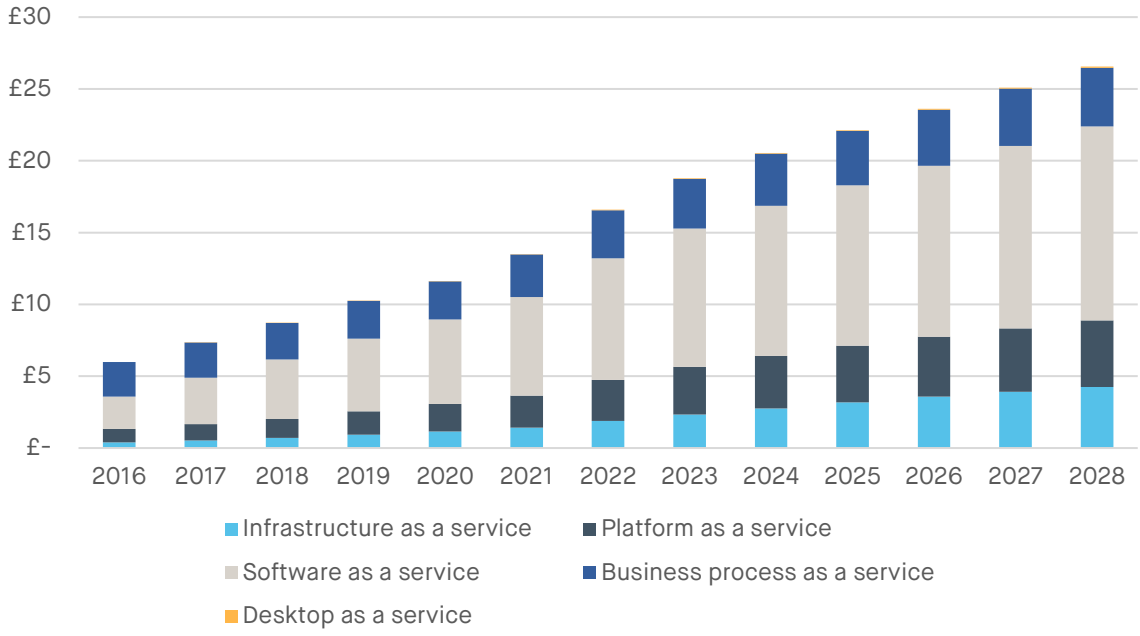


Source: Statista

Amazon and Microsoft are the two leading providers of cloud infrastructure services in the UK, with a combined share of 70% to 80% of IaaS and PaaS revenues in 2022.[66] These providers have also partnered with other prominent businesses, with customers that include BP, HSBC, and the UK Government.[67]

Compared to IaaS and PaaS, the SaaS segment has a more diverse range of suppliers and is not characterised by the same level of concentration. In 2022, the three hyperscalers' share of SaaS application was around 18%, most of which were services provided by Microsoft.[68] The UK is considered a global leader in the use of Microsoft software, holding 9% of all customers for Office 365[69] and 7% for SQL Server.[70]

Figure 4: Public cloud revenue in the UK by cloud delivery type, £bn



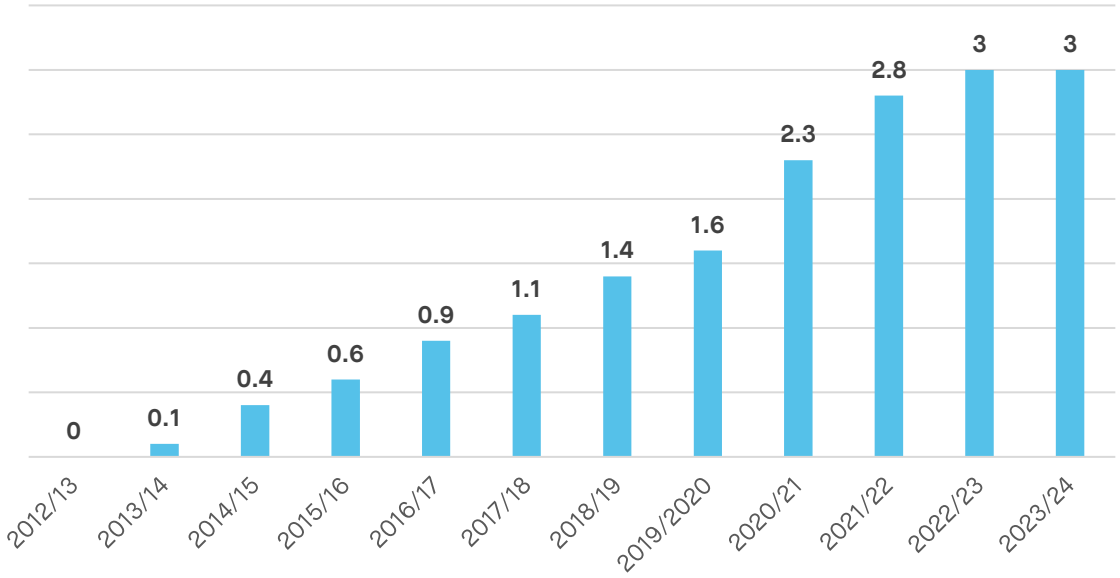
Source: Statista

A specific focus of this report is the public sector. Analysis by Deloitte highlights that governments' adoption of the cloud is accelerating, with countries shifting to a 'cloud first' approach to improve public services.[71] Due to the potential business benefits outlined above, integration with the cloud represents a significant opportunity for improved efficiency and spending within the public sector, especially in the context of restrained budgets.[72]

Indeed, the UK government's G-Cloud (government cloud) procurement policy framework, introduced in 2013, mandates that central government departments adopt cloud services over those deployed on-premises, helping them to buy IaaS, PaaS, or SaaS services from government-affiliated suppliers, and is encouraged among wider public sector organisations.[73]

This approach made the UK government an early adopter of cloud.[74] Between 2010 and 2015, the proportion of the UK public sector that had formally adopted at least one cloud service more than doubled from 38% to 78%.[75] From the beginning of 2016 (£340.1 million) to the end of 2021 (£1.3 billion), public sector organisations were awarded around £4.4 billion of cloud services contracts, while the contract volume increased from 299 to 1,300.[76] From 2012/13 to 2023/24, total G-Cloud spend across multiple entities, including charities, was £17.3 billion.[77]

Figure 5: G-Cloud spend, £bn



Source: Crown Commercial Service

Public sector organisations represent a considerable stream of revenue for cloud providers. In central government, departments have invested billions in cloud services, while important public services, including health, policing, and local councils, have investment millions (Table 3).[78] [79]

For this reason, there are some concerns that the anti-competitive practices of certain legacy software vendors in the wider market may extend into the public sector, leading to potential repercussions on resilience and productivity. We discuss these concerns in the following chapter.[80]

Table 3: Top G-Cloud spenders, 2012/13 to 2023/24

Organisation	Evidenced spend
Central government	
Home Office	£1.9 billion
Department for Work and Pensions	£1.2 billion
HM Revenue & Customs	£1.0 billion
Ministry of Justice	£965 million
Cabinet Office	£440 million
Department of Health and Social Care	£360 million
NHS Digital	£340 million
Defence Digital	£320 million
Student Loans Company	£300 million
National Highways	£290 million
Wider public sector	
Transport for London	£84 million
Manchester University Hospitals NHS Foundation Trust	£82 million
Barts Health NHS Trust	£80 million
NHS Arden and Greater East Midlands Commissioning Support Unit	£55 million
Mayors Office for Policing and Crime	£48 million
Metropolitan Police Service	£42 million
Bristol City Council	£36 million
Leeds Teaching Hospitals NHS Trust	£32 million
Thames Valley Police	£31 million
Kent County Council	£30 million

Source: Crown Commercial Service. Data accessed 13 May 2024

CHAPTER FOUR – RESTRICTIVE SOFTWARE LICENSING AND ITS BUSINESS IMPLICATIONS

Restrictive software licensing refers to the legal rights, restrictions, and terms and conditions of on-premises productivity software delivered over the internet (an SaaS model of deployment). These licensing agreements are used to manage user privileges, safeguard against piracy and hacking, and implement monetisation models. Essentially, a software license establishes the rules of using software over the internet.[81]

Software installed on computers using the cloud has revolutionised how products are accessed. One of the main advantages of shifting from traditional licenses, such as disks or downloads, is its convenience. It allows vendors to develop new software easily and quickly, while customers have immediate access to the latest versions of products, for example Microsoft Office 365 or Adobe Creative Suite.[82]

Many technology companies now have their own software licensing models for the use of cloud products.[83] This works well for fully integrated cloud services, but as we demonstrate it can present challenges when wanting to move systems or components, as licenses may be tied to a single provider.[84]

Software licensing, at its core a revenue model, directly influences vendor profit – and customer costs – and tends to be term-based or subscription-based.[85] As highlighted by prominent industry bodies and regulators, restrictive licensing agreements can significantly impact the total cost of using cloud services.[86]

There are concerns that restrictive licensing practices distort competition. As we have discussed, a small group of legacy software vendors are shutting out competing vendors by enforcing unfair and restrictive licensing terms on end-users, limiting the ability of other providers to compete.[87]

Anti-competitive licensing practices have been raised by association bodies across Europe, including a formal complaint to the European Commission by Cloud Infrastructure Service Providers in Europe (CISPE).[88] This followed separate complaints made by various industry groups, including from Italy[89] and Denmark,[90] with competition and consumer protection authorities in France,[91] The Netherlands,[92] the United States,[93] and Japan[94] also conducting studies into trade practices in their respective cloud sectors.

