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Infrastructure as a Service: Are the benefits being achieved?

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Contents

Overview

The previous Government wanted the public to have seamless, integrated, and trusted public services online. To achieve this, it expected public sector organisations (organisations) to make a range of improvements. This included organisations outsourcing information and communications technology (ICT) services to private ICT providers instead of buying and managing ICT infrastructure.

In 2010, the Government Chief Information Office (the GCIO) started work on Infrastructure as a Service, which allows organisations to buy virtual servers, storage services, and backup services from private ICT providers. Organisations can use what they need as their needs change without having to buy new physical infrastructure or change staffing levels. Organisations started using Infrastructure as a Service in 2012/13.

We carried out a performance audit that looked at whether organisations using Infrastructure as a Service and the wider public sector were achieving the benefits expected from it. Although the GCIO has not assessed all of Infrastructure as a Service's expected benefits, we saw some promising signs.

Organisations using Infrastructure as a Service, ICT providers, and the GCIO told us that Infrastructure as a Service is worthwhile and meeting expectations. People we talked to, including those from organisations not using Infrastructure as a Service, consistently understood why it was introduced, how it works, and what it is expected to achieve. This shows that the GCIO has clearly communicated Infrastructure as a Service's expected benefits.

However, some organisations that are required to use Infrastructure as a Service are not using it. This is because they believe it would not benefit them, it is not relevant or fit for their purposes, and it was not affordable.

It is not clear what action the GCIO is taking to ensure that all organisations required to use Infrastructure as a Service will either use it or get an exemption. At the time of our audit, the GCIO had not issued any exemptions.

The GCIO's measures show that organisations using Infrastructure as a Service are achieving benefits, such as:

- consolidation of ICT infrastructure;
- reduced prices for ICT services;
- business savings from avoided procurement costs; and
- cumulative price savings over time.

The costs of managing Infrastructure as a Service are now fully funded by the organisations that use it. This means that, from 1 January 2018, the GCIO reduced the fees that it charges organisations to manage Infrastructure as a Service.

The GCIO commissioned an external review in 2016 that found there have been measureable financial benefits from the more than 20 shared ICT services that the GCIO manages, including Infrastructure as a Service. The scale of the benefits has increased over time, and the review considered that the Government's target of $100 million in annual savings would be achieved in July 2017. The target was exceeded by March 2017.

However, the GCIO does not measure the other benefits realised from using Infrastructure as a Service. The review recommended that the GCIO work with organisations to identify measures that would provide a fuller and deeper understanding of the benefits of shared ICT services.

The GCIO plans to use the review to help it prepare a framework that measures the benefits of all shared ICT services.

We recommend that the GCIO ensure that the information it collects about all shared ICT services gives as thorough an understanding of their benefits as practical. It is likely that this framework would also provide the GCIO with evidence of benefits that it could use to encourage other organisations to use shared ICT services.

At the time of our audit, about a quarter of the organisations that could use Infrastructure as a Service were using it.

We also consider that, as the functional leader for public sector ICT, the GCIO could monitor and report opportunities and risks for ICT infrastructure throughout the public sector and proactively support organisations to move from traditional ICT models to "as a service" models.

Over time, the GCIO could identify those organisations that have started using Infrastructure as a Service to advance their strategic goals and share the benefits this approach is delivering. This would help other organisations understand how Infrastructure as a Service can help to provide easy access to public services online.

The GCIO told us that it will accelerate its implementation of our recommendation that it work with organisations to agree a set of measures for all its shared ICT services. The GCIO will use these measures to consistently monitor the effectiveness and efficiency of the services and report information about their benefits.

We thank the Government Chief Information Officer, the Government Chief Information Office, ICT providers of Infrastructure as a Service, and organisations we contacted for their co-operation with our audit. We also thank Ernst and Young for its significant contribution to our audit.

Greg Schollum
Deputy Controller and Auditor-General

19 February 2018

Recommendation

We recommend that the Government Chief Information Office work with public sector organisations to:

- agree a set of measures for all of its shared information and communications technology services, including Infrastructure as a Service; and
- use these measures to consistently monitor the effectiveness and efficiency of the services and report information about their benefits.

Introduction

1.1 In this Part, we discuss:

- why we did the audit;
- what we audited;
- what we did not audit;
- how we carried out our audit; and
- the structure of our report.

Why we did the audit

1.2 Traditionally, public sector organisations (organisations) build and manage their own information and communications technology (ICT) infrastructure,[1] and store and back up their information.

1.3 In 2010, the Government Chief Information Office (the GCIO[2]) started work on Infrastructure as a Service, which allows a potential pool of about 380 organisations to buy virtual servers, storage services, and backup services from selected private providers of ICT infrastructure services (ICT providers). This means that organisations can use what they need as their business needs change without having to buy new physical infrastructure or change staffing levels.

1.4 Organisations started using Infrastructure as a Service in 2012/13. It was expected to produce significant benefits for organisations.

1.5 Some organisations have used Infrastructure as a Service for about five years. Because it was one of the first shared ICT services,[3] Infrastructure as a Service was expected to play an important role in encouraging organisations to outsource ICT services to ICT providers in an easy, effective, and efficient way.

1.6 We carried out an audit because we wanted to assess whether the GCIO was adequately monitoring and reporting Infrastructure as a Service's progress towards achieving its expected benefits.

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1 ICT infrastructure includes an organisation's hardware (mainly physical servers), software, networks, data centres, facilities, and related equipment, which is used to develop, test, operate, monitor, manage, and support ICT services.

2 The Government Chief Information Officer is also the chief executive of the Department of Internal Affairs. They are supported in their specialist role by the Government Chief Information Office, a business unit in the Department of Internal Affairs. We use the term "the GCIO" to refer to both the Government Chief Information Officer and the business unit. Towards the end of our audit, the Government Chief Information Officer was renamed the Government Chief Digital Officer and the business unit was renamed the Government Chief Digital Office.

3 Shared ICT services are technology services available through the GCIO, which multiple organisations can use to support the delivery of their business aims. Infrastructure as a Service is one of more than 20 shared ICT services. Appendix 1 provides a list of these shared ICT services.

