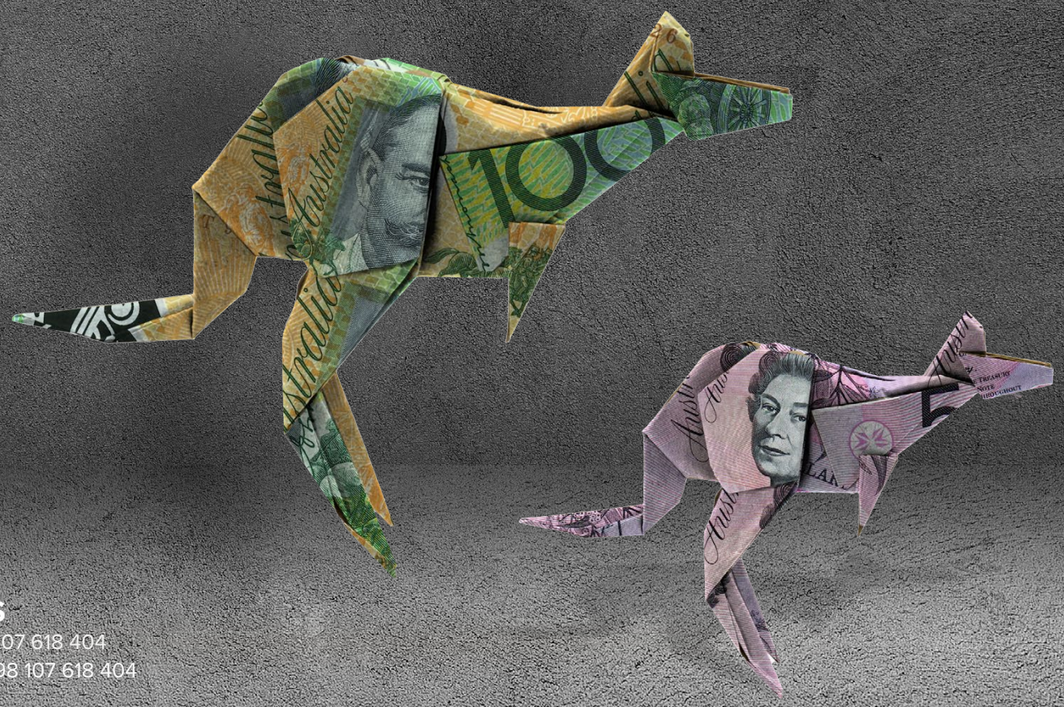
# The economic impact of Software as a Service in Australia.

2021

Insight Economics
Public Policy Corporate Strategy

IBRS | ANALYSIS INSIGHT JUDGEMENT

**It's too big to ignore.**



**IBRS**
ACN: 107 618 404
ABN: 98 107 618 404

**Insight Economics Pty Ltd**
ACN: 141 097 565
ABN: 29 627 712 906



**Executive Summary**
**p. 06**

**Chapter 1:**
Project background & method
**p. 24**

**Chapter 2:**
The direct economic impacts of Software as a Service
**p. 40**

**Chapter 3:**
The wider economic potential of Software as a Service to Australia
**p. 122**

**Chapter 4:**
Implications for governments & businesses
**p. 142**

**Appendix A:**
Key assumptions & data
**p. 148**

**Appendix B:**
The Monash Multi-Regional Forecasting (MMRF) Model
**p. 165**

**Appendix C:**
Bibliography
**p. 166**

## Foreword

In the last two decades, the rise of cloud computing and Software as a Service (SaaS) in particular, has fundamentally changed perceptions of how, where and who delivers technology solutions to an organisation.

Hearing the anecdotal benefits from our customers who have modernised their software environments and transformed their businesses, I wondered how significant the impact would be if all businesses and government entities started on the same transformation journey.

Much has been written about the benefits of the cloud to Australian organisations, but few rigorous studies have been conducted to explore direct savings, productivity impact and broader national interests.

To better understand the potential benefits of cloud technologies, and the cumulative economic benefit to Australia, TechnologyOne commissioned IBRS and Insight Economics to undertake research into the economic impact of SaaS – the first of its kind ever conducted in Australia.

The research looks at six key industry sectors – local government, state and federal government, higher education, health and aged care, asset and project intensive, and corporate and financial services.

Bringing together information from a wide variety sources and face-to-face interviews with business leaders in these key sectors, the evidence suggests that cloud technologies, in particular SaaS, have the potential to deliver substantial cost savings to organisations.

The savings come from reductions in the cost of ICT ownership and maintenance, and productivity improvements associated with the automation and simplification of business processes.

These savings can in turn be redirected to fund critical investment in infrastructure, services and roles across these industries, setting the scene for Australia to build on this momentum and set up a platform for generations of growth.

Accelerating the adoption of SaaS has the potential to add hundreds of billions of dollars to the economy over the next decade, transforming Australia and the digital lives of its citizens.

As a proudly Australian company, TechnologyOne is committed to seizing this moment by supporting organisations to make the leap to the most modern core business technologies.

We understand the challenge for businesses and government agencies in investing in these technologies ahead of realising efficiencies, especially when the economy is still in recovery mode, and are focused on how we can enable this acceleration.

I trust this report provides valuable insights to organisations on the realistic organisational impacts of moving to cloud, as well as quantifying the wider economic benefits for the Australian economy.

**Edward Chung**
Chief Executive Officer
TechnologyOne

# Executive Summary.

## What is Enterprise Resource Planning?

Enterprise Resource Planning (ERP) is a category of software that public and private organisations use to manage day-to-day business activities such as accounting, procurement, HR and payroll, document management, project management, customer relationship management, business analytics, risk management, regulatory compliance, asset management and supply chain operations.

## What is Software as a Service?

When ERP software is delivered as-a-Service in the cloud, it runs on a highly resilient pool of remote servers that are managed by high levels of automation and the vendor's staff, rather than from an on-premises data centre or server room managed by an organisation's own ICT staff. This is known as Software as a Service, or SaaS.

The SaaS provider manages and updates the software several times a year, using remotely distributed data centres. This enables organisations to realise operational efficiencies through a more agile software service and enable the avoidance of capital costs associated with maintaining hardware on-premises.

A number of Australian governments and businesses have been slow to adopt cloud due to the complexity of decommissioning legacy, aging software solutions, while others are adopting hybrid strategies that involve keeping both on-premise and adopting the cloud.

At the same time, however, there are still significant segments of both the public and private sector that have evaluated the potential for improved capability and cost efficiencies from ICT strategies that preference the cloud.

These cost savings and productivity benefits can in turn enable scarce public funds or private investment dollars to go towards higher, better uses than they otherwise would have, and/or can increase organisational output or sales compared to what would otherwise have occurred.

To realise these benefits, however, governments and businesses must successfully navigate potential transition costs and risks. While these benefits can be understood at a conceptual level, little data is available for the quantification of these benefits in Australia today.

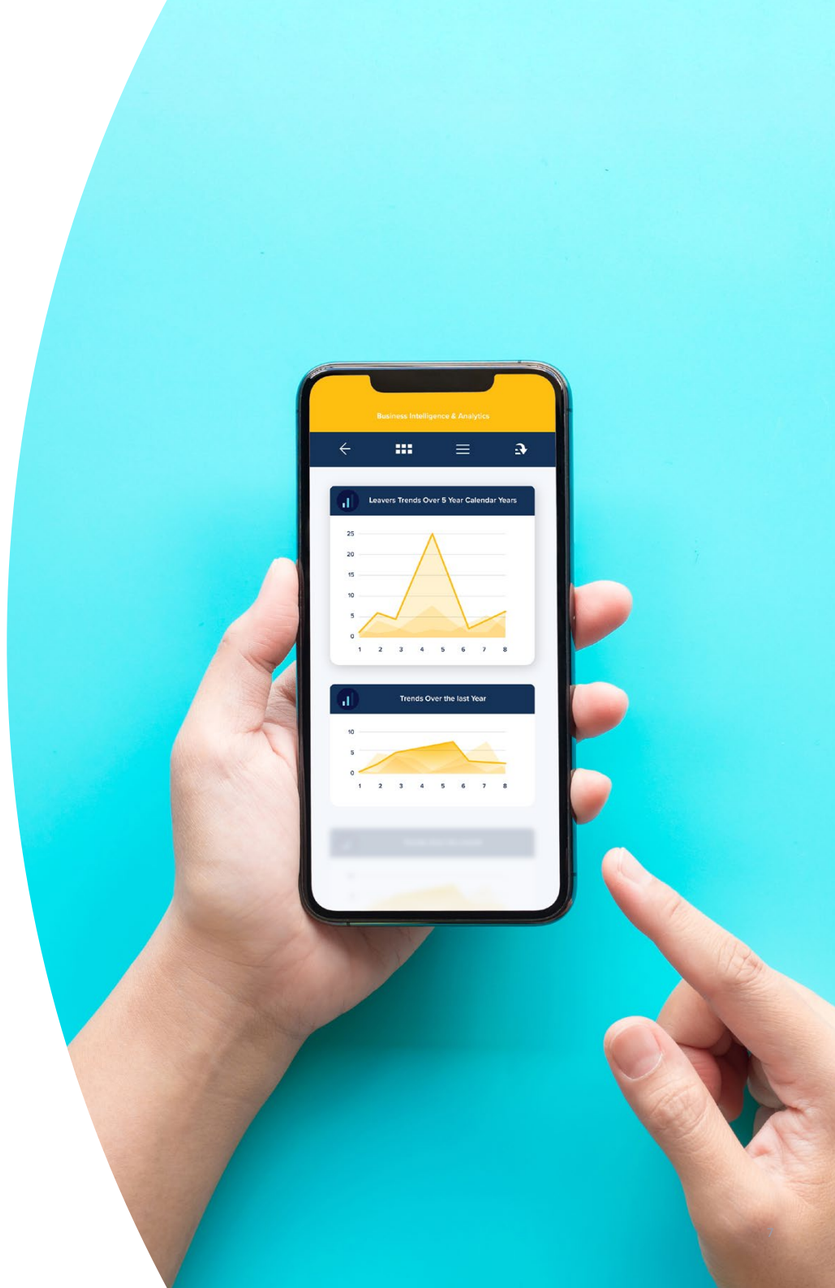
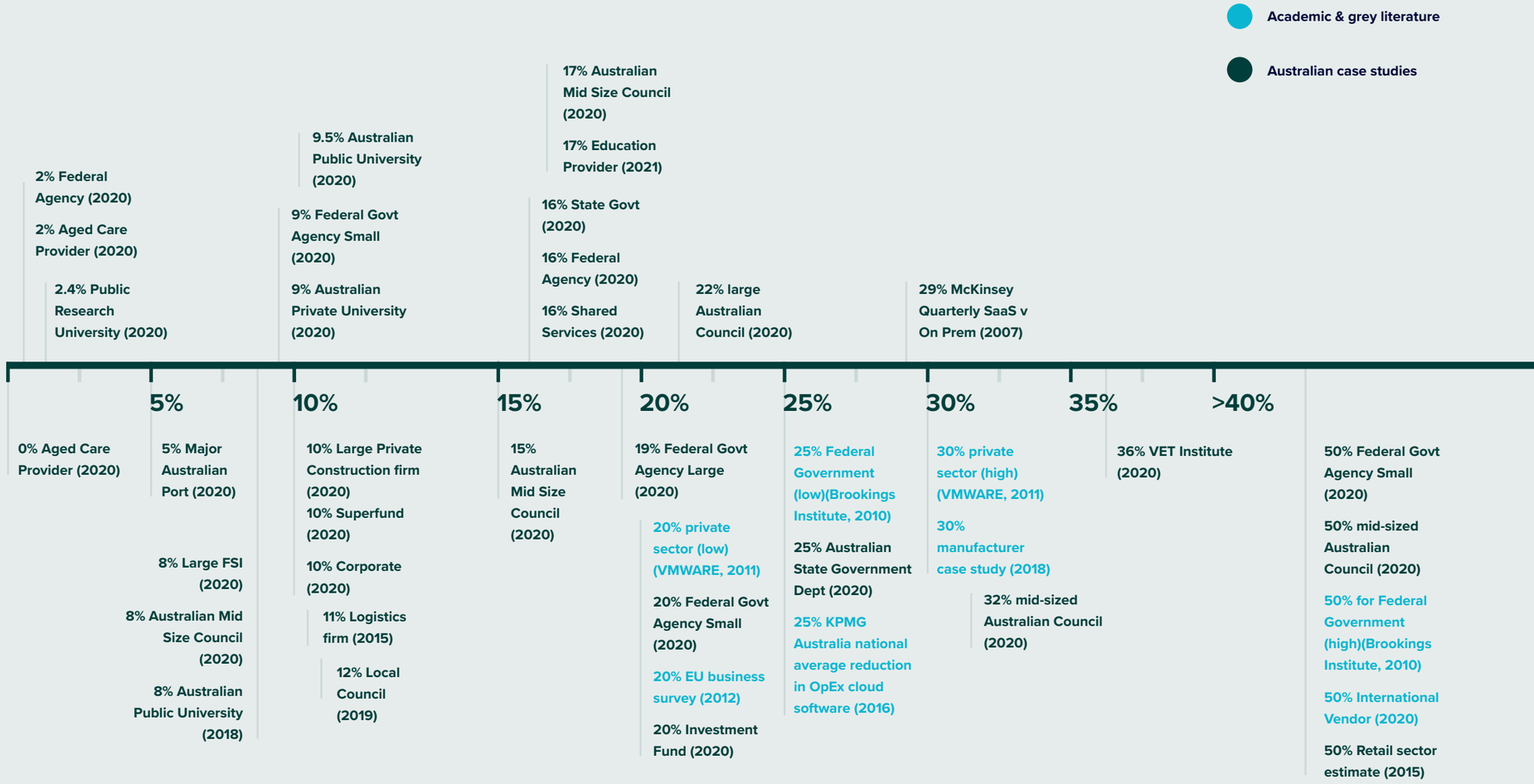