Though not the only cause of concern, Microsoft shoulders the bulk of these allegations. It supposedly imposes higher costs of acquiring and running Microsoft software in rival systems other than Azure (its cloud platform), with three licensing policies, Microsoft Office 365, Windows Server, and SQL Server, raising concerns about surcharges.[95]

As a legacy provider with key legacy software products, Microsoft is believed to substantially undermine competition and limit consumer choice in the cloud services sector by the foreclosure of alternatives.[i] [96]

In response to these accusations, the European Commission also opened a formal investigation into whether Microsoft has violated EU competition regulations in July 2023, citing unease around its "well-entrenched" productivity suites for business customers. The Commission has expressed concern that Microsoft "may be abusing and defending its market position in productivity software by restricting competition", limiting interoperability between its suites and rival products.[97] The investigation is ongoing.

Research suggests the costs of restrictive licensing practices are significant

A notable contribution to the cloud anti-competition debate comes from a study published in June 2023 by CISPE, led by Frédéric Jenny, Emeritus Professor of Economics at ESSEC Paris Business.[98]

In light of the above concerns, the research aimed to show that the behaviour of certain legacy software providers can directly harm cloud customers. In particular, it provides a quantitative evaluation of the economic harm incurred by European firms, indicating substantial financial costs.[99]

Using Microsoft's 'Bring Your Own License' (BYOL) policy, which terminated end users' ability to deploy on-premise Office 365 licenses on third-party infrastructure of their choice in 2019, as an "instructive example", the CISPE study found the policy change may have caused first-year repurchase costs of around €560 million (£480 million) for the European market.[ii] Compared with Microsoft's European overall Office 365 revenues in 2019 – €4 billion (£3.4 billion), half of which was accrued to Office 365 – this suggests a surcharge of around 28%.[100]

An additional overcharge of €1 billion (£858 million) linked to licensing charges imposed on non-Azure deployments of SQL Server may also be attributed to the policy change. The study also highlighted potential indirect costs related to missed opportunities for alternative solutions, such as financial savings from freely deciding between cloud providers.[iii] [101]

These practices have been identified as treating customers who cannot or choose not to select Microsoft over other infrastructure providers unfairly. However, it is crucial to note that these two examples represent a part of a wider set of harmful

[i] Another issue that has been raised, though it does not relate to restrictive software licensing directly, is the bundling and tying of services, whereby individual products, such as Microsoft Teams, are tied to wider offerings within Office 365, provided at minimal cost and installed automatically, preventing the purchase of alternatives.

[ii] This is a baseline estimate, based on conservative assumptions. The figure applies to companies that rescheduled their license repurchase to at least a year earlier than their original plans, incurring at least one year of extra costs. Some companies may have born extra costs for longer.

[iii] Also a baseline estimate.

commercial policies implemented by vendors.[102] As such, the actual costs resulting from such practices is likely to exceed what has been outlined by CISPE. It is also important to acknowledge that while Microsoft stands out as the most prominent accused provider, it is not the sole perpetrator of this behaviour.

Providers operating in the UK are currently under investigation

Concerns around competition in the cloud services sector are not just a European issue. There are also concerns in the UK.

While the state of the sector is healthy overall, with 71% of businesses saying they use more than one service provider according to Public First survey data,[iv] [103] the market may not be working as well as it could, particularly with regard to barriers to switching and multi-cloud – a significant minority (26%) said they would find it difficult to switch provider for productivity software.[104]

Because cloud computing is now so important to the economy – and increasingly so – if the markets fail to function optimally, businesses that rely on those services may experience negative consequences such as increased prices and poorer service quality. As demonstrated by CISPE's study of the European market, these costs could trickle down to British consumers.

In this context, the communications regulator, Ofcom, has conducted a market study into the supply of cloud infrastructure services (IaaS and PaaS) in the UK to assess whether the market is working effectively – and to determine whether regulatory action is necessary. The research involved 50 one-hour discussions and over 1,000 survey interviews with UK businesses that use cloud services.[105]

In its final report, published October 2023, Ofcom argued that competition is being limited by certain market features, making it more difficult for customers to use more than one cloud provider. Specifically, those features include:[106]

- **Egress fees**, additional charges that customers pay in order to transfer their data into a different cloud, which can make switching more costly and dissuade customers from using more than provider.
- **Technical barriers,** resulting in customers having to put additional time and effort into making their data and applications work across different cloud systems.
- **Spend discounts,** which, although they can provide some benefits to customers, may be structured to incentivise customers to use a single cloud provider.

It is under debate whether these behaviours reflect anti-competitive behaviours or natural outcomes in a capital-intensive but broadly competitive market.[107] To the extent to which there are problems, whether relating to restrictive software licensing or other issues, customers have expressed concern to Ofcom about being locked into a single cloud provider – a worry that, unless changes are made to how companies

[iv] Public First's fieldwork ran from 25 May to 1 June 2023 and reached a sample of 1001 UK senior business decision makers with an online survey.

run their operations, is likely to grow as the sector matures. When enough customers feel they lack viable alternatives, providers might decide to raise prices or offer diminished services, knowing that they face little risk of losing business.

Ofcom have also surveyed European organisations to get their views on the matter. Azure was widely perceived as the default option for cloud services due to its integration with legacy Microsoft software. These customers characterised Microsoft as being "deceptively expensive" and "inflexible", and it was criticised for making customers "pay for products they do not need" by way of its "tie-in mentality".[108]

Microsoft has strong IaaS and PaaS capabilities, but it also offers a wide range of SaaS services, such as Office 365. Its position in the SaaS sector therefore makes Azure an appealing cloud choice for enterprises that have already invested in Microsoft products. Estimates suggest Microsoft has a share of 70% to 80% in desktop operating systems,[109] granting it significant potential leverage in cloud and other adjacent sectors.

Overall, Ofcom argues that if customers continue to have difficulties switching to and using multiple providers, competitors will find it even more difficult to challenge the likes of Microsoft for customers. This could lead to long-term impacts, with market leaders entrenching their positions and further avoiding competition over time.[110] It claims the public sector is also affected by these challenges, a primary factor is the UK government's commitment to major market players, which builds a commercial barrier for public sector bodies seeking to use multiple cloud providers.[111]

Due to these concerns, Ofcom has referred cloud infrastructure services to the Competition and Markets Authority to carry out an independent investigation.[112] Ofcom found competition, particularly for new business, and cloud services are clearly innovating in terms of their offer to customers (integrating new services such as AI) but it also defined a number of potential barriers to competition. The probe was launched in October 2023, with the CMA confirming it would assess whether there are competition concerns (theories of harm based on Ofcom's research thus far) and, if so, what interventions can enhance the supply of services for customers.[113]

In June 2024, the CMA published its first working paper, one part of a series of consultative interim reports for its cloud services market investigation. While the full assessment is pending, its emerging view is "based on the evidence we have seen to date, licensing terms may have an impact on customers' choice of cloud provider". It goes on to say that:[114]

> *"Our customer evidence indicates that the cost or ease and/or ability to use Microsoft software licenses are either a key or a plus selection factor for many customers, and some particularly consider the ability to make use of their existing investment in licenses in their decision. These customers are therefore more likely to choose Azure for running at least their Microsoft workloads, and possibly more widely."* – **Competition and Markets Authority, June 2024**

The same working paper also considered some of the specific concerns raised with Microsoft, particularly regarding legacy software use. It argues that pre-existing use of Microsoft software, were "very important" for many Azure customers." It also notes that "even for customers that would have chosen Azure due to their pre-existing use of Microsoft regardless of licensing terms, the licensing terms may still influence future decision making and therefore potentially harm competition". For Azure customers considering switching, licensing terms could present further obstacles, the CMA says.[115]

> *"The evidence also shows that pre-existing use of Microsoft software, and the associated skills developed, were very important selection factors for many Azure customers. Nevertheless, even many of these customers indicated that licensing terms were also a consideration in their decision-making process."*
>
> *"Further, we note that even for customers that would have chosen Azure due to their pre-existing use of Microsoft regardless of licensing terms, the licensing terms may still influence future decision making and therefore potentially harm competition. In particular, for Azure customers considering switching, licensing terms may result in an additional friction to doing so."* – **Competition and Markets Authority, June 2024**

Restrictive cloud software licensing practices may be costing UK businesses millions of pounds in additional costs

In its response to the CMA issues statement,[116] Microsoft argued that restrictive software licensing "risks being a distraction from the broader industry-wide issues the CMA is considering".[117] That objection does not provide a technical justification for restrictive software licensing and begs the question of whether we can identify quantitative costs to the UK. It also raises whether the issue appears material from the perspective of public sector leaders and others making practical decisions.