1.7   We also wanted to find out:

- whether the expected benefits from Infrastructure as a Service were being achieved for organisations and for the wider public sector; and

- whether the GCIO was applying lessons to improve its broader implementation and management of changes to public sector ICT infrastructure.

What we audited

1.8   We focused our audit on the GCIO's role because it is the lead agency for Infrastructure as a Service. Part 2 and Appendix 2 have more information about the GCIO's role and the strategic context for shared ICT services.

1.9   Our main audit question was: Are the benefits expected from Infrastructure as a Service being achieved for organisations and the wider public sector?

1.10   We looked at:

- the suitability of the governance arrangements;

- aspects of Infrastructure of a Service's design;

- whether the GCIO clearly communicated Infrastructure as a Service's expected benefits;

- whether the GCIO regularly assesses and reviews progress towards the expected benefits; and

- whether the GCIO is using lessons from implementing Infrastructure as a Service to improve its implementation. This is especially important because the GCIO expected that using Infrastructure as a Service would increase organisations' confidence to use other shared ICT services, such as Telecommunications as a Service, and, eventually, public "cloud" services.[4]

1.11   When the GCIO did not have information specific to Infrastructure as a Service, we looked at evidence about all shared ICT services, such as governance arrangements.

What we did not audit

1.12   We did not look at:

- the procurement process that the GCIO used to select ICT providers to deliver Infrastructure as a Service;

- the contractual arrangements between the GCIO, organisations using Infrastructure as a Service, and ICT providers;

- the suitability of any technical services supplied by the ICT providers; and

- other shared ICT services.

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4   Public cloud services are applications, services, or resources that ICT providers make available to users through the Internet on demand.

How we carried out our audit

1.13   We analysed documents from the GCIO and other organisations involved in Infrastructure as a Service. We also analysed documents that are available online, such as Cabinet papers and general information about shared ICT services.

1.14   We talked to two or more senior individuals from each of six organisations using Infrastructure as a Service for different periods to understand their experience of using it, the effect it has had on their organisation, and their experience of working with the GCIO. We met with chief information officers, chief technical officers, and chief financial officers.

1.15   We interviewed staff from four organisations that were required to use Infrastructure as a Service[5] and two organisations that chose to.[6] We did this to see whether there were any differences in their comments.

1.16   We interviewed seven people from the GCIO who had important roles in managing Infrastructure as a Service.

1.17   We invited the three ICT providers to meet with us. We wanted to get their perspective on the changes that Infrastructure as a Service has made to their work and to their relationships with organisations, and whether the service is performing as planned. Two of the ICT providers accepted our invitation.

1.18   We wrote to selected organisations that are required to use Infrastructure as a Service (excluding district health boards[7]) but that had not yet started using it. We wanted to find out why they are not using it and whether there are any barriers to using it.

The structure of our report

1.19   In Part 2, we discuss why Infrastructure as a Service was established, how it operates, and how it is governed.

1.20   In Part 3, we discuss Infrastructure as a Service's benefits and whether organisations, ICT providers, and the GCIO consistently understand those benefits.

1.21   In Part 4, we discuss how the GCIO assesses and reviews Infrastructure as a Service's benefits, the extra information we looked at to get a deeper

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5   Appendix 3 lists the organisations that are required to use Infrastructure as a Service.

6   So that we could include a variety of organisations in our sample, we considered organisation size, the type of work organisations do, and the sectors the organisations work in. We also considered the GCIO's advice on whether organisations were high, medium, or low users (based on consumption levels, which means the quantity of services an organisation buys) of Infrastructure as a Service.

7   We did not contact the district health boards because we knew that they were part of an unsuccessful joint project co-ordinated by NZ Health Partnerships Limited (NZHP) to adopt Infrastructure as a Service, which had delayed uptake. In 2016/17, NZHP worked with 12 district health boards to help them connect to their preferred ICT provider and with their planning to transition to Infrastructure as a Service.

understanding of its benefits, and what the GCIO could do to better measure the benefits of all shared ICT services.

1.22   In Part 5, we discuss what the GCIO has done to identify and apply lessons from implementing Infrastructure as a Service to improve its broader implementation and management of changes to public sector ICT infrastructure.

How Infrastructure as a Service operates and is governed

2

2.1 In this Part, we discuss:

- why Infrastructure as a Service was established;
- how Infrastructure as a Service operates; and
- the GCIO's governance arrangements for Infrastructure as a Service.

Summary of our findings

2.2 The GCIO has a clearly defined operating model for Infrastructure as a Service that is operating as designed.

2.3 The organisations using Infrastructure as a Service, ICT providers, and the GCIO consistently understood the operating model and could clearly explain their own and each other's roles in implementing Infrastructure as a Service.

2.4 The GCIO has suitable governance arrangements for Infrastructure as a Service that support achieving its expected benefits.

Why Infrastructure as a Service was established

2.5 The GCIO leads the development of the Government's ICT strategy and integrated programme of work.[8]

2.6 The Government expected the GCIO to:

- put in place a new operating model for public sector ICT;
- lead improvements in ICT investment management; and
- reduce the amount of ICT assets that organisations own.

2.7 The Government wanted the public to experience seamless, integrated, and trusted public services online. To achieve this, organisations were expected to make a range of improvements. This included outsourcing ICT services to ICT providers.

2.8 The GCIO introduced Infrastructure as a Service to support the Government's goal of providing a more effective and efficient way for organisations to outsource their ICT services.

2.9 The GCIO's work on Infrastructure as a Service and other shared ICT services also underpinned Result 10 of the Better Public Services initiative,[9] which aimed to give people easy access to public services online. The areas that Result 10 focused on were supported by foundational elements, including common standards and approaches, such as shared ICT services.

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8   The Government we refer to in this report was in power during our fieldwork and until the General Election in October 2017. Some of the roles and responsibilities we describe may change under the current Government.

9   The Better Public Services initiative was launched in 2012 for the public service to focus on 10 significant problems. Information about Better Public Services is available from the State Services Commission's website, at ssc.govt.nz.

2.10   The Government wanted to be a single customer for ICT services from the private sector. Infrastructure as a Service was an early step towards this goal.