**Figure 1:**
Total Cost of Operations (TCO) Savings - Research and Case Studies



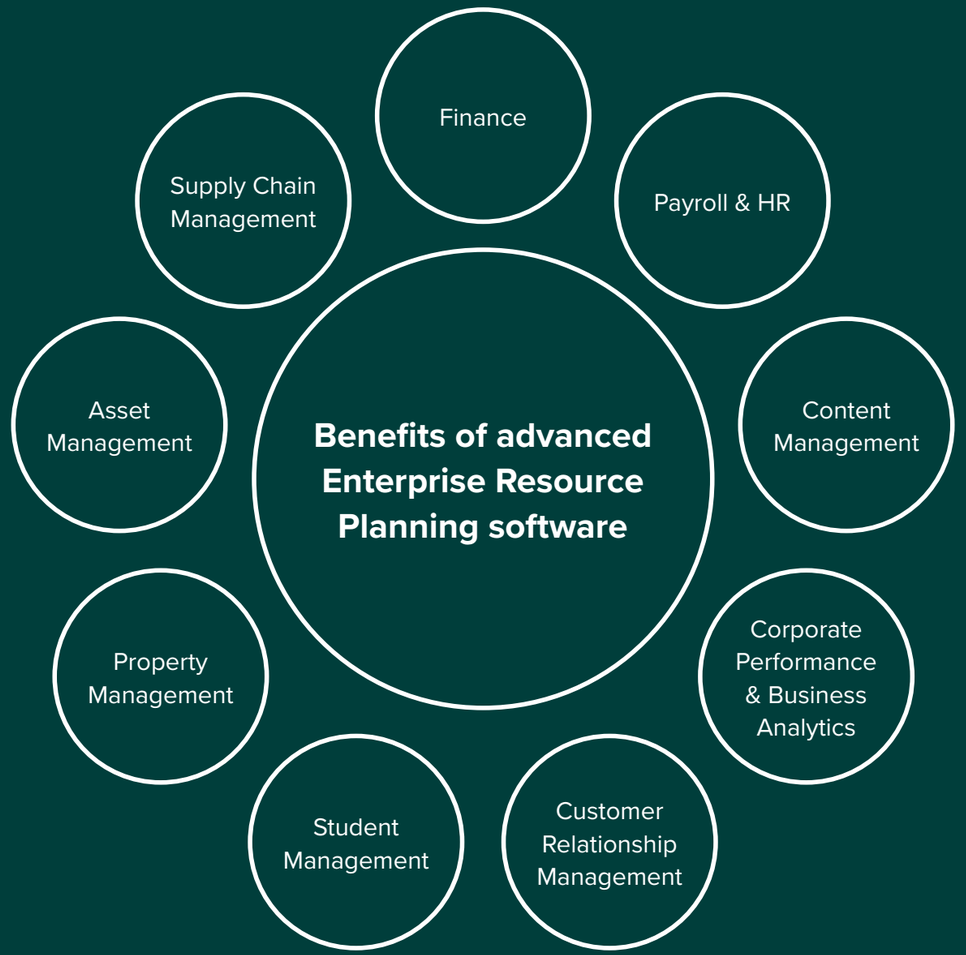

Source: IBRS and Insight Economics

## Key findings: Direct organisational impacts of Software as a Service

This study confirms that significant benefits have been realised by Australian firms as a result of the migration to a SaaS solution. However, the magnitude and nature of the benefits varies substantially. There are still substantial savings and benefits yet to be obtained.

Globally, total cost of operations (TCO) savings are routinely estimated to be in the range of 20 to 50 per cent. This study took a more conservative approach to cost savings, but still revealed strong savings ranging from two per cent up to 50 per cent (Figure 1).

**Figure 2:**
Wider business and consumer benefits
– Major benefits




In addition to potential efficiencies in the costs of ICT, the migration from traditional on-premises solutions to SaaS enables a range of wider business and customer benefits, including:

- Increased workflow efficiencies and labour productivity
- Enhanced customer experience
- Improved workforce collaboration
- Improved asset, supply chain and inventory management
- Reduced cyber security risks
- Improved disaster recovery
- Reduced energy and carbon emissions.

These benefits are summarised in Figure 2.

---

98% reduction in inventory wastage, 10 per cent reduction in current stock, and >25% reduction in supply chain contract costs (Australian hospital, 2021)

25-50% cost savings for SMEs (Dept of Industry)

80% reduction in energy usage and avoidance of 4 Mt CO2-e 4 through increased in cloud computing from 25% to 40% by 2025 (E3, at energyrating.gov.au)

87% reduction in energy usage through cloud models (Lawrence Berkeley National Laboratory)

22% increase in developer productivity (AEC 2018) 25-35% reduction in change cost from streaming and standardising work patterns (AEC 2018)

20%+ reduction in food and beverages costs (F&B) through better supply chain and wastage management (Aus firm)

Increased security with between 10% and 20% per cent of businesses reporting a security incident or breach in 2018 (ABS)

2.2%-3.4% reduction in COGS across supply chain as a result of full information on average, maximum 13.8% (Cachon, Fisher, Wharton School, U Penn)

Universities can increase the efficiency by 55%, mobility by 49% and cost by 25%.

15% reduction in asset related labour costs (Operations & Maintenance Best Practice Guide, Federal Energy Management Program)

3-5% reduction in annual operations budget through asset management (Case study)

20-30% reductions in inventory requirements through better inventory and supply chain management (PS Market Research)

5-7% reduction in annual maintenance costs through cloud technology enabling more efficient first fix 8-30% reduction in reactive maintenance costs (Predictive Maintenance Strategy for Building Operations: A Better Approach)

3% reduction in annual capital expenditure through enhanced asset management and tracking (TechOne)

5% reduction in labour costs through business analytics (OECD, 2017)

10%-30% reduction in capital budget requirements through improved planning 28% revenue growth for SMEs from digital engagement including cloud, ERP (Deloitte Australia)