Replicating CISPE's analysis of the economic consequences of unfair cloud software licensing for European firms, the SMF estimated the costs of such behaviour within the UK private sector.[118] This exercise followed the same basic approach and calculations of CISPE, the primary change involving the use of UK-specific data and proxies. For a detailed breakdown of the methodology used, including limitations and caveats, please refer to the appendices.

Like CISPE, we used Microsoft's Bring Your Own License policy as an illustrative example of the potential costs of such practices for users. We found that the policy change, which ended customers' ability to use on-premises Office 365 licenses on non-Microsoft infrastructure, may have resulted in first-year repurchase costs totalling a baseline of £586 million for UK businesses.

Table 4: Estimated costs of private sector firms deploying Office 365 on non-Microsoft IaaS that repurchased at least one year ahead of time

	Estimate
Total volume of licenses affected	2,779,135
Harm per repurchased license	£211
Total harm from repurchasing Office licenses	**£586,366,400**

Source: SMF analysis of multiple sources. See Appendix B for details

We also estimated the additional costs suffered by companies that shift from on-premises to non-Azure deployments of the database software, SQL Server. Updating CISPE's methodology with UK data, we found the total overcharge may amount to £300 million for private sector firms. We compare these findings with public sector estimates (refer to Table 6 and Table 7) in Chapter Five.

Table 5: Estimated overcharge of private sector firms using SQL Server on non-Microsoft IaaS

	Estimate
Total number of cores affected	74,116
Overcharge per core	£4,043
Total harm from repurchasing Office licenses	**£299,657,400**

Source: SMF analysis of multiple sources. See Appendix B for details

CHAPTER FIVE – CONFRONTING THE PUBLIC SECTOR COSTS

We have already highlighted some of the implications of restrictive licensing practices for businesses, including harmful economic costs. In this chapter, we take a deep dive into those consequences, weighing up the views and experiences of IT professionals who both use and oversee the management of cloud products as part of their day-to-day work.

To understand how people are affected by current licensing practices, we present insights from 15 semi-structured interviews with individuals who oversee the use of cloud services. While the majority of participants are IT professionals that manage cloud within public services and non-profit entities (which share similarities in many aspects), including those from central government, local government, and charities, we also engaged with private sector professionals. Additionally, senior cloud experts were consulted to provide a more strategic view of the impact of cloud licensing on the economy. All interviews took place during March and April 2024.

IT professionals revealed several restrictive software licensing concerns

Those interviewed for this research unveiled several costs, tensions, and complications associated with restrictive licensing practices. For some participants, such practices represent a significant problem that leads to additional financial costs, reduced service capabilities, and worse user experience. For others, they can entail smaller inefficiencies and inconveniences. There were some interviewees that expressed no qualms with regard to the terms of their licensing agreements, and are generally happy with the services they receive.

Overall, while unfair software licensing did not emerge as an all-pervasive issue that affects all organisations we spoke with, the key finding from the qualitative research is that such practices do exist – and can result in significant harm.

Participants believe legacy software providers exploit their position in on-premises productivity software

IT personnel spoke of several challenges relating to legacy software and how it is licensed, which might restrict users' ability to use and move between cloud providers as they would like. For instance, as the default supplier for productivity software such as Office 356, some participants felt that Microsoft in particular has a distinct competitive advantage. The vast majority of the IT professionals we interviewed said they use Microsoft software packages as part of their cloud systems.

> *"Microsoft Office is a major requirement for any office, right? So they've got a monopoly."* – **Naveen, IT architect consultant, central government**[v]

> *"We don't have an alternative. The big players monopolise the industry."* – **Kerry, IT project manager, government agency**

[v] The names provided are not participants' real names. Pseudonyms have been used instead.

> *"Microsoft is the global supplier for desktop software, and they can leverage that relationship."* – **Robert, delivery leader, IT consultancy**

According to one industry expert, a senior leader with strategic oversight of the use of cloud within higher education, Microsoft has been the largest software provider[119] for so long that "all institutions" now have Office 365 licenses. He says tension arises when looking to integrate different systems, as it can lead to compatibility issues and flexibility constraints.

> *"By default, when you go to cloud, Azure is the option… We could pick and choose, but it all needs to be integrated. Microsoft is aware of this."* – **Raymond, senior technology leader, higher education**

> *"It takes a lot of work decommissioning old legacy systems."* – **Kerry, IT project manager, government agency**

Because its software is embedded across most UK offices, one participant said companies like Microsoft capitalise on their positions in order to impose "umbrella agreements" with highly integrated contracts across entities and services. These agreements can be an issue for fragmented public sector organisations which have restricted budgets and may lack the leverage to negotiate more favourable terms and conditions.

> *"It all goes through [central government], and they probably have an overarching agreement with Microsoft."* – **Kerry, IT project manager, government agency**

> *"Lock-in is much more of a problem for the public sector. It is disjointed and runs smaller budgets, so they have very little leverage… The public sector element has fantastically bad value."* – **Robert, delivery leader, IT consultancy**

This claim is supported by another participant, who oversees software purchasing for an academy trust. He said his institution inherited Microsoft systems from a school previously overseen by the local council. Despite not getting the "best value for money" and a desire to change providers, he feels restricted to that legacy software provider – as an independent, his academy must honour that broad institutional contract. This points to the embedded nature of legacy providers within IT ecosystems, which can result in challenges.

> *"You don't always have freedom of choice in the public sector."* – **Kyle, digital strategy director, academy school**

Restrictive software licensing impacts the freedom of choice of users, and may result in lock-in

Some legacy software is tightly integrated with the provider's infrastructure, including through licensing terms, and is therefore perceived as having a strong potential to lock-in customers. While few participants spoke of experiencing 'lock-in' in explicit terms or feeling they were completely tied to a single provider, many said they had encountered or were aware of restrictive software licensing practices in some form.

> *"Licensing agreements tie you in. Once you get into it, it's difficult to get out. It would be good if they had more flexible arrangements."* – **Kerry, IT project manager, government agency**

One participant discussed being overly entrenched or "tied" to Microsoft's suite. They acknowledged that licensing may have limited their capabilities, and pursuing alternative solutions could enhance competitiveness and improve the digital experience for users – but would result in additional expenses. Opting to use Zoom instead of Teams, for example, would "cost more in some ways" due to having to integrate with the existing suite of applications.

> *"There are positives to having one provider with a suite of things that work together very well, but the challenge of that is you're tied in."* – **Raymond, senior technology leader, higher education**

Another interviewee gave a separate but related example involving OpenAI, a Microsoft-backed software product. She noted that it integrates seamlessly with Azure, but is more difficult to integrate into other workflows. Although this feature can offer convenience and potentially smoother operational efficiency, it was also described as providing limited freedom of choice, while further embedding her organisation into the established system.

> *"Because we were on Microsoft Azure, the most straightforward thing to use was OpenAI, because it was all Microsoft-linked. What effect has that had on our choices?* – **Adanna, product manager, central government**

A different IT professional recounted a past experience of losing data after migrating between email systems, and believed that such a scenario could "quite easily" happen again. While he did not specify any immediate challenges, he acknowledged the potential complications of being unable to use different providers under the terms and conditions of his organisation's license agreement. He further noted a lack of consumer choice in the sector, which may exacerbate this challenge.

> *"There's a great danger that lost data could happen again. But it's difficult to know who to trust, especially when you give us X, Y, and Z providers to choose from."* – **Kyle, digital strategy director, academy school**

An additional issue surfaced with regard to restrictive licensing terms. Though one participant described the transition from perpetual products to SaaS as a "revelation", he acknowledged some "complications" around functionality and using software in different contexts. Specifically, he mentioned Microsoft's Privileged Identity Management, SQL Database, and Office 365 as examples of on-premises software with "proprietary" or "unique" features that are "locked into the cloud offering", making it difficult to transition between systems.

> *"They're not things you can just reuse in another cloud. They're sufficiently unique, and are only available to Microsoft. All their PaaS services are like this, all their SaaS services are like this. That's their hook to keep you tied in, so that you're using functionality no one else has."* – **Dylan, IT consultant, financial services**

> *"All the big providers do it. The major concern is that every cloud provider has its own specific services which can't be used anywhere else once the application is built. You either start from zero and with a different provider, or you can't use it."* – **Tobias, computing professor, academia**

This can lead to additional or inflated costs

Restrictive software licensing restrictions can result in additional costs. One respondent, an IT director working in higher education, says licensing models are important for offering capability for users, and historically software access has offered significant student value. However, she expressed concern over how software providers now "snare you in", which can make it "difficult to extract" from their systems. This is believed to be detrimental to the education sector, as it results in hiked up renewal costs.