Infrastructure as a Service's operating model

2.11   We expected the GCIO to draw from practical experience and use an evidence-based approach when designing Infrastructure as a Service. We also expected the GCIO to have a clear operating model for Infrastructure as a Service.

2.12   When Infrastructure as a Service was created, there were not many examples from overseas governments that the GCIO could use as guidance. This made it difficult for the GCIO to take a strict evidence-based approach to designing Infrastructure as a Service.

2.13   Instead, the GCIO worked with some organisations that would use Infrastructure as a Service to ensure that it would be practical and meet multiple organisations' needs. The design of Infrastructure as a Service is consistent with the GCIO's approach to functional leadership, which is for initiatives to be centrally led and collaboratively delivered.

2.14   The GCIO has a clearly defined operating model for Infrastructure as a Service that is operating as designed. The organisations using Infrastructure as a Service, ICT providers, and the GCIO consistently understood the operating model. They could clearly explain their own and each other's roles in implementing Infrastructure as a Service.

2.15   In establishing Infrastructure as a Service, the GCIO:
- selected three ICT providers and awarded them long-term contracts to deliver services;
- negotiated a set of contracts between the GCIO, ICT providers, and organisations, using standard terms and conditions; and
- charged organisations a monthly fee to recover the costs for putting Infrastructure as a Service in place and to fund its ongoing management.

2.16   Infrastructure as a Service offers three main services to organisations:[10]
- **Utility computing** – organisations specify and buy virtual servers when they need them. As a result, organisations' operating costs increase and decrease in response to demand.
- **Storage as a service** – organisations specify and pay for the disk space needed to store their operating systems and applications data. Organisations can pay for different levels of response times.

10   A range of ancillary services is also available through Infrastructure as a Service.

- **Backup as a service** – a copy of the organisation's data is held on a system in case the original data is lost or damaged. Organisations pay different amounts depending on capacity requirements and the type of storage device (such as tapes or disks) used to store the backup.

2.17   Although ICT providers mostly own and manage the ICT infrastructure used to supply services, there could be times where they host an organisation's ICT assets. This is normally a temporary measure so the organisation can fully depreciate older assets before completely transitioning to Infrastructure as a Service. The transition is more efficient because the ICT provider's hosting environment is already set up and configured for the organisation.

2.18   The GCIO appointed three ICT providers on the Infrastructure as a Service panel. The GCIO has a 10-year contract with each ICT provider to provide services, with an option to renew their contracts for another five years.[11]

2.19   Organisations pick one of the ICT providers from the panel. Each organisation has a contract with the GCIO and a contract with the ICT provider it picked. Appendix 4 sets out more information about the contracts.

2.20   The Government initially funded the GCIO to establish Infrastructure as a Service. The GCIO now charges organisations that use Infrastructure as Service a monthly fee. This fee covers:

- recovering the cost of the process to select ICT providers;
- the annual costs of updating supplier performance reporting, commercial change processes, and the ancillary services that ICT providers make available;
- providing security certification;[12] and
- services and support to organisations.

2.21   In our view, that the GCIO could appoint a panel of approved ICT providers suggests that Infrastructure as a Service met industry standards for service delivery at the time.

2.22   Overseas governments have approached the GCIO for advice on shared ICT services, including service design. This indicates that those overseas governments consider the GCIO's general operating model for shared ICT services, which they say is based on Infrastructure as a Service, is sound and transferrable to other countries.

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11   Two ICT providers' contracts are due for renewal in 2021. The other ICT provider's contract is due for renewal in 2022.

12   This involves the GCIO checking that services available through Infrastructure as a Service meet security requirements. The certificate will tell organisations wanting to buy the service what checks the GCIO performed and whether there are any residual risks that organisations should be aware of.

Governance arrangements

2.23   We expected that, to achieve Infrastructure as a Service's benefits (which we discuss in Part 3), the GCIO would have a clear strategic direction that is supported by suitable governance arrangements.

2.24   The GCIO has put suitable governance arrangements in place. The *Government ICT Strategy 2015* and *Integrated Work Programme*[13] are clear and provide the direction and expected benefits from Infrastructure as a Service. Infrastructure as a Service is in both documents as part of the focus on introducing shared ICT services to provide better public services online.

2.25   The GCIO has governance bodies for the shared ICT services at the strategic and operational level. This is appropriate because of the need to align Infrastructure as a Service with other shared ICT services and because of its maturity. The governance arrangements align with the *Government ICT Strategy 2015* and *Integrated Work Programme* to enable Infrastructure as a Service to be consistently delivered.

2.26   The documentation that supports the governance arrangements and design of Infrastructure as a Service sets out:

- the business case outlining its establishment, expected benefits, and options analysis;
- roles and responsibilities;
- terms of reference for the strategic governance group; and
- the set of standard legal contracts.

13   The strategy and work programme are available from ict.govt.nz.

Understanding what Infrastructure as a Service is meant to achieve

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3.1   In this Part, we discuss:

- the benefits expected from Infrastructure as a Service; and
- whether organisations consistently understood the expected benefits.

Summary of our findings

3.2   Staff in organisations using Infrastructure as a Service could clearly explain why they used it, and most of them could give us documentation supporting their decision to do so.

3.3   The GCIO's staff understood what the expected benefits for individual organisations and the wider public sector were.

Benefits expected from Infrastructure as a Service

Consolidating demand

3.4   Infrastructure as a Service consolidates demand by having three ICT providers provide physical and virtual infrastructure for a potential pool of about 380 organisations. ICT providers also employ the staff needed to look after the infrastructure and provide services.

3.5   Consolidating demand leads to efficiencies, such as reduced operating overheads for data centre power, air conditioning, networking, property costs, and physical and cyber security. Fewer people should be needed to manage the ICT infrastructure,[14] and responses to cyber-security incidents and natural disasters should be more efficient.

Reduced duplication and capital spending

3.6   Organisations that use Infrastructure as a Service do not need to buy as many ICT assets, so capital spending by organisations should reduce.