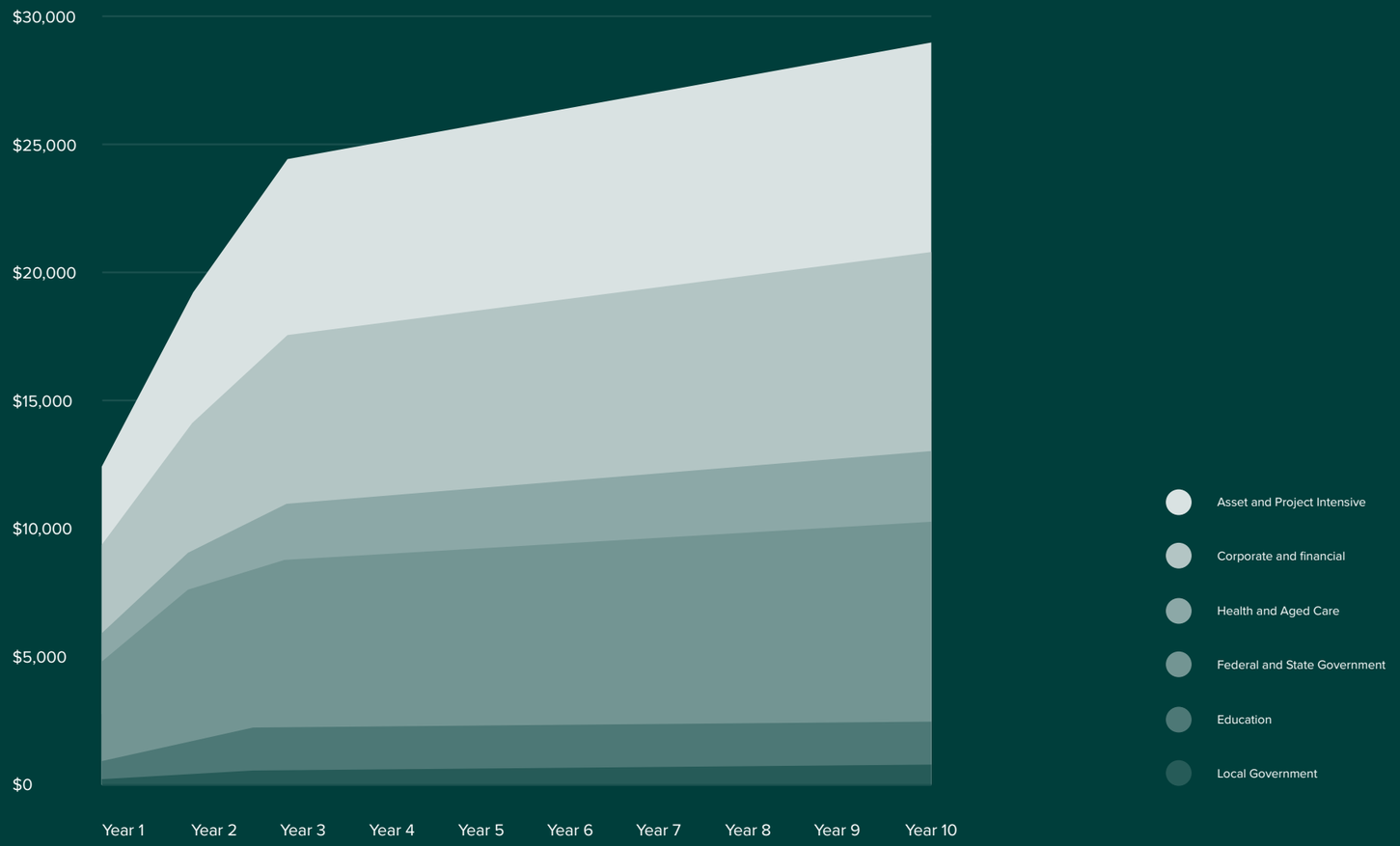
5% to 6% uplift in output through business analytics (Brynjolfsson, Hitt and Kim 2011)

25% reductions in administrative staff arising from e-procurement (Government Agency 2020)

90% reduction in invoicing costs through e-invoicing 40% more revenue growth (Microsoft, 2011, survey of 3000 SMEs)

Source: IBRS and Insight Economics

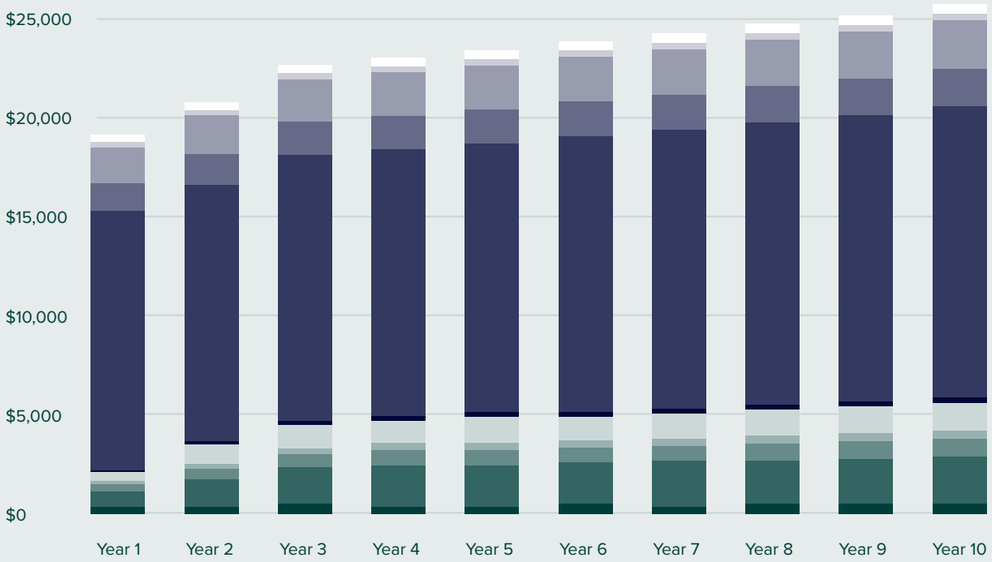
**Figure 3:** Direct impacts of migration to SaaS (Native Integration) across all sectors



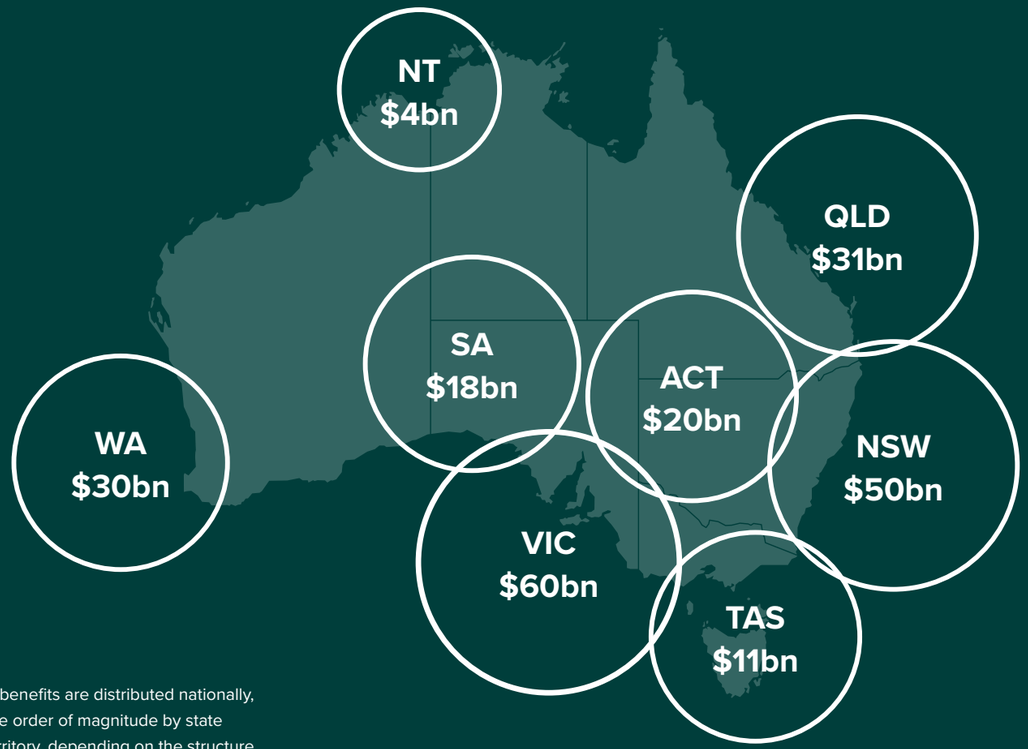

**Modelling shows that in aggregate, the direct benefit potential to Australian organisations of moving to a SaaS solution compared to Australia's current software capability, would be expected to be in the order of $252 billion dollars over the next ten years, allowing for a three year ramp up of investment, or $224 billion in NPV2% terms (Figure 3).**

## Figure 4: Direct impacts of migration to SaaS (Native Integration) by benefit type (in A$1000s)

A majority of the expected direct benefits are derived from TCO savings, which account for 32 per cent of the benefits on average, and labour force productivity, which accounts for a further 54 per cent of the benefit potential from a migration to SaaS on average across all sectors (Figure 4). Critically, labour productivity represents an increase in output capacity for a given level of labour inputs; this allows organisations to meet growth in demand without expanding staff levels compared to what would have been required if a traditional on-premises strategy had been continued.




## Figure 5: Direct impacts of migration to SaaS (Native Integration) by state and territory



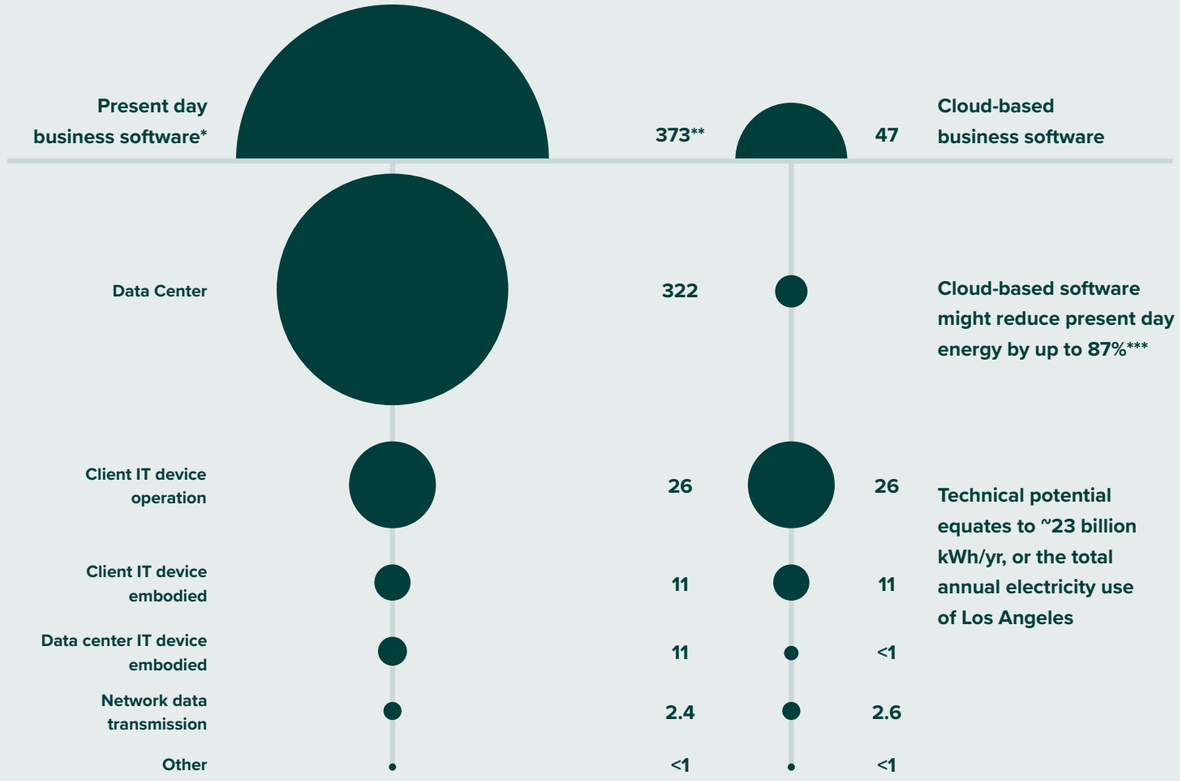

These benefits are distributed nationally, with the order of magnitude by state and territory, depending on the structure of their local economy and the relative benefit potential by sector. For example, significant benefits are expected in ACT in spite of its smaller population footprint as a result of the presence of Federal Government departments and agencies in that jurisdiction.