> *"It used to be a pittance to buy SQL licenses. But my perception is that once they have snared you in and chucked that net out and caught you, it's hard to extract. They're now playing with the costs of the licensing models."* – **Gina, IT operations director, higher education**

Another way in which a cloud software provider may harm competition, as noted by the likes of CISPE[120] and Ofcom[121], is through the bundling of different services into a package. It is alleged that providers with a dominant market position offer their services at a lower total price than competitors that do not have a full range of services or operate across the full cloud stack, giving them an advantage. As articulated by one interviewee, this may ultimately lead to additional costs as prices go up over time.

> *"I hear from colleagues that what tends to happen with Microsoft in particular is they'll give you a bundle price, where the cost of individually buying the things you need outweighs the cost of buying ten."* – **Dylan, IT consultant, financial services**

Other participants raised concerns about unfair software licensing and additional costs. One reported difficulties using software across two different types of infrastructure, even though both were provided by the same organisation, which occasionally requires them to buy the same license twice. Another suggested providers exploit the bureaucratic nature of local government and its procurement practices, which may lead to inflated costs.

> *"We have university infrastructure which you can install the software on, and we have different 'save haven' infrastructure used for security purposes which is with the same provider. Sometimes we have to buy applications twice."* – **Darren, digital services director, higher education**

> *"Some providers have been quite difficult to deal with in terms of licensing. For example, if we have 500 licenses for one of our applications and we want more than that they will charge a hell of a lot more. I feel that a lot of providers, because you're a local authority where even getting a contract signed can take a month, they know they can charge whatever they want."* – **Charlotte, IT project manager, local government**

The wider organisational implications of these practices are significant

Restrictive software licensing practices can have far-reaching organisational implications. These issues appear to occur across various services and public sector departments, indicating systemic challenges and inefficiencies, with several participants describing these impacts as significant.

Restrictive software licensing can damage organisations' efficiency and budgets

This is exemplified by the experiences of senior IT professionals at a prominent university. They informed us that Microsoft had recently increased the costs of certain software licensing renewals by 9%, resulting in an uplift amounting to tens of thousands of pounds. This change is perceived to be part of an ongoing trend towards evolving practices and costs, which also includes the removal of long-standing education discounts and the introduction of more expensive consumption-based price models. Additionally, the expiration of Microsoft's Bring Your Own License model means the university now has to provide licenses for every collaboration an academic engages in – resulting in further costs.

> *"It feels like they're trying to force us down a path and they think they've got us over a barrel."* – **Raymond, senior technology leader, higher education**

> *"It does cause tension in the relationship between the supplier and the client. Whereas you were working in partnership, you end up no longer feeling you want to be a partner with that supplier, you may be stuck with them. It causes tension and distrust."* – **Gina, IT operations director, higher education**

> *"The writing is on the wall. It will kill university budgets."* – **Raymond, senior technology leader, higher education**

Across an institution comprising thousands of staff and students, these costs can quickly accumulate. Consequently, we were told the university is unable to license access as it used to, thereby limiting its ability to improve the digital experience of its users. As a result, temporary users can no longer be covered under Office 365, alumni are not kept on for as long, and international students – who rely heavily on online services – have reduced access. Together, these outcomes lead to less engagement with the institution, and risk damaging the overall student experience.

> *"Students should be equipped with digital tools in a modern digital setting. That's not really possible if you can't use tools like Microsoft suite in your day-to-day activities."* – **Raymond, senior technology leader, higher education**

> *"We hold back, we don't spend. It means we have a lesser product set to keep the costs down."* – **Gina, IT operations director, higher education**

These views were supported by a respondent from a different university who, despite feeling they were not exclusively tied to any single provider, raised some concerns about potential practices and costs related to lock-in. Specifically, he pointed out the accumulated costs linked to licenses for thousands of students and staff. In the context of declining student numbers and tighter budgets, these additional costs could lead to difficult organisational decisions, such as choosing whether to streamline staff or software access.

> *"I still don't think we're getting best value from a software application perspective. And as I said, the cloud element just brings in another complexity, because you then have to consider the terms and conditions of that particular software application."* – **Darren, digital services director, higher education**

> *"Do you want to keep a member of staff or do you want to keep a software application? That's the level we're at now."* – **Darren, digital services director, higher education**

We were also told about the potential financial impacts of unfair software licensing practices elsewhere in the public sector. According to one participant, the scale of additional costs, if present, within central government alone – comprising government departments with multiple agencies and thousands of employees each requiring individual licenses – implies costs equivalent to millions of pounds. This is supported by a paper from the Cabinet Office's Central Digital & Data Office, which acknowledges that billions of pounds of cloud infrastructure spending has been inhibited by vendor lock-in.[122]

> *"Government departments probably have an overarching agreement with Microsoft. We're talking millions of pounds."* – **Kerry, IT project manager, government agency**

Other consequences include squandered resources and poorer services

This was echoed by another IT professional, also working in Whitehall, who said, depending on the specific issue, additional costs could feasibly range from a few thousand to several million pounds. Commercial harm aside, there are also likely to be "opportunity costs" that arise from lock-in effects, resulting from missed opportunities or alternative allocation of resources. These potential costs are likely to intensify over time as the public sector becomes increasingly dependent on cloud services, we were told.

> *"It can be up to several million. The size of the organisation, the nature of the problem, the repercussion throughout the supply chain, all of that has to be factored in."* – **Naveen, IT architect consultant, central government**

> *"If you're locked in with a cloud supplier, you're in a lot of trouble. It's subtle. It's not just commercial, it's also the opportunity cost."* – **Robert, delivery leader, IT consultancy**

> *"Usage of the cloud is only increasing. That's increasing our service level agreement with them, because we're asking them to look after more."* – **Kerry, IT project manager, government agency**

Private sector workers interviewed as part of this research highlighted similar impacts. One respondent recalled a situation involving Oracle Database which, due to complications with "tricky" licensing practices and lock-in tendencies, incurred substantial additional costs. To avoid the same issue happening again, his company decided to migrate to a different provider and convert their database.

> *"Oracle are very good at being vague enough in their licenses for you to hammer yourself in certain situations."* – **Dylan, IT consultant, financial services**

However, due to their reliance on Oracle's proprietary software, this required significant resources: a 200-person department was "locked down" to two-years of full-time work, equivalent to millions of pounds, solely to mitigate risk without adding new value to the company. As a result, regulatory updates were delayed or not carried out to the usual high standard.

> *"The business wanted to make their systems better. Because we had to do these changes, it had no benefit to the business. Not at all. Because we were financially noosed by Oracle and Microfocus."* – **Dylan, IT consultant, financial services**

> ***"****It was a multi-million pound project to get out of Oracle into a different system... it was so expensive, license-wise."* – **Dylan, IT consultant, financial services**

For a civil servant working in IT, such debacles would be nothing short of a "disaster" for the public sector. Millions of pounds of taxpayers' money spent on wasted technology could be "publicly embarrassing" and might even result in a significant media fallout. Although this participant acknowledges this is the worst possible outcome, they say it is not beyond the realm of possibility.

> *"I think it would be a disaster. We've already spent millions on these services."*
> – **Adanna, product manager, central government**

Indeed, as highlighted by CISPE – discussed in more detail below – the detrimental effects caused by potential unfair licensing behaviour is likely to be exacerbated in the context of public services. Excess costs are ultimately financed by the taxpayer and may entail the diversion of resources from other government objectives or budgets.[123]

There are other issues related to cost and competition in the cloud infrastructure sector

We also heard about some of the wider issues related to cost and competition in the UK cloud sector. While it is not within the scope of this report to delve into these broader challenges in detail, interviewees raised additional concerns and frustrations they believed to be important to this discussion.

Ofcom's market report into cloud competition discusses a range of features that allegedly make it difficult for customers to use different providers. One of those features is technical barriers where, due to interoperability and portability restrictions, customers have to put considerable time and effort into reconfiguring their IT system to work across clouds.[124]

This is supported by several IT workers we interviewed, who expressed the belief that migrating to different cloud infrastructure is overly challenging. Some said they would refrain from changing their current arrangements even if there were aspects of their system they were dissatisfied with, precisely because of the considerable effort required to switch to another provider. Many perceived this as inherent to the system, viewing it as a deliberate strategy by providers to keep customers locked in.

> *"Even if I was disgruntled and faced with additional fees, I might stay anyway. It's not worth the hassle."* – **Kerry, IT project manager, government agency**

> *"The difficulty wouldn't just lie within the agreement, it would be actually doing the physical move... It's just not worth it."* – **Charlotte, IT project manager, local government**

> *"Even if we have these issues, because we have already migrated into the cloud to reverse it all the way back is difficult. That's where the power comes in, strategic power."* – **Naveen, IT architect consultant, central government**

It is not clear, however, to what extent these challenges reflect anti-competitive behaviour, or a competitive process that competing providers have an incentive to overcome. In its submission to the CMA market investigation, the CCIA has argued that customers "often find workarounds to technical barriers that can be inherent to the technology, or a natural consequence of vigorous competition. Widely available cloud-based open standards and software are designed in a way that preserve safety, privacy, and security."[125]

Another issue highlighted by Ofcom was committed spend discounts, whereby customers are incentivised to commit to a new cloud provider at the outset of an arrangement and remain with them over time.[126] While participants acknowledge this can help with upfront costs, in the long-term they contended that suppliers end up recouping those discounts by committing customers for their growing cloud needs.