3.7   There should be less ICT infrastructure in total and less waste because there is less duplication of assets. When organisations own their ICT assets, it is common for them to own spare assets (which incurs costs), and they do not always make the best use of assets that are in use.

Better resource management, service levels, and risk management

3.8   Infrastructure as a Service allows organisations to use only the resources they need and pay only for what they use.

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14   For example, if an organisation needed two people to look after 100 servers, an ICT provider would need fewer than 20 people to look after 1000 servers.

3.9   Organisations' business units are also expected to get faster service, because ICT providers are contractually obliged to be ready to respond to changing business needs, such as sudden increases in demand.

3.10   When organisations own their infrastructure, their business units often need to wait while their ICT teams buy, receive, and configure extra servers and put them into use, which could take weeks.

3.11   ICT providers are more easily able to provide a consistent and quality service because they can recruit specialist staff more easily than some organisations. They also have access to new technologies that can help the effectiveness and efficiency of services. ICT providers can also mitigate risks more effectively and efficiently than most organisations.

3.12   Infrastructure as a Service is expected to reduce risk at the organisation level by:

- **improving cyber security** – ICT providers have more consistent and rigorous processes for meeting government security requirements; and

- **increasing resilience** – ICT providers have the capacity, equipment, and expertise to prevent potential interruptions to services and can respond more effectively when interruptions happen.

Reduced total cost of owning ICT infrastructure

3.13   Organisations using Infrastructure as a Service should own less ICT infrastructure, which means their total cost of ownership should decrease. The total cost of ownership is an estimate of the total costs of goods, services, or construction works over the whole of the infrastructure asset's life.[15] How much the total cost of ownership will decrease for organisations using Infrastructure as a Service will vary.

3.14   To understand whether Infrastructure as a Service would decrease their total cost of ownership, organisations need to calculate their current total cost of ownership. Examples of the costs that organisations should include in their analysis include:

- insurance;

- floor space;

- electricity to run the servers and cool the room the servers are kept in;

- network equipment;

- service contracts with the seller for three to five years;

- depreciation;

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15   For example, the initial purchase price of infrastructure assets plus installation costs, operating costs, and maintenance minus the residual value on disposal. See Ministry of Business, Innovation and Employment (2013), *Total cost of ownership: An introduction to whole-of-life costing*, page 1, www.procurement.govt.nz.

- upgrades and maintenance; and

- the cost of employing staff with the right expertise to look after the infrastructure to an acceptable standard.

3.15   Because ICT providers were to provide services to a potential pool of about 380 organisations for 10-15 years, the GCIO wanted better commercial terms than individual organisations could negotiate. The GCIO negotiated with ICT providers that prices for services would decrease as the quantity of services consumed through Infrastructure as a Service increases.

Procurement savings

3.16   Normally, once an organisation has decided to outsource its ICT services, procurement consists of two stages:

- an organisation puts together a shortlist of ICT providers; and

- an organisation chooses and negotiates a contract with its preferred provider from the shortlist.

3.17   Organisations using Infrastructure as a Service do not have to go through the entire procurement process when deciding which ICT provider to use. They can choose their preferred ICT provider from a panel and decide which services they want to buy. Organisations also save time and costs because the GCIO provides security certifications for services available through Infrastructure as a Service.

3.18   The GCIO has a standard set of procurement contracts. This saves the time and cost of preparing individual contracts. It also ensures that all organisations and ICT providers operate under the same terms and conditions. These standard contracts also mean that organisations do not need procurement and legal expertise or outside help. The contracts allow for new services to be introduced.[16]

3.19   Because the GCIO's contracts with ICT providers are for 10-15 years, organisations do not need to independently re-test the market during that period. One of the main reasons that organisations want to re-test the market is to get a better price on services.

Organisations' understanding of expected benefits

3.20   We expected the GCIO's staff and organisations to have a consistent understanding of Infrastructure as a Service's expected benefits.

3.21   The GCIO's staff could clearly explain the expected benefits from Infrastructure as a Service. Staff could also explain how Infrastructure as a Service contributes

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16   Any new services that an organisation or ICT provider wants to introduce through Infrastructure as a Service are automatically made available to other organisations after the GCIO has ensured that the change is within the scope of the original procurement and has approved the change. This provides an opportunity for improvements to be taken up quicker.

to the Government's strategic goals, such as achieving efficiencies for the wider public sector by consolidating demand and improving service delivery.

3.22 Staff from organisations using Infrastructure as a Service could clearly explain why they used it, and most of them could give us documentation supporting their decision to do so. The reasons people gave, which were consistent with the expected benefits, included:

- to reduce their infrastructure risk;

- to reduce the total cost of ownership and get greater transparency about costs;

- to improve service performance; and

- that they had ageing or deficient ICT infrastructure.

3.23 Some people also said that their organisation used Infrastructure as a Service because their organisation was required to use it.

Assessing the benefits of Infrastructure as a Service

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4.1   In this Part, we:

- estimate the benefits of Infrastructure as a Service from the measures that the GCIO uses;
- discuss the deeper understanding of Infrastructure as a Service's benefits we got from our work; and
- discuss the need for the GCIO to better measure the benefits of all shared ICT services.

Summary of our findings

4.2   The GCIO collects information about three main measures. These measures assess the consolidation of demand and the benefits resulting from economies of scale.

4.3   The GCIO could improve the methods it uses to calculate benefits for two of its measures – "organisation uptake" and "business savings" – to reduce the risk of understating or overstating benefits. Nevertheless, demand has been consolidated and monetary benefits have been achieved.

4.4   People we talked to from ICT providers, the GCIO, and organisations using Infrastructure as a Service consider that Infrastructure as a Service is worthwhile and meeting expectations. Organisations were generally satisfied with their provider's performance in delivering the agreed services and levels of service under their contract.

4.5   In 2016, the GCIO had a private firm independently review the GCIO's assessment of business savings for all its shared ICT services, including Infrastructure as a Service. The review found that there have been measureable financial benefits, which have increased over time and would reach the Government's target of $100 million annual savings in July 2017. The target was exceeded by March 2017.

4.6   The reviewer recommended that the GCIO work with organisations to identify measures that better represent the range of benefits from shared ICT services and that could be consistently applied to all organisations that subscribe to these services. The GCIO plans to use the reviewer's report to help prepare a measureable framework for all shared ICT services.