# Increasing cloud computing to 40% by 2025 would reduce Australia's emissions by 4Mt CO2-e in 2030.

In addition to direct economic effects, a transition away from on-premises solutions to SaaS will have an environmental impact through lower carbon emissions and energy savings compared to current software solution. This is because most of the installed data centre capacity is inefficient and carbon intensive, comprised of a significant volume of small data centres. Modelling by E3 consulting for the Australian Government found that a migration to the cloud would see a substantial reduction in Australia's carbon emissions.

The modelling shows that an increase in cloud computing from 25 per cent to 40 per cent by 2025 (Figure 6), enabling the retirement of these small, inefficient data centres, would see energy use reduce by 80 per cent and Australia avoid 4Mt CO2-e of emissions by 2030. Accelerating the adoption of cloud technologies has the potential to further improve Australia's carbon footprint by 2030.

## Figure 6: Environmental impacts




Source: E3, 2014, Energy Efficiency Policy Options for Australian and New Zealand Data Centres, Consumer Research Associates, report to the Department of Industry, and Masanet, E, 2013, The Energy Efficiency Potential of Cloud-Based Software: A U.S. Case Study, Lawrence Berkeley National Laboratory.

## Figure 7:
## Opportunity costs of inefficient ICT solutions

### Local government cost savings

Rehabilitate more than 3,500 kms of two lane urban sealed roads

Rehabilitate more than 9,900 kms of two lane rural sealed roads

Fund NSW local government's infrastructure backlog more than 2.4 times over

Fund more than 422,000 shade sails in urban spaces to reduce skin cancer

Fund construction of more than 1,400 new recreation centres

### Federal and state government cost savings

Fund more than 11,500 kms of new roads

Fund more than 4 new Sydney Harbour tunnels

Fund more than 11 million hospital services over ten years, a 16% expansion in public hospital services per annum

Fund 90,000 additional registered nurses per annum for the next 10 years, a 33% expansion in the supply of registered nurses

Fund more than 883,000 residential aged care places over ten years, a 41% uplift in services

### Health and aged care cost savings

Fund more than 3.7 million hospital services

Fund more than 297,000 residential aged care places

Fund 34,000 additional registered nurses

Improve quality and sustainability of residential aged care

### Higher education cost savings

Fund more than $1.1 billion in new research per annum over the next ten years, or $7.4 billion in absolute terms over ten year horizon

Fund more than 5,600 new Professor roles each year for the next ten years

## Key findings:
## Opportunity costs of funding

The opportunity costs of these operational efficiencies for each sector are significant. As shown in Figure 7, funding that might otherwise have been directed at ICT services can be usefully redirected towards other important investments and services that serve the community and improve Australia's international competitiveness, including:

- New infrastructure programs
- Local road rehabilitation
- Investment in community services that can improve the safety, health and wellbeing of Australian families
- More nurses
- More aged care places
- More teachers in classrooms
- Reduced waiting times for health and hospital services
- Improved access, quality and safety in residential aged care
- Cutting edge, competition enhancing research
- More professors in higher education settings.

## Key findings:
## Wider economic impacts of Software as a Service

To evaluate the full economic impact potential of SaaS, the direct impacts identified were input into the Monash Multiregional Forecasting (MMRF) computable general equilibrium (CGE) model of the Australian economy operated by the Centre of Policy Studies at Victoria University. The The model is frequently used by Federal and State governments in the evaluation of new policy proposals and investments. The MMRF CGE model allows for an evaluation of the wider multiplier effects of SaaS through the Australian economy over time.

Two scenarios were developed to explore the economic benefit potential of SaaS

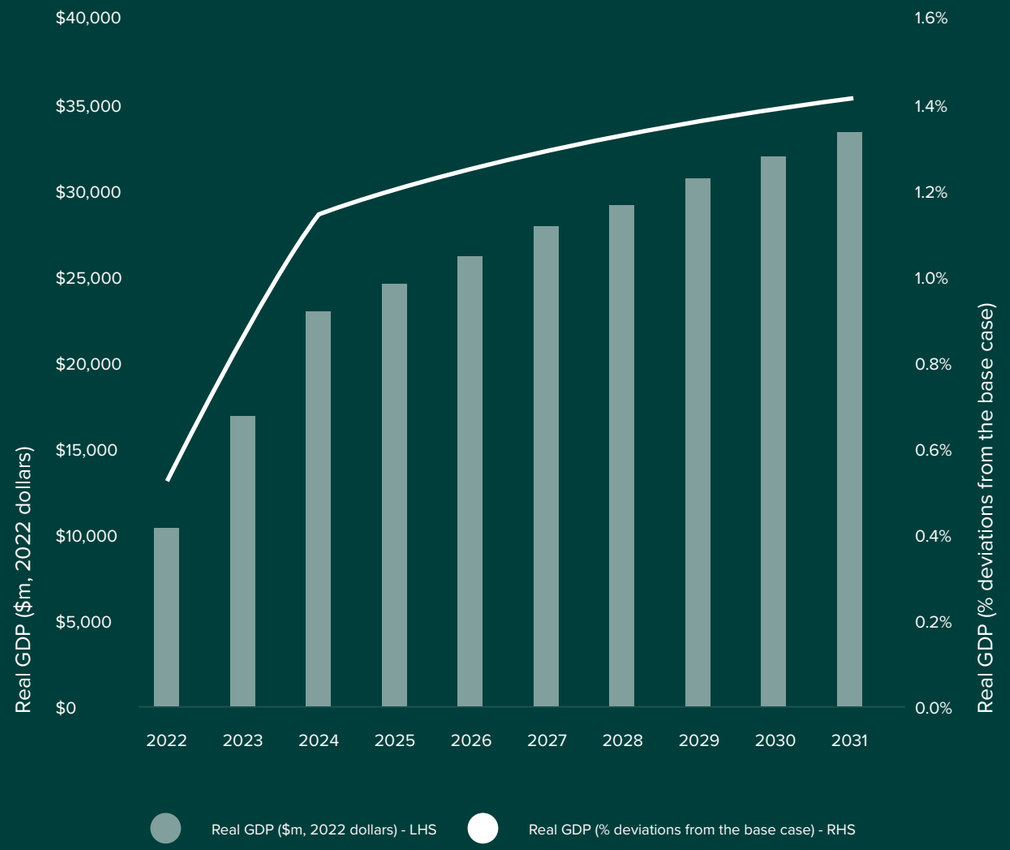
- *Scenario 1: The economic impact potential of SaaS* — This scenario evaluated the impacts to total output (Gross Domestic Product and Gross State Product) consumption and investment at a national and state level, arising from the migration of organisations to SaaS solutions over the next three years.
- *Scenario 2: The economic impact of increased local purchasing of SaaS* — This scenario evaluated the impacts to GDP, GSP, consumption and investment arising from not only a migration of organisations to a SaaS solution over the next three years, but also the effects of a 10 per cent uplift in local purchasing.

The CGE modelling shows that the economic potential of SaaS technologies for Australian economic futures is significant, with economic output expected to expand by 1.3% above base case expectations as a result of increased competitiveness of Australian firms and productivity of the Australian government. The economic potential of Australia is maximised with increased local purchasing, assuming equivalent cost and quality outcomes for Australian purchasers.

In Scenario 1, which isolates the impact of the transition to SaaS alone, economic growth is expected to significantly expand:

- GDP is expected to be more than $224 billion greater in NPV2% terms over the next decade, which translates into economic expansion of $26 billion per annum or 1.2 per cent increase on average over the 10-year forward period.
- The above equates to an expansion of GDP of 1.3 per cent by 2030 from the base.
- Household consumption is expected to increase by $15.9 billion each year, which translates into more than $140 billion in consumption potential by Australian households in NPV2% terms over the forward 10 years.
- An additional 7,500 jobs are created annually over the 10-year horizon (0.6 per cent increase).

**Figure 8:**
**Expected growth in GDP over time, Scenario 1 ($2021, 2022-2032)**




Source: Centre of Policy Studies, Victoria University

In Scenario 2, which adds to the impact of the transition to SaaS the additional effects of an uplift in Australian purchasing, economic growth is expected to see further expansion above Scenario 1 projections:

- Total economic output expands by a further $571 million more per annum above Scenario 1 expectations, or roughly $5.1 billion over the 10-year horizon compared to Scenario 1.
- Australian household wealth is expected to expand by an additional $1.1 billion per annum above Scenario 1 expectations, or an additional $9.7 billion in economic output over the 10-year horizon compared to Scenario 1.
- Australian government revenues increase by an additional $243 million per annum, or $2.2 billion over the next ten years, compared to scenario 1.

## Key findings: Implications for decision makers

Policy to shape ICT investments should focus on the wider workforce productivity gains, rather than just ICT savings.

Taking up enterprise software that offers new and more efficient processes, especially online self-services and fully integrated reporting and analytics, returns significant gains to the wider Australian community.

Australia's executives need to work with line managers and ICT executives to identify where new technology capabilities can improve productivity.

This traditional business process modelling approach to streaming business processes is at least partly superseded by the SaaS operating model.

Embedded low-code forms and workflow tools that enable non-technical staff to quickly digitise manual processes are critical to delivering greater productivity gains.

SaaS flips the notion of designing work processes from a top-down approach to that of continual improvement.

Organisations need to adopt a continual improvement culture in order to get the most from modern, SaaS ERPs.