> *"They put the costs up when you renew. They'll give you a discount, make it look like you're getting it cheap. They'll get their costs back later on because they know you're going to renew... They know what they're doing."* – **Kerry, IT project manager, government agency**

> *"Microsoft is almost definitely used the most. Because they're giving the non-profit incentives that really help."* – **Klaus, owner, IT consultancy firm**

> *"Amazon gave us credits to be exclusive to them. This is how they get you, they target all the startups with accelerator credits, what looks like a huge amount of money. Once you've built everything on them, you're kind of stuck."* – **Benjamin, IT engineer, technology startup**

Again, more investigation may be needed to ascertain if and when this reflects anti-competitive behaviour versus a pro-competitive means to increase the utilisation of valuable assets. The CCIA argued in its submission to the CMA that such discounts "can provide a mutual benefit to the extent that they allow cloud firms making large investments in infrastructure to increase the utilisation of those assets, allowing them to improve the overall proposition to their customers." It cited a Public First poll that found 78% of customers consider the practice somewhat or very positive.[127]

Related to this is the general pricing model of using cloud services, which some IT workers consider to be misleading. According to participants, providers impose background costs and other subtle incremental pricing mechanisms on customers, which can lead to inefficiencies and higher costs. These models can be difficult to understand, meaning costs can escalate quickly, particularly among large

organisations with several staff. Though it is not a competition issue per se, respondents believe this aspect of the cloud pricing model is unfair – and costly.

> *"You have to be very, very specific on what you need. Even if you have a machine turned off or a resource that's not being used, it will still be charged."* – **Amir, IT infrastructure engineer, health charity**

> *"We really didn't understand all of the gotchas of the pricing model. We've been burned by that a few times."* – **Benjamin, IT engineer, technology startup**

> *"Suppliers go out of their way to make it as complex as possible. I understand they're trying to maximise revenue, but the amount of variations of modules and add-ons, which I supply to thousands of staff, is creating an economy where a number of applications are not fit for purpose. I can't afford it."* – **Darren, digital services director, higher education**

There may be a significant amount of wasted public sector expenditure on restrictive cloud software licensing

To complement qualitative data provided by interviewees, we quantified the economic harm inflicted on the public sector by unfair licensing practices. Following the same methodology set out in the preceding chapter, we calculated the additional costs incurred by public services customers using Office 365 and SQL server software on non-Microsoft infrastructure, comparing them to private sector estimates. Explanations for all calculations can be found in the appendices.

Examining the potential cost of restrictions to users' ability to use Office 365 on third-party cloud infrastructure, our calculations suggest the termination of the Microsoft's Bring Your Own License policy may have resulted in additional public sector harm worth £56.1 million. This figure is considerably lower than that of the private sector (£586 million; Table 6).

Table 6: Estimated costs of public sector organisations deploying Office 365 on non-Microsoft IaaS that repurchased at least one year ahead of time

	Estimate
Total volume of licenses affected	265,679
Harm per repurchased license	£211
Total harm from repurchasing Office licenses	**£56,055,300**

Source: SMF analysis of multiple sources. See Appendix B for details

With regard to the overcharge potential of using SQL Server on non-Azure infrastructure, our analysis suggests additional public sector costs of £7.8 million. Like the previous analysis, this figure is much lower than the estimates produced for the private sector (£300 million; Table 7). For comparison, a summary overview of the private sector and public sector costs are provided in Table 8 below.

We can also provide a rough estimate of the longer-term economic harm caused by deploying Microsoft Office 365 and SQL Server on third-party infrastructure, if these

practices are left unaddressed. Purely for these two examples, we calculate that restrictive licensing practices may cost the public sector approximately £300 million – almost a third of a billion pounds – during the upcoming parliament, potentially presenting a strain on public finances in the years to come. Please refer to the appendices for this calculation.

Table 7: Estimated overcharge of public sector organisations using SQL Server for on non-Microsoft IaaS

	Estimate
Total number of cores affected	1,931
Overcharge per core	£4,043
Total harm from repurchasing Office licenses	**£7,806,100**

Source: SMF analysis of multiple sources. See Appendix B for details

It is important to acknowledge that the examples we have provided are intended to illustrate the potential harm caused by unfair licensing practices in the cloud sector. They should not be considered conclusive and, as indicative cost exercises, they represent only two policies within a much bigger software ecosystem. As highlighted by CISPE, they "form part of a wider set of commercial policies employed by legacy software vendors",[128] suggesting the actual additional costs incurred by all software licensing practices, such as with Windows Server,[129] are likely to be much higher.

That said, these exercises go some way to highlight the likelihood of significant inefficiencies and wasted expenditure present in the public sector. And as we have discussed, these practices not only result in direct financial costs but are also likely to generate significant indirect opportunity costs. Beyond monetary losses, these two examples alone could create far-reaching repercussions throughout the public sector.

For instance, the government recently announced its commitment to boost productivity across public services. In the Spring Budget, £800 million was allocated to various initiatives, including £34 million to enable AI to detect fraud within the Public Sector Fraud Authority, £17 million to speed up service modernisation in the Department for Work and Pensions, and £6 million for digitising prison services.[130] The budget also revealed a more ambitious target to the science and technology sectors, with £100 million dedicated to support the transition to an AI-enabled economy.[131] A much larger sum of £3.4 billion was committed to NHS productivity, earmarked specifically for investment for data and technology transformation.[132]

The financial costs we have presented significantly undermine these ambitions. At a departmental level, it may also mean unnecessarily diverting funds from crucial and already-wounded public services such as healthcare and education. There could also be security risks, with the Central Digital & Data Office highlighting vendor lock-in as a challenge to the government's negotiating power over providers, potentially leading to inconsistent and sub-optimal security practices and resilience due to a lack of diverse options.[133]

For these reasons, there appears to be an economic and social imperative to improving the availability of cloud software and preventing further wastage of public resources. This underscores the need for measures that mitigate the impact of restrictive software licensing, aiming not only to reduce harm among customers but also to optimise outcomes within government.

Table 8: Estimated costs of deploying Office 365 and SQL Server on non-Microsoft IaaS

	UK private sector	UK public sector
Total harm from repurchasing Office licenses	£586,366,400	£56,055,300
Total overcharge from deploying SQL Server	£299,657,400	£7,806,100

Source: SMF analysis of multiple sources. See Appendix B for details

CHAPTER SIX – MITIGATING THE IMPACT OF RESTRICTIVE SOFTWARE LICENSING

As discussed above, the government has expressed its commitment to improving productivity across public services. Gareth Davies, head of the National Audit Office, emphasises that digital transformation can "make public money work harder" and release tens of billions of pounds for government priorities.[134] Realising this potential depends on tech being deployed and managed appropriately.

SMF primary research has revealed several software licensing concerns in the UK cloud sector, presenting significant productivity and operational implications. These impacts include diminished service expectations, compromised user experience, and additional expenditure.

Such costs may be more consequential in the public sector – where billions of pounds are spent on cloud services every year[135] – not least because any additional financial costs are borne by taxpayers. Inefficiencies in the system will ultimately result in poorer public value, weakening vital services. At an international level, they may stifle innovation and undermine competition.

As the cloud sector continues to expand and the public sector's reliance on cloud software services increases, these challenges are likely to intensify. In light of these issues, we make suggestions – as informed by cloud professionals – for ensuring the cloud sector operates smoothly, minimising harm to customers and increasing efficiency within the public sector.

We do not wish to stipulate exactly what an ideal sector should look like. Instead, we provide some possible remedies that could feasibly be implemented to alleviate the concerns we have addressed in this report.

Cloud professionals suggest some potential interventions to improve the market

We have identified a range of costs and consequences that suggest restrictions in the legacy software sector might mean cloud services are not working as well as they could for some UK customers.

Together with the French non-profit organisation Club Informatique des Grandes Entreprises Françaises (Cigref), CISPE has proposed 'ten principles of fair software licensing for cloud customers' to challenge the practices of some legacy software companies.[136] The principles "have been developed as an auditable best practice framework for businesses looking to the Cloud for growth, innovation and flexibility",[137] and include provisions such as clear and intelligible licensing terms, freedom to bring previously purchased software to the cloud, freedom to run on-premises software on any cloud, freedom from retaliation for cloud choices, and equal treatment for software licensing fees in the cloud.[vi] [138]

[vi] Please refer to Appendix C for a detailed explanation of these principles.