Estimated benefits from the GCIO's measures

4.7   When Infrastructure as a Service was introduced, the GCIO was to collect information that accurately assessed progress towards achieving each of the expected benefits from Infrastructure as a Service and its use by organisations.

4.8   However, it was not practical for the GCIO or the organisations using Infrastructure as a Service to routinely and cost-effectively collect information about all the expected benefits.

4.9   Instead, the GCIO uses three main measures to assess and review Infrastructure as a Service's benefits:

- **uptake** – the number of organisations using Infrastructure as a Service, which is a proxy for consolidation;
- **price reductions for services** – services that are available through Infrastructure as a Service; and
- **business savings** – estimated as part of the GCIO's work to estimate sustainable annual savings for all shared ICT services.

4.10   These measures help assess the consolidation of demand for ICT infrastructure and the benefits resulting from economies of scale. For example, it is easier to reach the consumption levels needed to trigger price reductions for services when more organisations use Infrastructure as a Service.

4.11   The GCIO reports on some or all of the measures:

- to the relevant governance committee in the Department of Internal Affairs;
- in the Department's quarterly reports to the Minister of Internal Affairs; and
- to Cabinet at agreed intervals.[17]

What the measures show

4.12   The GCIO's measures show that:

- depending on the method used, between 76 and 100 organisations are using Infrastructure as a Service for some ICT infrastructure;
- the price reduction targets that the GCIO negotiated with ICT providers have been met and prices have reduced; and
- business savings for all shared ICT services have increased over time and exceeded the Government's target of $100 million annually by March 2017.

Limitations to the measures

4.13   The measures do not show the other benefits from using Infrastructure as a Service.

17 Some information is available on the GCIO's website at ict.govt.nz.

4.14   The "uptake" and "business savings" measures are less reliable than the "price reductions for services" measure:

- The GCIO does not calculate uptake in a consistent way, which is why the number of organisations that the GCIO reports using Infrastructure as a Service can vary.

- There are also some limitations with the way the GCIO calculates business savings, which we discuss below.

4.15   In 2016, the GCIO had a private firm independently review progress towards the Government's savings target of $100 million annually from 2017/18 for all shared ICT services, including Infrastructure as a Service. The reviewer took a conservative approach and largely agreed with the GCIO's estimates. The reviewer found that savings would reach the target by July 2017. The target was exceeded by March 2017.

4.16   To confirm the GCIO's estimates for Infrastructure as a Service, the reviewer assessed the procurement savings and cumulative price savings for services over time. The reviewer had some reservations about the savings estimates for Infrastructure as a Service because of the GCIO's static market pricing method and the limited data set used.

4.17   The static market pricing method calculates savings achieved based on the market rates when Infrastructure as a Service was introduced. Since then, prices have reduced by arrangement and from competition. The static market pricing method could overstate savings. The reviewer commented that, in the future, the GCIO might consider using a flexible pricing method based on current market demands to calibrate the results of its static marketing method.

4.18   Savings estimates were based on two organisations' business cases for adopting Infrastructure as a Service. The GCIO said that each organisations' circumstances are different. This means that such a small sample is unlikely to represent the savings achieved by all organisations using Infrastructure as a Service.

Getting a deeper understanding of the benefits of Infrastructure as a Service

4.19   To get a deeper understanding of the benefits of Infrastructure as a Service and whether there are any real or perceived barriers to increasing organisations' uptake and use of it, we:

- asked people about Infrastructure as a Service's benefits;

- looked at how ICT providers' performance is monitored; and

- looked at information about the costs to manage Infrastructure as a Service.

What people said about Infrastructure as a Service

Staff in the organisations using Infrastructure as a Service

4.20 Staff in the organisations using Infrastructure as a Service said that they consider the service part of their normal operations. Their focus is now on working out which of the other shared ICT services they should use next.

4.21 This suggests that Infrastructure as a Service has been successful in helping organisations change from a traditional model of managing ICT services themselves to an "as a service" model.

4.22 People said that, through Infrastructure as a Service:
- they have increased cost transparency;
- they can respond quickly to changing business needs;
- prices for the services have reduced;
- procurement is faster and efficient, which means that staff can do other work;
- ICT infrastructure risks have reduced, because ICT providers are able to apply government security requirements more consistently and rigorously; and
- the potential for interruptions to their business is reduced.[18]

4.23 People said that they were using Infrastructure as a Service effectively as a utility but that they were yet to move to the next stage of using it to encourage innovation and help advance their organisation's strategic goals.

People from ICT providers

4.24 The GCIO designed Infrastructure as a Service to encourage ICT providers to improve the range of ancillary services available and increase the effectiveness and efficiency of services. The ICT providers we talked to consider that they have more constructive and closer working relationships with organisations because of Infrastructure as a Service's design.

Staff from the GCIO

4.25 The GCIO considers that Infrastructure as a Service is successful because it changed the operating model of organisations from a traditional ICT infrastructure model to an "as a service" model for at least some of their operations. This means that demand has been consolidated to some extent.

4.26 The GCIO points to the number of organisations that chose to use Infrastructure as a Service as a sign that it is worthwhile. The GCIO considers that Infrastructure as a Service has also led to organisations' interest in using public cloud services, which the GCIO supports.

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18 For example, organisations did not experience network outage or information loss after the 14 November 2016 earthquake, and ICT was quickly operational for organisations that needed to shift out of their buildings.

4.27   The GCIO said that, for organisations with old ICT infrastructure, poor maintenance or security practices, inadequate backups or staffing, and poor service levels, using Infrastructure as a Service delivered immediate improvements. It might also increase these organisations' total cost of ownership because they had underinvested before.

4.28   The extent to which service levels improved or individual organisations' total cost of ownership increased or decreased is not clear because the GCIO has not collected the before-and-after data.

Staff from organisations not using Infrastructure as a Service

4.29   The GCIO's reporting on uptake does not distinguish between organisations required to use Infrastructure as a Service and organisations choosing to use Infrastructure as a Service. The GCIO could not give us data on any barriers to organisations using Infrastructure as a Service it had identified.