# Chapter 1. Project background & method

**This chapter provides a short overview of Enterprise Resource Planning Software and options for its acquisition, through an on-premises model, an Infrastructure as a Service (IaaS) model and a SaaS model.**

## 1.1 What is Enterprise Resource Planning Software as a Service?

Enterprise Resource Planning (ERP) is a category of software that public and private organisations use to manage day-to-day business activities such as accounting, procurement, project management, customer relationship management, business analytics, risk management, regulatory compliance, asset management, and supply chain operations.

A complete ERP suite helps organisations to better manage their performance through tools for planning, budgeting, predicting, and reporting on a wide range of organisational and financial activities. ERP systems can bring together a single view of a multitude of business processes and enable the flow of data between them. By collecting an organisation's shared transactional data from multiple sources, ERP systems can eliminate data duplication and provide data integrity with a single source of truth.

Historically, public and private organisations have implemented ERP software solutions by deploying an on-premises ICT strategy. This meant that organisations would purchase and manage all the server and data centre hardware required to run the software at their offices. An on-premises model can require significant capital investment, as well as ICT consultants and training to customise software and manage the environment as needed. Many Australian businesses and public sector organisations continue to operate using an on-premises software solution.

As the wider ICT landscape has evolved, however, a combination of factors, including cyber security challenges, the pace of technology change and the potential to avoid costly capital investments have spurred the development of a range of new software delivery models.

In particular, ICT architecture is now being transformed by cloud computing technologies, with SaaS emerging as a major new delivery model for ERP software (Box 1.1).



## Figure 1.1: Overview of key Enterprise Resource Planning software modules

**Finance**

Finance software enables the effective management of an organisation's finances including accounts payable, accounts receivable, accounts reconciliation, charges and billing, debtor management, general ledger reporting, travel and expense reporting, and lots more.

**Human Resources and Payroll**

Human Resource & Payroll software enables the management of employees, including recruitment processes, timesheets, payroll, performance management, workplace safety, training, and employee self-service.

**Corporate Performance & Business Analytics**

Corporate Performance and Business Analytics software supports the management of budgeting, performance planning, business analytics and more.

**Content Management**

Enterprise Content Management software enables a collaborative approach to storing, editing and accessing documents including emails, documents, images, photos, videos and social media.

**Customer Relationship Management**

Customer Relationship Management software enables the management of client relationships by providing a single view of all customer information across an organization, in turn supporting more effective and efficient service delivery and/or sales.

**Student Management**

Student Management software allows students, academics, administrators and partners in the Higher Education Sector to connect through a single application, which in turn streamlines student recruitment, admission processing and engagement with existing students.

**Property & Rating**

Property & Rating software enables local governments to manage development submissions, billing and revenue collection, eService provision, mobile solutions for field officers, and rates calculation modelling.

**Asset Management**

Enterprise Asset Management software provides for a single view of all asset information across an organisation, enabling long-term asset planning and investment decisions with full information, management of multi-year capital works programs and more efficient day-to-day operational asset management.

**Supply Chain Management**

Supply Chain Management software enables the digital management procurement processes such as invoicing, requisitions, contracts, inventory control, purchase orders and quoting, supplier sourcing and web catalogues.

A complete ERP suite helps organisations to better manage their performance through tools for planning, budgeting, predicting, and reporting on a wide range of organisational and financial activities. ERP systems can bring together a single view of a multitude of business processes and enable the flow of data between them. By collecting an organisation's shared transactional data from multiple sources, ERP systems can eliminate data duplication and provide data integrity with a single source of truth.

Historically, public and private organisations have implemented ERP software solutions by deploying an on-premises ICT strategy. This meant that organisations would purchase and manage all the server and data centre hardware required to run the software at their offices. An on-premises model can require significant capital investment, as well as ICT consultants and training to customise software and manage the environment as needed. Many Australian businesses and public sector organisations continue to operate using an on-premises software solution.

As the wider ICT landscape has evolved, however, a combination of factors, including cyber security challenges, the pace of technology change and the potential to avoid costly capital investments have spurred the development of a range of new software delivery models.

In particular, ICT architecture is now being transformed by cloud computing technologies, with SaaS emerging as a major new delivery model for ERP software (Box 1.1).

## Box 1.1: Overview of software delivery models

**Since the advent of cloud computing in the mid-2000s, options for how and where software runs have expanded greatly. For this study, four different approaches have been explored:**

- On-premises
- IaaS
- SaaS – Mixed Stack (Best of Breed)
- SaaS – Native Integration (Common Stack).

### Delivery Model 1: On-Premises

The organisation's core business solutions are hosted in their own data centre or centres. In most cases, software is procured as perpetual software licenses, meaning that the software can be run indefinitely. In addition, organisations may pay annual fees for maintenance and support for the software, where the software vendor supplies the organisation's ICT departments with bug fixes, patches and upgrades, though it is then up to the organisation to actually install and test the updated software.

A benefit with the on-premises delivery model is that it allows organisations to amortise the licence fees of the software and upfront costs of the hardware needed over an extended period of time. This effectively lowers the annualised TCO of the solution.

This approach leads to 'legacy technology', where the software may be several editions out of date, and thus missing features or capabilities, or even security protections, of the latest edition from the vendor.

An additional benefit of sweating the assets of on-premises software is that it eliminates the time and effort needed to update software, which can be considerable. This further reduced the overall TCO over time.

This study found that organisations with on-premises software tended to have legacy enterprise software due to the effort (and risk) required for upgrades more than solely minimising cost of ownership.

*Business Perspectives on On-Premises: "Our ERP was last updated in 2017. It does the job and upgrading would be a major disruption to the business. We just can't justify the cost for the minimal additional functionality we get."*

### IaaS

The organisation's core business solutions are hosted by a third-party vendor, either as a fully managed data centre or a cloud service. The software has been procured with perpetual software licenses (though often with annual maintenance or support fees), has been upgraded to the most recent version of the vendor's offering, and makes use of any new capabilities found in the latest version.

Business Perspectives on IaaS: "IaaS frees up our IT staff to focus on what matters most - not running servers but giving the business new services." - Mid-Sized Agency

**SaaS: Mixed Stack or Best of Breed**

The organisation's core business solutions are procured on a OpEx model (subscription) and delivered by a cloud service using web clients. The underlying technical infrastructure is provided and managed as part of the software subscription. For the sake of simplicity, this study reports this shift as a move from hardware into software subscription (OpEx) costs.

The SaaS solution is updated and patched regularly by the vendor.

In the mixed stack approach to SaaS, organisations procure a wide variety of different core solutions from different vendors and use integration technologies to link them together. It is also known as a best-of-breed or BoB approach.

While most organisations using SaaS will have solutions from multiple vendors and have some degree of integration, the mixed stack approach has no emphasis on adopting larger core solutions that have pre-integrated modules. Instead, every business function is viewed as a separate system that will be integrated. A great deal of ICT focus is on integration.

This study found that organisations adopting a mixed stack approach to SaaS viewed the decision as a way to get maximum flexibility and the ability to change solutions. However, it was also noted that this approach was far more complicated and carries more risk than that of the following Native Integration approach. This adds complexity and cost to of operation of enterprise solutions. In addition, procuring multiple, narrowly defined solutions is significantly more costly than procuring a single stack of modules from the one vendor.

*Business Perspectives on SaaS (Mixed Stack): "The cost of our e-learning solution is nearly that of our entire ERP. So adopting the e-learning model of the ERP could save us [money]. We are looking at what we'd lose in functionality and seeing if it's worth changing."*

**SaaS: Native Integration (Common Stack)**

In this approach, the organisation procures a small number of enterprise SaaS solutions, generally from a single vendor, that provide pre-integrated business functions. Compared to the mixed stack approach, there is far less requirement to invest in integration technologies and services as a result.

This study found that in most cases the Native Integration approach is the fastest way of delivering new features and capabilities. While it does not eliminate the need for integration, it does retrain the costs associated with such. It also changes the focus of integration from being mostly inward facing (services within the organisation) to outward facing (integrating with external parties, such as suppliers and government agencies).

Almost all organisations interviewed, ICT strategy and architecture documents reviewed as part of this study show that organisations adopt a mix of the above models. As part of this study, each organisation's general strategy was identified, with a focus on how the core business solutions were deployed.

## Summary of key features of alternative software models

| | On-Prem | IaaS | SaaS Mixed Stack | SaaS Native Integration |
|---|---|---|---|---|
| Licensing | Persistent/CapEx | Persistent/CapEx | Subscription/OpEx | Subscription/OpEx |
| Major updates | Annual, or longer | Annual, or longer | 2-4 times a year | 2-4 times a year |
| Software patching, updating | By customer | By customer (often with higher levels of automation) | By vendor | By vendor |
| Hardware procurement (inc. network) | Persistent/CapEx | Subscription/ OpEx | Subsumed by licensing subscription/OpEx | Subsumed by licensing subscription/OpEx |
| Hardware maintenance | By customer | By vendor | By vendor | By vendor |

Source: IBRS

When ERP software is delivered as a service in the cloud, it runs on a network of remote servers rather than from a server room based on-premises. The SaaS provider manages and updates the software several times a year, using remotely distributed data centres. This can allow the organisation to realise operational efficiencies through a more agile software service and enable the avoidance of capital costs associated with maintaining hardware on-premises.

A number of Australian government agencies and businesses are well into their cloud journeys, while other are adopting hybrid software solution strategies. Market research estimates total expenditure on ICT in Australia to be in the order of $98 billion, with enterprise software accounting for an estimated $14 billion to $18 billion of total ICT expenditure. Enterprise expenditure on ICT is projected to grow by between 3.1 per cent and 3.6 per cent by IBIS and Gartner, respectively.

At the same time, however, there are still significant segments of both the public and private sector that have evaluated the potential for improved capability and cost efficiencies from a new ICT strategy.

- ABS data show that just under 30 per cent of Australian businesses had reported to be using cloud technologies, and among businesses with internet access 43 per cent of respondents said cloud technology was 'not important at all'.
  The uptake of cloud ERP is disproportionately lower among SMEs, who have the greatest upside potential due to the ability to scale capability through SaaS services. ABS data show the use of paid cloud computing services increased with each successive employment size range, with 25 per cent of micro businesses employing 0-4 persons utilising cloud services compared to 60 per cent of large businesses employing 200 or more persons. Similarly, in 2019, it was reported that only 14 per cent of SMEs had taken up advanced technology capabilities.
  On a sector basis, some sectors with potentially significant improvements in competitiveness through cloud technologies report the lowest levels of uptake; for example, only 20 per cent of Australian manufacturing firms had adopted cloud technologies, which is significantly lower than their international counterparts in North America and Europe.
- In the public sector, there has been an increasing appetite for migration to cloud services but many organisations have yet to transition. For example, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, ,released in 2017, suggested that while progress was being made in unpacking preconceptions of cloud technologies, there was still substantial work to be done to move government businesses to the cloud. Similarly, NSW's 2020 Government Cloud strategy which estimated only 13 of NSW's Departments (9) and Agencies (44) had some plan to adopt cloud solutions with most in transition or planning stages rather than actual completion. At a local council level, a recent Digital Productivity Report by the Local Government Association of Queensland indicated that while 98 per cent of respondents indicated their council will be investing in digital initiatives within the next five years, only 31 per cent of respondents indicated that their council has a digital strategy in place.