These principles are sensible, and offer a useful framework for monitoring and improving vendors' approaches to software licensing.[139] On the suggestion of IT professionals interviewed for this research, we present additional avenues regulators and policymakers could take to improve how cloud services are delivered.

Bring your own license models could be (re)introduced

Related to standardisation is the BYOL model, which allows companies to use their software licenses with greater flexibility. As mentioned above, some legacy software vendors have imposed restrictions on BYOL, depriving users of the ability to deploy certain licenses on third-party cloud infrastructure. Given that Microsoft's termination of this policy may have amounted to overcharges worth millions of pounds, revisiting it would seem both fair and pragmatic.

> *"A bring your own license would be wonderful. That will bring higher education institutions together. I'd like Microsoft to allow that."* – **Raymond, senior technology leader, higher education**

One participant explained that the removal of BYOL ultimately has restricted his users' – university staff and students – access to software applications. They say the policy should be reinstated, highlighting its ability to promote interoperability but potential cost-saving benefits of using existing licenses rather than continually purchasing new ones. Another participant echoed similar sentiments, suggesting the introduction of perpetual licensing to ensure more consistent and predictable costs.

> *"Bring back perpetual licensing. That would be the one thing I'd ask for. But I don't think they will, they make too much money off subscriptions."* – **Dylan, IT consultant, financial services**

Centralised public sector procurement could help to improve licensing agreements

There are a variety of guidance, frameworks, and agreements in place with suppliers to ensure optimal outcomes in the public sector. The G-Cloud framework fulfils this function for cloud services, with the Crown Commercial Service overseeing procurement to mitigate the risk of lock-in, promote competition in the public sector, and secure better value for money.[140]

> *"If a smaller council is having problems bought into this bigger contract and are locked-in, that's very different to a council with its independent, smaller contract."* – **Robert, delivery leader, IT consultancy**

There may be room for improvement, however, particularly with regard to extending its support to smaller public sector organisations. These entities, operating under independent contracts, may lack the leverage to negotiate better terms. For one participant, government procurement could be improved in order to accommodate smaller organisations under larger contracts, enabling them to circumvent lock-in. Such an arrangement does not have to be monolithic; it could function at departmental level.

There may also be potential for relevant organisations like the Government Digital Service and Local Government Association to offer support for public sector entities

in navigating procurement and negotiating terms with software suppliers – including strategies for mitigating lock-in.

Transparent reporting can raise awareness of licensing practices and drive positive competition

According to Ofcom, cloud providers may not consistently provide full transparency regarding the compatibility of their cloud services with those of competitors. As a consequence, customers may be unable to predict their cloud expenditure, which can be exacerbated by a lack of price transparency and usage complexity. This can increase the technical burden on customers who wish to navigate multiple clouds.[141]

> *"It would be good to know what kind of margin these service providers are charging, and to see it broken out by service."* – **Benjamin, IT engineer, technology startup**

Implementing transparency and accountability measures could support fairness and integrity in how software licences affect consumer choices in the cloud sector. By way of regulatory intervention, the reporting of licensing practices would provide stakeholders with insights into the cost structures and profit margins, helping to identify potentially unfair practices and encourage positive competition among providers. While this approach is unlikely to dramatically improve the current system, it can aid policymakers to better understand the issues at hand with low implementation costs.

> *"In terms of policy, it's hard to communicate the pain because it's extremely technical."* – **Benjamin, IT engineer, technology startup**

Improved communication and clearly defined licenses would bring clarity for users

Clearly defined licenses could provide clarity to users navigating the complexities of on-premises productivity software, potentially avoiding the unexpected costs and complications identified above. By improving overall communication and ensuring licenses are straightforward and easily understandable, users will be better placed to make informed decisions about their purchases.

> *"Licenses should be very clear on what is covered and what isn't covered. The quality of agreements should be easy to understand and not require team of lawyers."* – **Dylan, IT consultant, financial services**

To address this, cloud service providers can translate otherwise complicated jargon to accessible terms. Measures may include the use of plain language, software licensing agreements written in non-technical terms, and standardised agreements with consistent format and content across providers. With some degree of regulatory oversight to ensure compliance, this would help to promote greater transparency and user understanding of cloud software license agreements.

Standardising services would help with interoperability problems

Although not strictly a licensing issue, some professionals we spoke with also said that greater standardisation across different cloud software services would help to remove barriers to switching between providers. To mitigate lock-in, trade industry body techUK have already called on the government to encourage 'interoperability by

design' in cloud infrastructure so applications can be written across PaaS services,[142] with Ofcom highlighting similar recommendations.[143]

> *"Standardisation within tech and within SaaS products would improve interoperability between suppliers."* – **Dylan, IT consultant, financial services**

Participants believe there is scope for increasing the portability between SaaS products, enabling them to work across different platforms and services. While removing some of the technical differentiation between products through (mandated) standardisation could potentially limit innovation and product differentiation,[144] professionals we spoke to believe some degree of greater harmony and less complexity across services would help to lower barriers to switching providers, should the need arise.

> *"I wish there was greater harmony across providers"* – **Kerry, IT product manager, government agency**

APPENDICES

These appendices outline additional information too detailed for the main body of the research. They include a list of CCIA's members, a description of the costing methodology used to estimate the economic harm of restrictive software licensing, and CISPE and Cigref's 'ten principles of fair software licensing for cloud customers'.

Appendix A: List of CCIA members

The Computer & Communications Industry Association and its members provided feedback on some of the complex technical details of this report. It is important to emphasise that their contributions did not impact the editorial independence of this research. At the same time, CCIA sponsorship does not imply endorsement of all the views in this report and CCIA members will have diverse perspectives on the issues covered. CCIA members include:[145]

- Amazon
- Apple
- Cloudflare
- Deliveroo
- Dish Network
- eBay
- Google
- Intel
- Intuit
- Meta
- Nord Security
- Opera
- Pinterest
- Rakuten
- Red Hat
- Shopify
- Texas.net
- Taiwan Semiconductor Manufacturing Company
- Uber
- Viagogo
- Waymo
- X
- Zebra

Appendix B: Costing methodology

The SMF has replicated CISPE's analysis of the economic consequences of restrictive cloud software licensing for European firms,[146] estimating the costs of such behaviour within the UK private sector and public sectors. This exercise

followed the same basic approach and calculations of CISPE, the primary change involving the use of UK-specific data. We performed four calculations for this analysis, looking at the total costs associated with use of Office 365 and SQL Server on non-Microsoft IaaS.

It is important to acknowledge that the examples we have provided are intended to illustrate the potential harm caused by unfair licensing practices in the cloud sector. They should not be considered conclusive and, as indicative cost exercises, they represent only two policies within a much bigger software ecosystem. While informative, they should be approached with a degree of caution.

Repurchasing Office 365 licenses for third-party IaaS use

This section illustrates Microsoft's software policy change in 2019, which mandated that Office 365 customers repurchase their existing on-premises software licenses if deployed on third-party cloud infrastructure. These costs apply to companies that rescheduled their license repurchase at least a year earlier than planned, incurring an extra year's costs.

CISPE has noted that some companies may have faced additional costs for longer – firms could have repurchased licenses more than a year ahead of time, for example – which means our estimate might be at the lower bound of the total overcharge. CISPE also highlights that these costs can be considered as 'pure' extra costs, as the repurchased licenses did not include any new or updated services.[147]

To calculate the total aggregate costs, we multiply four key variables together:

- The number of UK firms or organisations that have deployed Office on non-Microsoft IaaS and repurchased their licenses by at least one year ahead of time.
- The average number of Office licenses per firm or organisation.
- The annual price of a Microsoft Office 365 license.
- The average proportional cost of repurchasing Microsoft software.

UK private sector

First, we calculated the number of UK private sector firms that have deployed Office on non-Microsoft IaaS and repurchased their licenses at least a year earlier than planned:

- We started by referring to estimates by Enlyft, which shows that 283,895 companies in the UK used Microsoft Office 365 in 2023.[148]
    - In CISPE's analysis, Enlyft's 2023 firm count is adjusted to reflect 2019 values, based on the annual growth rate of 15.3% annually in Office 365 commercial seats between 2019 and 2022. This adjustment involved dividing the reported 2023 figure by 1.153^3.[149]
    - To err on the side of caution, we decided to use Enlyft's reported, more timely numbers rather than adjusted figures and provide costs for the 2023 period. While this choice does not dramatically alter the final estimates, it does introduce a bias in the direction of recent trends and, as a result, may not align directly with CISPE's estimates.