4.30   Therefore, we asked some staff from organisations that are required to use Infrastructure as a Service why they are not using it. Their comments suggested that they understand the expected benefits of Infrastructure as a Service but did not accept that it would produce enough benefits for them. Their main reasons for not using Infrastructure as a Service were that:

- benefits would be few;

- Infrastructure as a Service does not align with their ICT strategy; and

- there are barriers to entry, such as:
    - financial constraints;
    - service complexity;
    - current infrastructure; and
    - the effort needed to implement Infrastructure as a Service.

4.31   Between them, the organisations said that they did not see Infrastructure as a Service:

- improving their security profile;

- providing technological innovation that they could take advantage of without extra investment;

- providing much benefit in terms of ability to scale up and down on demand so that they do not need to allow for future demand; and

- providing much benefit in:
    - making costs transparent so that they could know what they are paying for and could manage their budget better; and
    - shifting the workload to allow them to focus on their core business without worrying about ICT provisioning and management.

4.32 The organisations were satisfied that the GCIO had appropriately informed them about Infrastructure as a Service at the right time in their decision-making. We asked the organisations to say what extra support the GCIO could offer to make it easier for them to use Infrastructure as a Service in the future. They said that:

- no additional support was required;
- Infrastructure as a Service is not relevant or fit for their purposes; and
- Infrastructure as a Service was not affordable.

4.33 We shared the organisations' comments with the GCIO. The GCIO said that the comments aligned with its own understanding of the reasons organisations do not use Infrastructure as a Service. The GCIO also said that some organisations want to use public cloud services and do not want to do this through Infrastructure as a Service.

4.34 One of the benefits expected from Infrastructure as a Service is that organisations would understand their total cost of ownership of ICT infrastructure, even if they decide not to use it.

4.35 The GCIO said that some organisations' cost modelling for using Infrastructure as a Service is flawed because the organisations did not assess total cost of ownership. For example, the GCIO said that some organisations exclude employee costs from their analysis, which underestimates the financial benefits that Infrastructure as a Service could deliver.

4.36 It is not clear what action the GCIO is taking to ensure that all organisations required to use Infrastructure as a Service will use it or get an exemption. At the time of our audit, the GCIO had not issued any exemptions.

Providers' performance

4.37 Providers send organisations' monthly service performance and delivery reports that summarise, for example, contacts between them during the previous month, information about resolved and outstanding issues, and reports on any unplanned events. The reports will also show whether organisations are paying for what they are not using.

4.38 The monthly reports follow a template developed by the GCIO, which ensures that each organisation gets a consistent set of data regardless of which provider they use.

4.39 The people we talked to were generally satisfied with their provider's performance in delivering the agreed services and levels of service under their contract. The small sample of monthly reports we looked at confirmed what people said.

Management costs for Infrastructure as a Service

4.40   We asked the GCIO for information about its costs for managing Infrastructure as a Service from 2010/11 to 2016/17 compared to the revenue it gets from organisations' monthly fees.

4.41   The fees organisations pay to the GCIO now cover the GCIO's costs of managing Infrastructure as a Service. This improvement in the GCIO's overall financial position is because more services are being used through Infrastructure as a Service, confirming that demand is consolidating.

4.42   The GCIO reviews the fee every year. Until 31 December 2017, the GCIO set the monthly fee at 2.5% of the organisations' monthly payment to ICT providers. Because the costs of establishing Infrastructure as a Service have been recovered, the monthly fee was reduced to 1.5% of the organisations' monthly payment to ICT providers from 1 January 2018.

4.43   Figure 1 shows that the revenue that the GCIO received from organisations exceeded costs for the first time in 2013/14. The GCIO's overall financial position for Infrastructure as a Service was positive for the first time in 2016/17.

Figure 1
The GCIO's overall financial position for managing Infrastructure as a Service, revenue, and costs, from 2010/11 to 2016/17
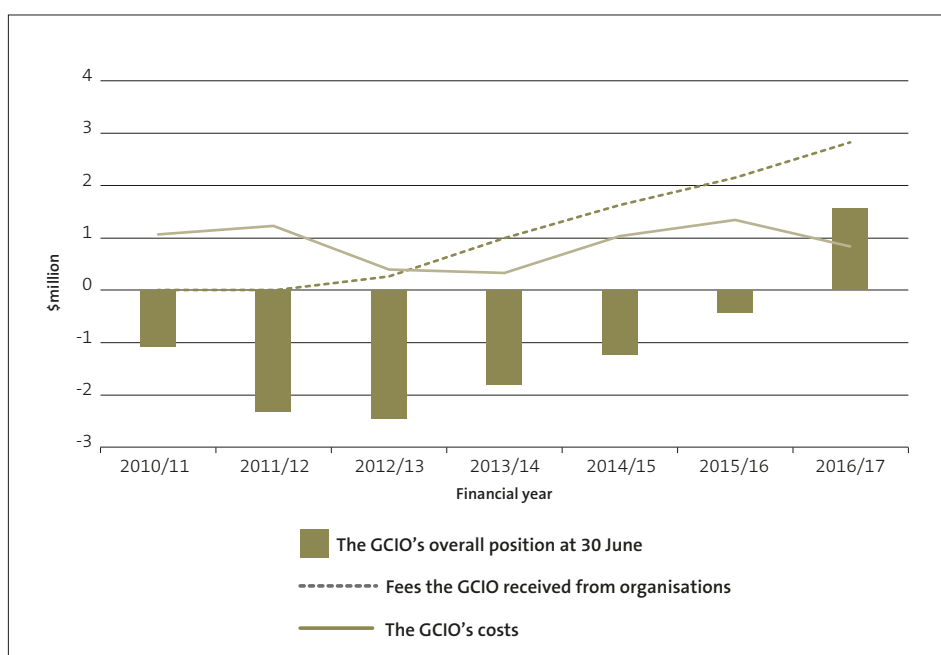
Source: The Government Chief Information Office.
Note: There was a lag between designing Infrastructure as a Service and organisations starting to use services because it can take months for organisations to transition from an in-house model to Infrastructure as a Service. This means that organisations did not start to pay monthly fees until 2012/13.