Evidence suggests cloud technologies have the potential to deliver substantial cost savings as well as other business benefits, including:

- Increased productivity
- Increased workflow efficiencies
- Enhanced customer experience
- Improved workforce collaboration
- Reduced cyber security risks
- Improved disaster recovery.

These cost savings and productivity benefits can in turn enable scarce public funds or private investment dollars to go towards higher, better uses than they otherwise would have, and/or can increase organisational output or sales compared to what would otherwise have occurred.

To realise these benefits, however, governments and businesses must successfully navigate potential transition costs and risks. While these benefits can be understood at a conceptual level, little data is available for the quantification of these benefits in Australia today.

To better understand the potential net benefits of cloud technologies, and the cumulative economic benefit to Australian communities of unlocking these efficiencies, TechnologyOne commissioned IBRS and Insight Economics to undertake an economic impact of SaaS. The report will be used to inform key decision makers as to the realistic organisational impacts of moving to cloud, as well as quantifying the wider economic benefits at a state and national level.

## 1.2 Economic impact assessments: Objectives and key methodological considerations

The credibility of the economic impact assessment depends on adherence to key methodologies required by central agencies for business case development. The core elements of the economic impact approach governments are looking for include:

**Additionality:** The most fundamental principle underpinning a successful socio-economic impact assessment is that of additionality. When we seek to value the economic impacts of an activity or investment, we want to understand the extent to which there has been a change in outcomes compared to what would have otherwise occurred if that activity or investment had not occurred. The impact of the activity or investment is the change in any of these dimensions that is realised compared to what would have otherwise occurred. This hypothetical counterfactual scenario is typically referred to as the 'base case'. In the context of this study, the 'base case' is the continuation of current on-premises capabilities over the forward ten-year period, allowing for improvements in cyber security and disaster recovery.

'Additional' economic impact arises from new money being spent in Australia that might not have otherwise been spent, or from the realisation of productivity improvements which in turn allow for scarce dollars to be redirected to higher, better uses.

**No 'free lunches':** Another important aspect of an economic impact assessment is that the costs of implementation are factored into the analysis; this is what is referred to as the 'net' benefits of an activity compared to what would have otherwise occurred. Understanding the net benefits of an activity or investment helps governments and decision makers to allocate scarce resources in the form of money, labour or capital, to the highest impact activities or investments. Training and change management costs have been included in the cost assumptions for organisations to enable a like-for-like comparison across models.

**Evaluation horizon:** It was assumed there would be a three-year transition towards a SaaS environment among businesses that remain in an on-premises or IaaS environment. Benefits are modelled over a ten year forward period (2022-2032).

**Impacts of time:** A number of factors must be addressed to account for the effects of time. First, to account for the time value of money all impacts must be adjusted in order to bring all into today's dollars (A$2021). In addition, future impacts will need to be discounted at an appropriate social discount rate, which is typically the 'risk-free' rate of ten-year Commonwealth bonds. The ten-year bond is currently 1.665 per cent; the analysis in this report selected two per cent as a discount rate, noting that historically a risk-free rate of five per cent has been the standard social discount rate required by governments, with seven and 10 per cent employed as sensitivity analyses.

**Multiplier impacts:** The transition to SaaS will have both 'first round', 'direct' impacts, as well as 'second round' or 'multiplier' impacts.

- First round effects — The first round, direct effects of SaaS are likely to include reduced costs to organisations compared to an on-prem or IaaS model, arising from reduced configuration and installation costs, reduced licence costs (which may particularly advantage small and medium sized organisations), lower maintenance costs, and lower costs for new upgrades. In economic terms this translates to reduced operational expenditure by governments, which can allow for those funds to be reallocated to other, more productive uses by that organisation, be it investment in roads, education services, health services or other public services. There may also be direct impacts arising from improvements in services to the community as a result of SaaS. Through a more dynamic and rapid transition to best practice software solutions, SaaS may provide clients with time or cost savings, through avoided travel and time spent at Council offices, or improved ability to navigate to key services by businesses or households. Over time, these benefits may increase in size, as a more competitive market structure leads to increasing value for money for governments.
- Multiplier impacts — These first-round, direct impacts will have further second-round, multiplier effects through the economy. Second-round, multiplier impacts arise from 'upstream' production effects, such as increasing demand for supplier goods or services, or 'downstream' consumption effects, reflecting more monies (capital), resources (labour) or productivity within the economy. For example, reduced expenditure on ICT can have productivity spill-over into the wider economy which would see growth in GSP or GDP to the base case. Similarly, to the extent that households or businesses see reduced costs or greater revenues through an enhanced service offering by governments, this too can change economic outcomes.

An impact evaluation which only considers the first-round effects is said to be a 'partial equilibrium' analysis. An impact evaluation which considers the second round, multiplier impacts is said to be a 'general equilibrium' analysis.

The credible evaluation of the full economic impact of an activity therefore requires the use of a computable general equilibrium (CGE) model or an input-output model, which evaluates the upstream production and downstream multiplier effects. A CGE model will evaluates the net effect of all changes on economic activity over time, measured in output (GDP or GSP), consumption, investment, and jobs.

**Other social and environmental impacts:** The transition to cloud-based technologies will also be expected to have an impact on access to public services in some sectors and Australia's carbon emissions.

- Social impacts have been explored qualitatively through case studies due to the complexity of the impacts across different sectors, which are likely to vary substantially by organisational size and focus.
- Third party analysis of the environmental impact of transitioning to cloud technologies is discussed but these impacts are beyond the scope of this report and not formally quantified here.

With these core principles in mind, the following section outlines a proposed method, which incorporates these key considerations for credibility.

## 1.3 Approach to valuing Software as a Service: Project method and key data sources

To understand the current software landscape across key sectors of the Australian economy and value the potential range of effects a transition to SaaS can have for an organisation, a mix of desktop research and consultations was undertaken for the following key sectors of the Australian economy (Figure 1.2):

**Local Government:** Based on local council reporting by state in 2021, there are 544 local councils in Australia today. Within this, there are 229 large, or very large councils, with more than 7,000 rateable properties within their purview, and 315 small to medium sized councils. More than 186,000 persons are employed in the local government sector, which oversees the maintenance of critical infrastructure and the delivery of significant services to their local communities. Financial reporting by local governments show that local governments manage more than $423 billion in community assets.

**Federal and State Governments:** Based on a bottom-up review of current departments and agencies by federal and state jurisdictions, it was estimated there more than 965 federal and state departments and government agencies in operation in Australia today. These organisations vary significantly by size and organisational focus, with policy departments at both a federal and state level tending to have fewer operational constraints than departments which have a significant service delivery structure. For the purposes of this study government departments at a federal and state level were segmented into policy-oriented departments and service-oriented departments, while agencies at a federal and state level were segmented by size. It was estimated there were 64 policy departments, 46 service departments, 242 large agencies and 613 small agencies. ABS data show that more than 246,000 people are employed in a federal government capacity, while more than 1.6 million people are employed by state and territory governments. Consolidated financial reporting for federal and state governments show that, combined, federal and state governments manage approximately $1.1 trillion in assets.

**Health and Community Services**: Based on Australian Institute for Health and Welfare for hospitals and residential aged care (GEN Aged Care Data), there are more than 2,200 hospitals or residential aged care providers in operation today. Within this there are 659 public hospitals and 657 private hospitals, 278 private aged care providers, 111 public aged care providers and 463 not-for-profit/charitable providers of residential aged care. The aged care sector employs more than 375,000 people, while the hospital sector employs more than 434,00 people nationally. The ageing of Australia's population continues to drive significant growth in demand for services across this sector. At the same time, many aged care providers in particular struggle to sustain profitability. ATO data show that private hospitals and residential aged care providers spend more than $184 million in asset maintenance per annum and $1.3 billion in goods and services in order to deliver care.

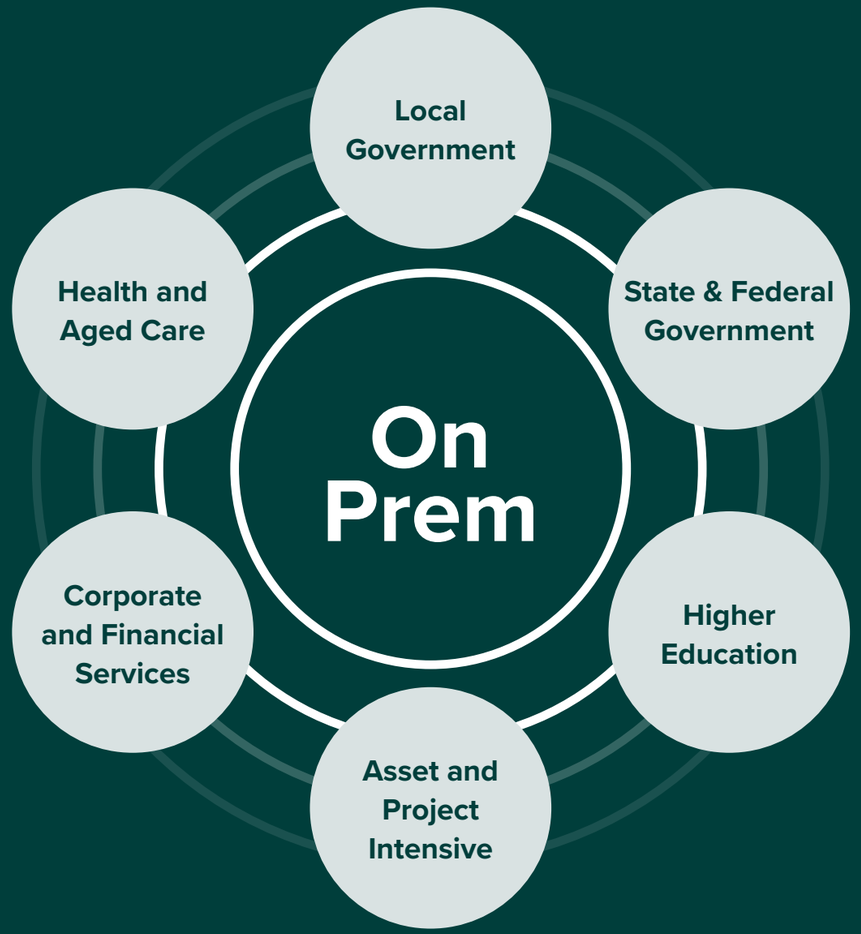
**Higher Education:** Based on university reporting and TAFE institute reporting there are more than 100 higher education providers in operation in Australia today. Approximately 59 vocational education providers are in operation nationally, and 42 universities. These organisations educate more than 2.6 million students per year and employ more than 288,000 academic and non-academic staff. ATO data show that universities and VET providers spend more than $45 million in asset maintenance per annum and can incur significant expenses in casual staff coping with admissions and other student administration each year.