- The next step was estimating the share of these firms that deployed their licenses on non-Microsoft IaaS. For this we relied on Eurostat data, indicating that 53% of UK firms use cloud computing services in 2020.[150]
- We also drew on Ofcom figures from 2023, estimating that 69% of cloud-using firms use IaaS, although it is worth noting this researched focused on companies and organisations already using or considering cloud infrastructure services, potentially overstating the use of IaaS relative to cloud users overall.[151]
- Additionally, we considered estimates for the share of Microsoft's rivals in the IaaS sector (65%), with the CMA noting that Microsoft is the second largest provider of IaaS, with its share increasing from [30% to 40%] in 2019 to [30% to 40%] in 2022.[152]
- Due to Microsoft released new versions of Office every three years, CISPE assumes that the number of firms repurchasing their licenses is uniformly distributed over time and that firms in their last year before planned repurchase did not reschedule, and therefore two-thirds of firms decided to repurchase prematurely. It suggests the share of firms that repurchased their licenses was 66.7%.[153]
- Multiplying these four figures together, our final estimate for the number of UK firms that hold Office 365 licenses deployed on third-party IaaS is 45,011.

Secondly, we estimated the average number of Office licenses per firm:

- Like CISPE, we assume that Microsoft licenses are primarily purchased for higher-skilled, university-educated workers. According to the OECD, the share of workers with tertiary education in the UK is 51.3%.[154]
- This figure was then multiplied by the average firm size of companies using Office 365. While specific UK data is unavailable, Enlyft[155] provides public data on the number of companies across different size categories. Following CISPE's analysis, the average size of the global Office-using business was estimated by taking mid-points in each category and multiplying the percentage of software-using firms falling in that size bracket. Under this approach, we estimate the average firm size to be 120 employees.
    - It is worth mentioning that InfoClutch[156] offer similar estimates but, being based on extrapolation from scraping public data, it is more uncertain than Enlyft's proprietary data. We later use InfoClutch estimates to help establish a range of total costs.
- Multiplying these factors together suggests UK firms have 62 licenses each on average.

Thirdly, we present figures for the average annual price of an Office 365 license:

- Our baseline estimation uses the price of an Office 365 Enterprise E3 license (£264.00). Estimates for the cheapest (E1, £98.40) and most expensive (E5, £436.90) Office 365 types are also available to provide a range of costs.[157]
- Customers purchasing licenses for numerous users receive discounts from Microsoft. CISPE assumes that the maximum discount available is the price offered to governments, arguably large and influential customers, resulting in

an implied price reduction 11.2%.[158] We have adopted that same approach for our analysis.

The final estimate to be factored into CISPE's calculation is the average proportional cost of repurchasing Microsoft software:

- CISPE assumes this to be approximately 90% of the original license price, based on responses to a survey it conducted.[159]

Multiplied together, these estimates result in first-year repurchase costs totalling a baseline of £586 million for UK businesses, surpassing the Europe-wide €560 million (£480 million) costs calculated by CISPE.[160] As we have noted, differences in methodologies and our preference for using reported, more recent data these two figures may not be directly comparable. An alternative cost estimation using InfoClutch,[161] instead of Enlyft, for estimating both the number of companies in the UK that use Microsoft Office 365 and the average size of license-owning companies provides a much higher estimate, nearly £1 billion.

	Baseline	Alternative
The number of firms that deployed Office on third-party IaaS and repurchased licenses at least one year earlier		
Number of firms with Office 365 licenses	283,895	272,791
Percentage of cloud user firms	53%	53%
Share of cloud user firms that use IaaS services	69%	69%
Non-Microsoft share of IaaS spend	65%	65%
Share of firms that repurchased licenses	66.7%	66.7%
Number of firms affected	**45,011**	**43,251**
The average number of licenses per firm		
Share of workers with tertiary education	51.3%	51.3%
Average firm size (employees)	120	195
Average number of licenses per firm	**62**	**100**
The average annual price of a license		
Office 365 Enterprise E1 (cheapest)	£98.40	£98.40
Office 365 Enterprise E3 (baseline)	**£264.00**	**£264.00**
Office 365 Enterprise E5 (most expensive)	£436.80	£436.80
Average discount	**0.888**	**0.888**
The average proportional cost of repurchasing software		
Percentage of the original license price	**90%**	**90%**
Total harm from repurchasing Office licenses		

Office 365 E1	£218,554,779	£340,818,248
Office 365 E3	**£586,366,426**	**£914,390,423**
Office 365 E5	£970,169,904	£1,512,900,518

UK public sector

The approach for estimating the costs of repurchasing Office 365 licenses for third-party IaaS in the public sector follows a similar broad methodology as used for the private sector. However, adjustments were made to reflect differences between the public and private sectors in terms of data sources and conceptual considerations.

The first change was in the number of organisations that use Microsoft Office 365:

- Instead of relying solely on Enlyft data, which specifically covers the private sector, we used Department for Business and Trade business population estimates. This allowed us to assess the scale of Office usage within the public sector compared to the private in terms of organisational count.[162]
- To do this, we excluded sole traders from the private sector count of companies under the assumption they are unlikely to be the affected population and to focus on companies. This ensures the number of Microsoft-using 'firms' is not inflated.
- We acknowledged that, according to the Department for Business and Trade, total public sector employment (5.40 million) is significantly lower than that reported by the ONS (5.93 million),[163] with a difference of 530,000, equivalent to 25.2% of total employment in the non-profit sector. This can be taken to indicate around 25% of non-profit organisations are part of the wider public sector. We adjusted the total public sector organisation count by the additional non-profit organisational numbers to take a ratio of the 'wider' public sector to the private sector company count.
- We applied this proportion (2.64%) to the percentage of private sector firms with licenses, as set out in the calculation above. This results in an estimated count of 7,493.

Another difference lies in the average firm size of public sector organisations compared to companies:

- The private sector is comprised of a 'long tail' of smaller firms. For example, government data shows there are over 4 million sole traders in the UK, while there are fewer than 5,000 in central and local government, while the public sector is more likely to contain larger organisations.[164] Given this disparity, it is unlikely that the distribution of software usage by firm size in the private and public sectors will be similar.
- We referred to Department for Business and Trade data[165] which shows the average firm size of central and local government is 436 employees. This figure may be a conservative assumption, as larger government organisations will be more likely to use this software more frequently.

Overall, we estimate the first-year repurchase costs for Office 365 on non-Microsoft cloud infrastructure in the public sector total a baseline of £56.1 million. This is

considerably lower than the private sector costs, and can be explained by there being many more individual firms than in the public sector, even though companies have less employees on average and, as a consequence, a smaller average number of licenses per firm.

	Baseline	Alternative
The number of organisations that deployed Office on third-party IaaS and repurchased licenses at least one year earlier		
Number of orgs with Office 365 licenses	7,493	/
Percentage of cloud user organisations	53%	/
Share of cloud user orgs that use IaaS services	69%	/
Non-Microsoft share of IaaS spend	65%	/
Share of orgs that repurchased licenses	66.7%	/
Number of orgs affected	**1,188**	/
The average number of licenses per firm		
Share of workers with tertiary education	51.3%	/
Average org size (employees)	436	/
Average number of licenses per org	**224**	/
The average annual price of a license		
Office 365 Enterprise E1 (cheapest)	£98.40	/
Office 365 Enterprise E3 (baseline)	**£264.00**	/
Office 365 Enterprise E5 (most expensive)	£436.80	/
Average discount	**0.888**	/
The average proportional cost of repurchasing software		
Percentage of the original license price	**90%**	/
Total harm from repurchasing Office licenses		
Office 365 E1	£20,893,336	/
Office 365 E3	**£56,055,291**	/
Office 365 E5	£92,746,027	/

Overcharge on SQL Server for third-party IaaS use

CISPE's analysis quantifies the additional costs incurred by companies that migrated from on-premises SQL Server to third-party cloud deployment between the end of 2019 and 2022. The calculation involves the multiplication of three main factors:

- The number of European firms that possess SQL Server on non-Microsoft IaaS.
- The average number of cores required per firm.

- The difference in the average price of a perpetual SQL Server 2022 license when it is deployed on third-party IaaS, or with Azure Hybrid Benefit.

UK private sector

CISPE calculated the number of European firms transitioning to deploy SQL Server on non-Microsoft IaaS was carried out in four steps:

- The first step involved calculating the number of UK firms that possess SQL Server licenses. Again using Enlyft as a data source, this resulted in a count 13,759.[166]
  - Similar to its Office calculations, CISPE adjusted these 2023 figures to 2021 values using the average annual growth rate of the worldwide database management systems sector between 2017 and 2021 (19.7%). In practice, this involved CISPE dividing the 2023 figures by 1.197.
  - Like the previous analysis, we opted to use Enlyft's current reported numbers instead of adjusted figures. It is important to note this decision introduces a bias favouring recent trends, and may not be directly comparable with CIPSE's estimates.
- We then sought to calculate the number of SQL Server-using firms that migrated from on-premises to the cloud over a two-year period. between 2020 and 2022, following CISPE's methodology. As comparable Eurostat data for the UK was unavailable, we used the most recent data from the period 2018 to 2020. This revealed a migration rate of 11%, which is lower than CISPE's estimated 17.1% increase among European firms.[167]
- Next, we estimated the share of IaaS-user firms among all UK cloud service users (69%)[168] and the percentage of non-Microsoft firms in the IaaS sector (65%).[169] These percentages are the same as those used in the Office 365 analysis.
- This results in 679 as the number of UK firms that migrated to the cloud and deployed their SQL Server licenses on non-Microsoft IaaS.