Measuring the benefits of all shared ICT services better

4.44   The independent reviewer that the GCIO used in 2016 recommended that the GCIO work with organisations to identify measures for the benefits of shared ICT services, which could be consistently applied to all organisations that subscribe to the services.

4.45   The GCIO plans to use the reviewer's report to help prepare a measureable framework for all shared ICT services. The GCIO has not yet set a timetable for this work, and we consider that it should.

4.46   It is likely that, as well as demonstrating fuller accountability for the benefits of each shared ICT service and the funds organisations pay the GCIO to manage them, generating a deeper understanding of benefits would provide the GCIO with evidence that it could use to support greater uptake and use.

4.47   We encourage the GCIO to take this opportunity to ensure that the information it collects about all shared ICT services provides as thorough an understanding of their benefits as practical.

Recommendation

We recommend that the Government Chief Information Office work with public sector organisations to:

*   agree a set of measures for all of its shared information and communications technology services, including Infrastructure as a Service; and

*   use these measures to consistently monitor the effectiveness and efficiency of the services and report information about their benefits.

Applying lessons from Infrastructure as a Service

<div style="text-align: right; font-size: large;">**5**</div>

5.1   In this Part, we discuss whether the GCIO uses lessons from implementing Infrastructure as a Service to improve its broader implementation and management of changes to public sector ICT infrastructure.

Summary of our findings

5.2   The GCIO has not taken a structured approach to identifying lessons from implementing Infrastructure as a Service. However, the GCIO said that it has used lessons from implementing Infrastructure as a Service to design other shared ICT services.

5.3   People we talked to said that they would appreciate the GCIO finding ways to proactively share organisations' experiences of implementing Infrastructure as a Service to help them get more value from it.

5.4   We consider that, as the functional leader for public sector ICT, the GCIO could monitor and report opportunities and risks for ICT infrastructure throughout the public sector and proactively support organisations to increase the capabilities needed to move from traditional ICT models to "as a service" models.

Identifying and applying lessons from the implementation of Infrastructure as a Service

5.5   We expected the GCIO to take a structured approach to reviewing Infrastructure as a Service's implementation and make adjustments, as needed, to improve its effectiveness and efficiency. We expected the GCIO to:

- understand organisations' experiences of joining Infrastructure as a Service;
- share insights with organisations that are not using Infrastructure as a Service and encourage them to use it; and
- transfer applicable lessons from implementing Infrastructure as a Service to the design and implementation of other shared ICT services.

5.6   The GCIO could not supply us with evidence that it took a structured approach to identifying lessons from implementing Infrastructure as a Service.

5.7   The GCIO said that, in practice, it has used its experience in implementing Infrastructure as a Service to design and implement other shared ICT services. The features of Infrastructure as a Service that it says have been carried over to other shared ICT services include:

- collaborative working;
- setting up panels of approved ICT providers;
- using standard legal contracts;

- using collective bargaining power to get beneficial commercial terms and conditions; and

- a cost-recovery approach to fund the establishment of a shared ICT service and the GCIO's continuing management of it.

5.8 The GCIO has not systematically asked organisations for information about their experiences in using Infrastructure as a Service to make improvements or share useful practices, including identifying and addressing any barriers to uptake.[19]

5.9 For example, the people we talked to said that they would have valued the GCIO providing scenarios or case studies that show what other organisations have done, show whether those organisations achieved the benefits that they expected and how, and share tips on avoiding problems and risks.

5.10 Over time, the GCIO could identify organisations that have started using Infrastructure as a Service to advance their strategic goals and share the benefits this approach is delivering. This would help other organisations understand how Infrastructure as a Service can help to provide easy access to public services online.

5.11 The GCIO considers that generic scenarios and case studies would not help because each organisation's circumstances are unique. Instead, the GCIO uses a relationship management model to work with organisations individually, at the organisation's request.

5.12 The GCIO's staff do not document their knowledge about the organisation's relationship with the GCIO and Infrastructure as a Service, which means the information could be lost when staff leave the organisation.[20]

5.13 This creates a risk of undermining the GCIO's relationship management approach. It also means that data is not available to produce scenarios or to spot trends in the issues that organisations raise with the GCIO.

5.14 In our view, the GCIO could supplement its customised and responsive approach by proactively providing general information that organisations can get from the GCIO's website.

5.15 In implementing Infrastructure as a Service, the GCIO mainly focused on its procurement aspects. These are important but are not the only element. For example, the GCIO is also responsible for giving Cabinet assurance that organisations and the wider public sector are identifying ICT risks and managing them well.

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19 Lessons could include reasons why an organisation stops using Infrastructure as a Service.

20 For example, the GCIO does not keeps records of issues that organisations raise at operational meetings that discuss Infrastructure as a Service, because the GCIO wants to encourage free and frank conversations.

5.16   However, the GCIO could not supply us with a report showing how the high-level ICT infrastructure profile for the potential pool of about 380 organisations that could use Infrastructure as a Service has changed since Infrastructure as a Service was introduced.

5.17   We consider that, as the functional leader for public sector ICT, the GCIO could:

- monitor and report opportunities and risks for ICT infrastructure throughout the public sector, including:
    - providing a high-level view of ICT infrastructure in the wider public sector;[21]
    - leading initiatives to address opportunities and risks that Infrastructure as a Service might have introduced in the wider public sector; and
- proactively support organisations to increase the capabilities needed to move from traditional ICT models to "as a service" models.

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21 For example, it would be useful to know what proportion of organisations are using an "as a service" model for ICT infrastructure, even if they are not using Infrastructure as a Service.

Appendix 1
List of shared information and communications technology services

The GCIO has promoted and facilitated the use of "as a service" models for ICT. Organisations can use most of the shared ICT products and services in any order – they do not need to use Infrastructure as a Service first. A description of each shared ICT service is on the GCIO's website, ict.govt.nz, in the products and services section.