**Project and Asset Intensive:** The project and asset intensive sector was defined to include public and private organisations focused on the design and build of major infrastructure projects across Australia, as well as public and private organisations that oversee the ownership, operation and maintenance of major electricity and other utility assets, such as water supply, gas supply, waste collection and waste treatment, ports and airports. Based on ABS and ATO data, as well as publicly owned statutory authorities or government business enterprises, this sector was defined to include more than 2,100 organisations, with the vast majority of these being privately owned construction companies with 20 to 200 employees (1,594 businesses). The balance was assumed to include 107 large construction firms with more than 200 employees, 128 publicly owned organisations focused on essential services and other infrastructure delivery and 338 privately held firms similarly delivering electricity, utilities, transport or other asset intense services. ATO data shows that privately held firms spend $2.6 billion in maintenance each year and ABS data show that more than 1.5 million people are employed in this sector.

**Corporate and Financial Services Industries:** The corporate and financial services industry sector is defined to include more than 7,600 businesses, which collectively employ more than 3 million Australians. Within the sector, key market segments were defined as:

- Financial Services firms, which is further segmented by firm size. Large financial services firms employing more than 200 persons (131 businesses), small to medium sized financial services firms employing between 20 and 200 persons (558 businesses).
- Corporate and Retail firms, which are segmented by telecom, media and professional services (1,607 businesses); major supermarket and food retailers (50 businesses); other major retailers and corporates employing more than 200 people across a range of subsectors, including clothing and footwear, furniture, housewares, electronics and computers, sporting goods, toy and games, department stores, car and motorcycle sales, fuel sales, pharmaceutical retailers,small to medium sized retailers (1,220 businesses) and small to medium sized manufacturers (4,046 businesses).

## Figure 1.2: Key sectors in scope




Desktop research and market interviews were undertaken for each of these sectors and for the key ERP software modules (See Figure 1.1) to develop an understanding of the order of magnitude and dimensions of impact by sector and software capability.

More than 68 case study interviews were conducted, stratified across all sectors and key segments within each sector, in addition to the review of other IBRS and TechnologyOne case study data. Importantly, not all interview participants were TechnologyOne clients; approximately 50 per cent of the survey sample were not current TechnologyOne clients. As case study firms shared commercial in confidence data and business cases with IBRS, their organisations have been de-identified in this report.

The data to develop assumptions for this project were derived from the following sources:

- Australian Bureau of Statistics (ABS) and Australian Taxation Office (ATO) data for business counts, employment, wages, expenditure on cost of goods sold and maintenance and repairs, and inflation
- IBIS World Software Suppliers in Australia report
- Consolidated financial statements for Australian Government at federal, state, territory and local government levels.
- GEN Aged Care Data 2020 for residential aged care provider numbers by jurisdiction, service demand, supply and cost
- Australian Institute for Health and Welfare (AIHW) and Independent Hospital Pricing Authority (IHPA) data for trends in service demand, supply and cost
- National Centre for Vocational Education and Research (NCVER)
- Publicly available data on student and staff numbers for Australian universities
- Commercial in confidence case study and business case data.

# Chapter 2. The direct economic impacts of Software as a Service

SaaS can have a range of direct impacts on an organisation, be it a public sector organisation or a private firm; these impacts can include changes in the TCO for ICT, changes in wider business workflow process efficiencies, improvements in labour force productivity, improvements in asset and supply chain management, improvements in workforce collaboration and sales revenue through field force effects, as well as time and cost savings to customers through online and more effective services delivery. To realise these benefits, the organisation may also need to undertake change management and training activities to support the transition to a new ICT operating environment.

Based on case study interviews as well as desktop research, this chapter identifies the ways in which different ICT architecture solutions can impact an organisation depending on their industry and business size. The wider, multiplier economic effects of these support services are quantified in Chapter 3.

## 2.1 Overview of the direct impact analysis

Both academic and grey literature as well as real world Australian case studies, indicate that public and private organisations alike are expected to observe a number of changes in organisational outcomes as a result of the transition to a cloud-based software solution compared to a traditional on-premises model. These impacts fall into three major categories:

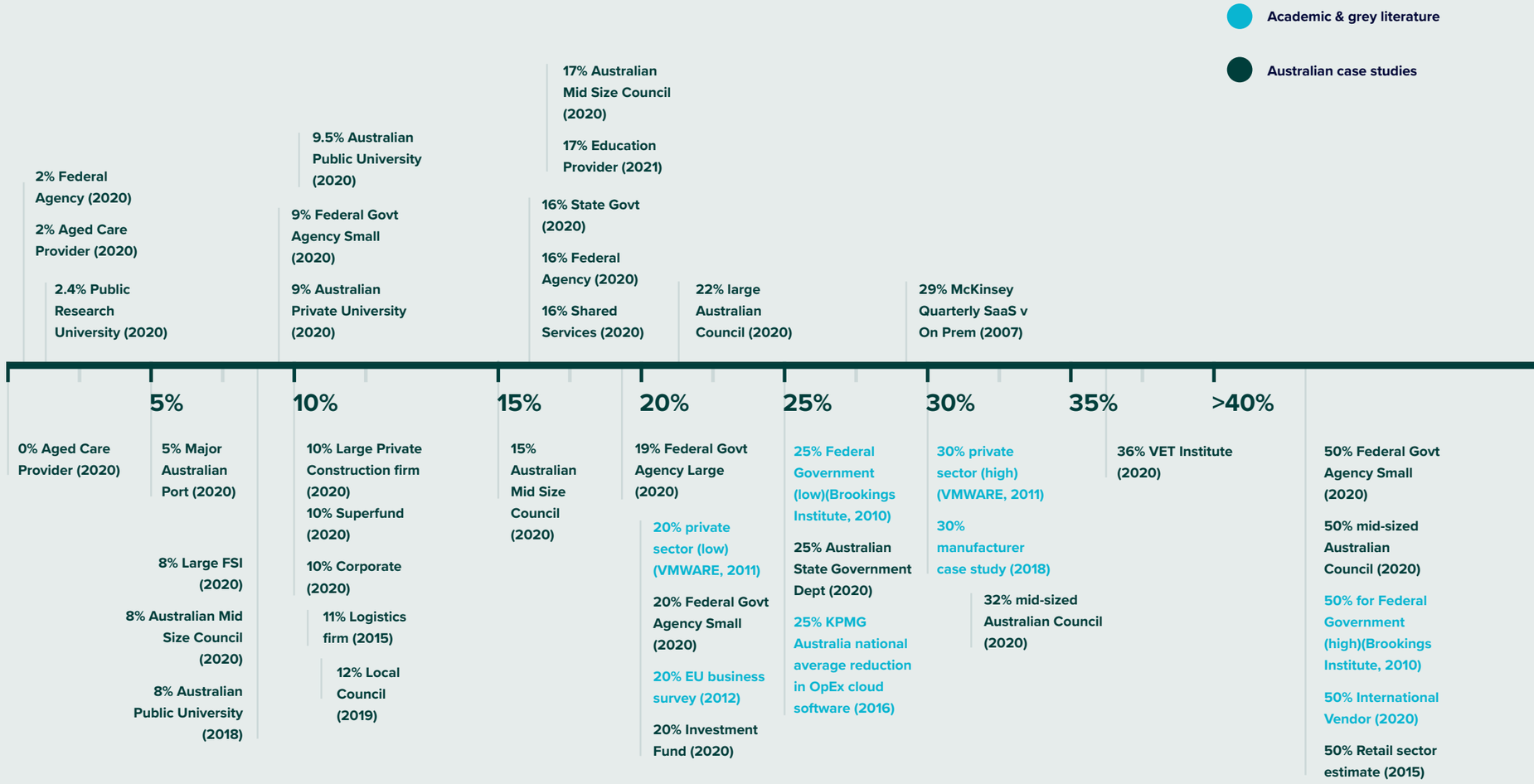
- Changes in the TCO for ICT
- Changes in wider business output potential and input efficiencies
- Changes in consumer costs and experience.

This section provides an overview of the literature and key data developed through case studies undertaken for this report. The following sections (See Sections 2.2-2.7) provide a detailed discussion of impacts observed by sector.

### Impacts on the TCO for ICT

Academic literature and international case studies developed over the past decade point to very substantial savings in ICT costs accruing organisations that have transitioned from a traditional on-premises software strategy to a SaaS solution. Globally, TCO savings are routinely estimated to be in the range of 20 to 50 per cent (Figure 2.1).

## Figure 2.1: Estimated total cost of operations savings




Source: IBRS and Insight Economics

**Closer to home, the case study interviews undertaken for this report suggest that the realisation of TCO savings has been significant for local firms, but has varied substantially by sector, firm size and organisational structure. Some government agencies in particular have reported deep savings realisation in their transition to a SaaS model, with reductions in TCO of 25 per cent to 50 per cent.**

**In other sectors, the impacts have been more muted, particularly in sectors that may have underinvested in ICT historically, such as the residential aged care sector. Critically, however, as these businesses are investing in new software solutions, they may not observe a significant change in the costs of ICT but they may report very significant step-changes in wider business capabilities.**

In addition to potential efficiencies in the costs of ICT, the migration from traditional on-premises solutions to SaaS solutions can also enable a range of wider business and customer benefits. Both the literature and the Australian case studies highlight a range of potential wider business benefits realisation:

**Wider labour force productivity improvements:** Academic and grey literature and international case studies report that advanced software capabilities delivered through SaaS enable significant labour force productivity improvements which further enable organisations to deliver a higher level of output for a given level of staff. For example, a recent OECD report outlining multiple firm-level studies suggest that advanced cloud-based software that enables data-driven innovations within businesses, improves labour productivity compared with traditional models by approximately five per cent to 10 per cent, and that these improvements in productivity are consistently higher than the improvements expected from the implementation of ERP using an on-premises model. Other studies have reported higher levels of productivity improvement, including a study of 500 firms in the United Kingdom which found that firms in the top quartile of online data use are 13 per cent more productive than those in the bottom quartile , and a US study that reported improving data quality and access by 10 per cent, increases labour productivity by 14 per cent on average, albeit with significant cross-industry variations. Within this, some software modules deliver very significant savings; for example, electronic and automated invoice processes can result in cost savings of 60-80 per cent compared to traditional paper-based processing. Such savings in billing and invoicing were validated with local case studies, though the reported savings were lower: 25 to 35 per cent. Australian firms interviewed for this study similarly indicated the realisation of additional labour force productivity of between 1 per cent (in health and aged care) and seven per cent (governments) in addition to potential TCO savings, with improvements observed in finance, human resources and payroll, regulatory and compliance, and other admin functions. Importantly, most of this productivity allowed organisations to service growth in demand without expanding their staff; while this represents a savings compared to the number of people that would have been hired if an on-premises capability had been sustained, it does not represent a significant reduction in historical staff numbers.