Secondly, we calculate the number of cores required by the average firm by multiplying three variables:

- Enlyft data suggests the average firm size of SQL Server license-possessing firms in the UK is 1,068. This follows the same calculation as that used for the Office 365 analysis, taking the midpoint of each firm employment size category, multiplying it by the number of firms in that category, and then dividing the resulting sum by the total number of firms.[170]
- To identify the share of employees requiring an SQL license, Department for Digital, Culture, Media & Sport figures were used which indicate the share of online job advertisements that specify SQL skills as necessary (4.8%) in the UK between April 2017 and March 2018.[171] This is assumed to represent the proportion of workers likely to be using SQL in their daily tasks and, therefore, need an SQL license.[172]
- To convert the number of SQL-using employees to the number of cores required, we followed CISPE's which approach averages the virtual CPU recommendations per person for single-session and multi-session use cases with a medium workload type, sourced from Microsoft's website.[173]

- Multiplying these factors together results in an average of 109 cores per firm.

Lastly, we estimate the license price for 2022 SQL Server:

- We converted American prices, as used by CISPE, to British pounds. CISPE notes that an Enterprise edition SQL Server 2022 perpetual license is $15,124 (£11,9450), which covers two cores. The Azure Hybrid Benefit offers four virtual cores for every single on-premises one, and CISPE assumes that a firm using third-party IaaS pays $7,562 (£6,070) for a single core, while licensing a single core costs only $1,890 (£1,517) for customers benefitting from the Microsoft policy.[174]
- The cost difference (£4,553) was used to estimate how much affected firms are overcharged.

Similar to the Office calculations, enterprises purchasing numerous licenses may receive preferential agreements with Microsoft regarding the per-core price of licensing:

- CISPE assume an average discount of 11.2% on retail prices, as in the case of Office 365 licenses.[175]

Updating CISPE's methodology with UK-specific data, we estimate the total overcharge for private sector firms amounts to just under £300 million. This is significantly lower than CISPE's analysis of the harm incurred by European firms, which estimated €1 billion (£858 million) in CISPE's analysis, primarily due to differences in estimating the average firm size of 964 employees, significantly altering the cost projections. Our preference for using reported, more recent data may mean these two figures are not directly comparable. Using InfoClutch instead of Enlyft for estimating the number of UK companies using SQL and their average firm size yields a higher estimate of around £770 million.[176]

	Baseline	Alternative
The number of firms deploying SQL Serve on non-Microsoft IaaS		
Number of firms that hold SQL licenses	13,759	32,461
Percent of firms that migrated from on-premises to the cloud over a two-year period	11%	11%
Share of cloud user firms that use IaaS services	69%	69%
Non-Microsoft share of IaaS spend	65%	65%
Number of firms affected	**679**	**1,601**
The average number of licenses per firm		
Average firm size (employees)	1,068	1,162
Share of employees requiring an SQL license	4.8%	4.8%
Number of cores per licensed employee	2.13	2.13
Number of cores per firm	**109**	**119**

SQL license price		
License price per core for customers deploying on third-party cloud	£6,070	£6,070
License price per core for Azure Hybrid Benefit users after migration to cloud	£1,517	£1,517
Average discount	0.888	0.888
Total overcharge from deploying SQL Service licenses on third-party infrastructure		
Total overcharge	**£299,657,400**	**£769,245,455**

UK public sector

The methodology used to estimate the costs of SQL Server overcharge for third-party IaaS in the public sector closely mirrors that of the private sector. Two adjustments were made to accommodate differences between public and private sector data sources:

The first was the number of UK companies that hold SQL Service licenses:

- We applied the public sector to private sector count proportion (2.64%) discussed above to the percentage of firms with a license in the private sector (13,759), resulting in an estimated 363 firms.
- This adjustment reduces the number of affected firms in the public sector to 18, compared to the private sector.

The other significant change was how we calculated the average firm size of companies:

- Similar to previous analyses, this was calculated taking the average size of the global SQL-using business was estimated by taking mid-points in each category and multiplying the percentage of software-using firms falling in that size bracket.[177]
- This results in an average firm size of 1,054. In contrast to our Office calculations, where there is a significant difference between private and public sector firm sizes, this figure closely aligns with the private sector average firm size (1,068).
- This can be attributed to the widespread adoption of Office software across small and medium-sized enterprises for general productivity tasks, whereas SQL Server tends to have a more specialised role in larger firms. This makes average firm sizes comparable between the public and private sectors.

With regard to the overcharge potential of using SQL Server on non-Azure infrastructure, our analysis indicates additional costs of £7.8 million for the public sector. Like the Office 365 analysis, this figure is significantly lower than the estimate produced for the private sector. Using InfoClutch for estimating the number of UK companies using SQL Server and their average firm size suggests a higher estimate of around £18 million.[178]

	Baseline	Alternative
The number of firms deploying SQL Serve on non-Microsoft IaaS		
Number of firms that hold SQL licenses	363	857
Percent of firms that migrated from on-premises to the cloud over a two-year period	11%	11%
Share of cloud user firms that use IaaS services	69%	69%
Non-Microsoft share of IaaS spend	65%	65%
Number of firms affected	**18**	**42**
The average number of licenses per firm		
Average firm size (employees)	1,054	1,054
Share of employees requiring an SQL license	4.8%	4.8%
Number of cores per licensed employee	2.13	2.13
Number of cores per firm	**108**	**108**
SQL license price		
License price per core for customers deploying on third-party cloud	£6,070	£6,070
License price per core for Azure Hybrid Benefit users after migration to cloud	£1,517	£1,517
Average discount	0.888	0.888
Overcharge from deploying SQL Service licenses on third-party infrastructure		
Total overcharge	**£7,806,098**	**£18,416,581**

We also provide a rough estimate of the longer-term economic harm caused by deploying Microsoft Office 365 and SQL Server on third-party infrastructure, if these practices are left unaddressed. Purely for these two examples, we calculate that unfair licensing practices may cost the public sector £300 million during the upcoming parliament.

- The first-year relicensing costs for Microsoft Office on third-party cloud infrastructure creates £56.1 million in public sector harm. We multiply this by five to get £280.5 million in Office 365-related additional licensing costs over the next parliament.
- For the SQL Server calculations, we estimated that public sector organisations transitioning from on-premises to third-party cloud incurred an overcharge of £7.8 million over two years. Over five years, this harm ((£7.8 x 2)+(£7.8 ÷ 2)) totals £19.5 million.
- This results in a combined total of £300 million over five years. However, these estimates should be approached with caution. The Office and SQL

calculations use different timeframes, and both are based on current data and assumptions, which may evolve over time.

Appendix C: Ten principles of fair software licensing for cloud customers

CISPE and Cigref's 'ten principles of fair software licensing for cloud customers' aim to mitigate harmful practices for customers transitioning to the cloud. These principles serve as a challenge against software vendors using their market positions to restrict choice in the cloud sector, and help to encourage best practice. They include:[179]

(1) **Clear and intelligible licensing terms:** Licensing terms should be clearly written to allow customers to easily determine their costs and obligations. Software vendors should not charge or otherwise penalise customers for failing to comply with any ambiguous, misleading, or confusing license terms.
(2) **Freedom to bring previously purchase software to the cloud:** Customers moving software from on-premises to the cloud should not need to buy new licenses. They should be free from restrictions and additional costs that discriminate against their ability to run licensed software on a cloud provider of their choosing.
(3) **Freedom to run on-premises software on any cloud:** On-premises licenses that allow customers to run software on their own hardware should also allow use on any cloud without extra restrictions.
(4) **Efficient hardware use:** Licensing terms can restrict customers to use a vendor's software on dedicated hardware, which can drive inefficiencies and unnecessary costs. Software vendors should not restrict customers from running workloads on cloud resources.
(5) **Freedom from retaliation for cloud choices:** Vendors should not penalise or retaliate against customers for using their software on other cloud providers' offerings, such as by imposing higher fees.
(6) **Avoiding customer lock-in through interoperable directory software:** Directory software should support open standards for syncing and authenticating user identities without impeding customers from switching from one provider and locking them into a single directory solution.
(7) **Equal treatment for licensing fees in the cloud:** Software pricing should not vary based solely on who owns the hardware, for example in a customer's own data centre or one managed by a third party. Costs should be consistent regardless of where the software is installed.
(8) **Reliable and predictable software use:** Vendors should not materially change license terms to restrict previously permitted uses unless required by law or security concerns.
(9) **Licenses cover expected uses:** Software vendors should not mislead customers by selling licenses that should cover their intended software use but in fact require purchasing additional licenses.
(10) **Fair software transfers:** Where customers have the right to resell and transfer software licenses, vendors should continue to offer support and patches under fair terms to customers who have lawfully acquired a resold license.

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