The shared products and services that were available at 8 February 2018 were:

1. Amazon Web Services Cloud Framework Agreement;
2. Common Web Platform;
3. Confirmation Service;
4. Desktop as a Service;
5. Domain Name System Service;
6. Enterprise Content Management as a Service;
7. GCIO Assurance Services Sub-panel;*
8. HPE Software Framework Agreement;
9. Human Resource Information System;
10. ICT Security and Related Services Panel;*
11. Infrastructure as a Service;*
12. IT Managed Services;
13. Microsoft Licensing Framework Agreement;
14. One.govt;*
15. Oracle Software Framework;
16. RealMe Login Service;*
17. RealMe Verified Account Service;*
18. Retrieval Service;
19. Secure encrypted email (SeeMail);
20. Shared Workspace;
21. Telecommunications as a Service; and
22. Web Services Panel.

* Mandated shared ICT services, which organisations covered by the GCIO's mandate are required to use unless they are exempt.

Appendix 2
The Government Chief Information Officer's role and the strategic context

The Government Chief Information Officer is the "functional leader" for public sector ICT. The role is based on the principle of ICT work being centrally led (mostly by the GCIO) and collaboratively delivered (with organisations and ICT providers).

In June 2013, the Government's *ICT Strategy and Action Plan to 2017* was approved. The GCIO worked with organisations and the Government to revise the strategy in 2015 to ensure that, in a changing technology environment, it could achieve the Government's aim of ICT-enabled transformation of public services. The strategy's aims include:

- getting better results from existing spending (such as organisation modernisation initiatives) for the benefit of the wider public sector;
- adopting shared ICT services where possible (including Infrastructure as a Service);
- giving organisations easy access to innovations from the ICT industry;
- sharing policies, standards, and business models throughout the wider public sector; and
- organisations' ICT teams working with other business units to encourage innovation.

The GCIO is expected to work with organisations to help them understand the benefits of shared ICT services, accelerate organisations' use of shared ICT services, and report on organisational uptake and the benefits delivered by shared ICT services.

Organisations that must send Four Year Plans to the Treasury must include their plans to use shared ICT services.[22] The GCIO reviews organisations' ICT investment cases. In performing its reviews, the GCIO looks at whether organisations are using or planning to use shared ICT services. If organisations apply, the GCIO can exempt organisations required to use certain shared ICT services from using them.

The GCIO is responsible for giving Cabinet assurance that organisations and the wider public sector are identifying ICT risks and managing them well and that the benefits of ICT investments are being delivered.

More information about the GCIO's assurance role is on its website, ict.govt.nz. The GCIO's role is explained in more detail in a Cabinet paper titled *Implementing the functional leadership of Government ICT*, SEC (12) 81, which is available on the State Services Commission's website, ssc.govt.nz.

The Government's expectations of the GCIO align with Cabinet Circular CO (15) 5, *Investment Management and Asset Performance in the State Services*, which took effect from 1 July 2015. Over time, the Government wanted to encourage the expected benefits of an investment to be achieved. It also wanted:

- assets to be operated near their optimal levels of performance; and

- organisations to use any lessons from investments' performance to inform and improve the development of future investment activity; and

- lessons to be identified at the individual organisation level and for the wider public sector.

Appendix 3
List of organisations required to use Infrastructure as a Service

The organisations required to use Infrastructure as a Service are:

- all public service departments (there were 31 organisations in this group on the State Services Commission's list, which was last updated on 7 February 2018);

- 27 Crown agents, including all the district health boards; and

- five non-public service departments.

The first tranche of organisations required to use Infrastructure as a Service did not include the district health boards, which were included later.

1. Accident Compensation Corporation
2. Crown Law Office
3. Department of Conservation
4. Department of Corrections
5. Department of Internal Affairs
6. Department of the Prime Minister and Cabinet
7. Earthquake Commission
8. Education Review Office
9. Government Communications Security Bureau
10. Housing New Zealand Corporation
11. Inland Revenue Department
12. Land Information New Zealand
13. Ministry for Children, Oranga Tamariki
14. Ministry for Culture and Heritage
15. Ministry for Pacific Peoples
16. Ministry for Primary Industries
17. Ministry for the Environment
18. Ministry for Women
19. Ministry of Business, Innovation and Employment
20. Ministry of Defence
21. Ministry of Education
22. Ministry of Foreign Affairs and Trade
23. Ministry of Health
24. Ministry of Justice
25. Ministry of Māori Development
26. Ministry of Social Development

27.   Ministry of Transport

28.   New Zealand Customs Service

29.   New Zealand Defence Force

30.   New Zealand Police

31.   New Zealand Qualifications Authority

32.   New Zealand Security Intelligence Service

33.   New Zealand Trade and Enterprise

34.   New Zealand Transport Agency

35.   Office of the Clerk of the House of Representatives

36.   Parliamentary Counsel Office

37.   Parliamentary Service

38.   Serious Fraud Office

39.   State Services Commission

40.   Statistics New Zealand

41.   Te Kāhui Whakamana Rua Tekau mā Iwa – Pike River Recovery Agency

42.   Tertiary Education Commission

43.   The Treasury

44-63.   District health boards

Appendix 4
The Infrastructure as a Service contracts

Infrastructure as a Service ensures that all organisations get the same quality of service – for the level of service they buy – on the same terms and conditions.

The GCIO has a detailed, lengthy contract with each provider (called a **lead agency agreement**) that sets out the framework for operating Infrastructure as a Service and details the relationships between, and responsibilities of, the GCIO, ICT providers, and participating organisations. Among other matters, the lead agency agreement makes ICT providers responsible for telling the GCIO about new or improved technology or other changes that could improve or affect Infrastructure as a Service.

Two other contracts create back-to-back arrangements with the lead agency agreement. The contracts must be read alongside the lead agency agreement and are relatively short. The contracts are:

- a **memorandum of understanding** between the organisation and the GCIO, which includes arrangements for organisations to pay a monthly administration fee to the GCIO to pay for the costs involved in establishing and managing Infrastructure as a Service; and

- a **participating agency agreement** between the organisation and their preferred ICT provider, which sets out:
  - a plan for organisations to transition to Infrastructure as a Service;
  - the services and service levels that ICT providers will deliver after the move; and
  - prices for the services that organisations plan to use.

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