**Improved collaboration and sales:** Advanced cloud software can enhance collaboration, innovation and in turn, organisational output and/or firm sales through the synchronisation of workflow processes and the provision of real-time data for management decision. According to a survey by The Economist Intelligence Unit in 2012, nearly 60 per cent of companies consider that “organisational silos are the biggest impediment to using big data for effective decision making”. The uptake of cloud ERP technologies, including in particular CRM software modules, has been reported by international and Australian firms to substantially improve collaboration and organisational output/sales:

- Advanced technology uptake by Australian SMEs, comprised of a cloud strategy and advanced ERP systems (as well as digital marketing and social media strategies), was found to deliver 28 per cent more revenue growth over a 12-month period compared with Australian SMEs with a basic ICT strategy.
- A major international vendor reports customers utilising CRM software increase decision-making by 38 per cent, increase revenues by 25 per cent and see a 35 per cent increase in customer satisfaction.
- A survey of 247 IT and supply chain professionals found that cloud computing statistically significantly improved collaboration and firm revenues, while decreasing environmental impacts of ICT. The study also found that improved collaboration led to improved economic performance.
- A longitudinal survey data from 2016 to 2020 of more than 460 ICT executives, shows that cloud migration is linked to efforts to improve operational efficiency and agility.

**Workflow efficiencies and cost savings in supply chain and inventory management:** In 2017, it was estimated that 70 per cent to 80 per cent of order interactions between manufacturers and suppliers are still conducted manually. The development of cloud computing software alongside increasingly interconnected infrastructure capabilities, is expanding capabilities in supply chain management; international studies have found the uptake of cloud technologies that allow for real-time information, enable significant improvements in the management of supply chain and inventory management; for example:

- Research shows manufacturing execution systems enabled by advanced software reduce production personnel and support group time by 10 to 30 per cent, subject to complementary investments in business process reengineering.
- Research at the Wharton School of Management found, based on both case studies and empirical modelling, that the use of advanced technologies in supply chain inventory management reduce supply chain costs by between 2.2 per cent and 3.4 per cent on average compared with traditional management approaches, and that the maximum cost savings potential is between 12.1 per cent and 13.4 per cent. Advanced technologies enable cost savings by enabling faster and cheaper order processing, which lead to shorter lead times and smaller batch sizes, respectively. The study found that cutting lead times in half reduces costs by 21 per cent on average and cutting batch sizes in half reduces costs by 22 per cent on average.
- A recent study in Europe involving a survey of 394 companies randomly selected from a population of 2,036 companies with a staff of at least 50 employees, found use of cloud computing improves the integration of the physical and informational flows in the supply chain and enables them to be integrated more quickly and more effectively. Moreover, benefits were identified to be, improved issuing and planning, storage management efficiencies, shorter lead times, accurate supplier and client interaction, better organised informal flows and greater commitment from business partners.
- Locally, a private healthcare provider transitioning to a SaaS solution reported improvements in inventory management reducing wastage by 98 per cent, stock levels by 10 per cent and total supply chain costs by up to 30 per cent.
- A recent study into local government found that SaaS solutions results in 1.8 times more services delivered, with 12 to 25 per cent greater cost savings compared to on-premises solutions.

**Improved asset maintenance:** The maintenance of assets can create significant costs and downtime for organisations. Reactive maintenance is basically the 'run it till it breaks' maintenance mode: no actions or efforts are taken to maintain the infrastructure as the designer originally intended to ensure design life is reached. Both international and Australian studies and firms have reported that reactive maintenance, which is more costly to repair, accounts for approximately 55 per cent of all maintenance. The direct cost of machinery repairs undertaken during breakdowns has been reported to be at least three times greater than the cost of planned repairs, and the production outage times needed for the completion of an emergency repair has been estimated to be three to five times greater than that needed for a planned repair.

By contrast, there is very substantial literature showing that predictive and proactive maintenance of assets informed by complete and real time information about assets can significantly reduce reactive maintenance and production down times; this in turn reduces costs in the order of eight to 40 per cent depending on the sector and firm size:

- A 2017 study of deep digital maintenance found that predictive maintenance combined with remote maintenance will typically reduce the maintenance cost from 10 per cent to 40 per cent.
- A separate systematic review of the implementation of predictive asset management practices revealed around twenty instances of 10 per cent to 40 per cent improvements in operating and maintenance costs, over 2-5 years.
- The US Department of Energy had also produced an evidence-based guide for best practice improving operations and maintenance which reported that preventative asset management studies deliver cost savings of 12 per cent to 18 per cent over reactive management strategies. Predictive maintenance strategies can deliver a further eight per cent to 12 per cent improvement over preventative maintenance approaches. In aggregate, proactive, data driven asset maintenance can reduce costs by 20 per cent to 30 per cent over reactive approaches. By reducing breakdowns and asset downtime production has been shown to increase by 20 per cent to 25 per cent.
- Similarly, a systematic review of condition-based maintenance undertaken at the University College London , found predictive preventative maintenance strategies improved fault detection and diagnosis, resulting in a 10 per cent reduction in reactive maintenance and 11 per cent labour cost savings, a five per cent reduction in estimated electricity usage and associated carbon emissions, as well

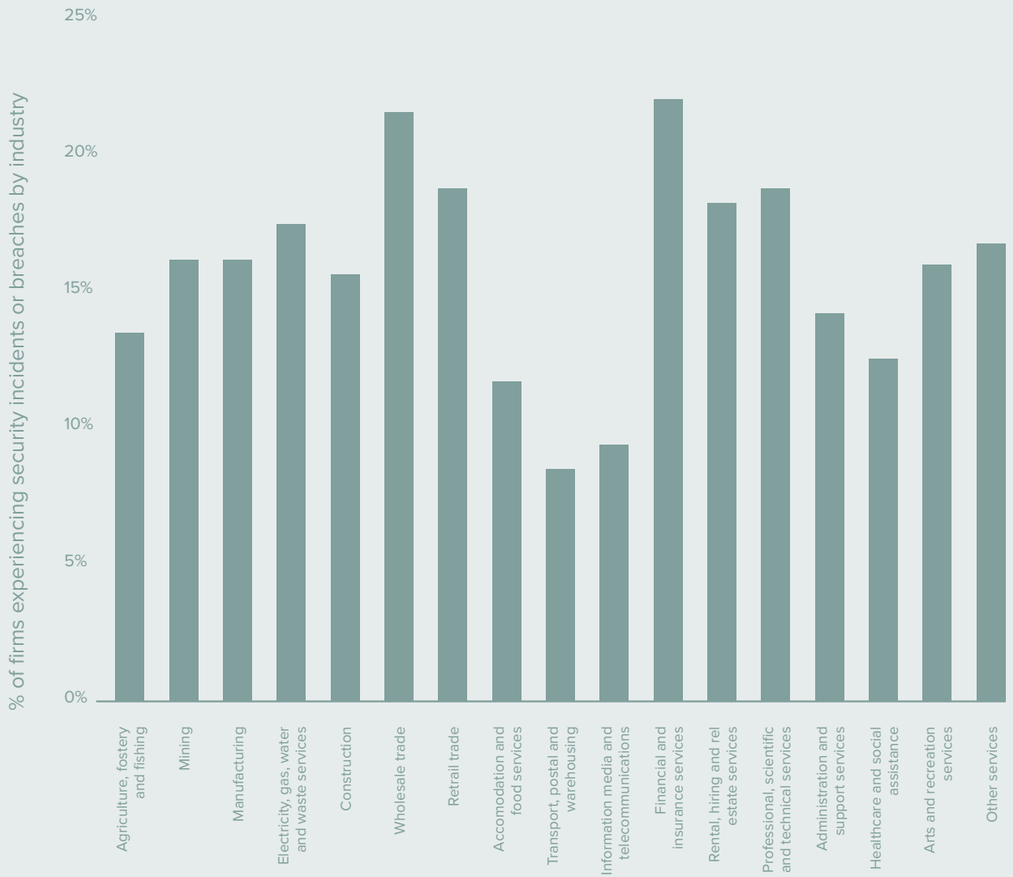
as consistent extensions of asset life. Furthermore, a pilot of condition-based management asset management approach at the University College London utilising sensor-based analysis of assets was developed with the expectation of deep cost savings (239 per cent net savings) compared to traditional approaches.

- Data driven decision making informed by real time condition-based asset assessments has also been shown to reduce capital investment requirements. The OECD also highlighted the case study of Rolls-Royce, which reported the predictive maintenance of assets had saved the firm up to 12 per cent over scheduled repairs, reducing overall maintenance costs up to 30 per cent and eliminating breakdowns up to 70 per cent. Increased reliability of its engines was also reported to have increased service revenues.
- In 2016 McKinsey reported predictive maintenance can drive value by decreasing the planned machine downtime, unplanned machine downtime, or changeover times. The predictive maintenance typically decreases the total machine downtime from 30 per cent to 50 per cent and extends the operation life of an asset.

Locally, the case studies revealed that the uptake of advanced software for improved asset maintenance had been lower than for traditional ERP software modules but that the order of magnitude for reactive maintenance reported in the literature corresponded to Australian experience, and that where firms had implemented these systems improvements, savings had been observed but there was limited data available to date.

**Improved cyber security and disaster recovery:** The risks and costs of cyber crime have been increasing significantly in the past decade. ABS data show that in 2018 security incidents or breaches had impacted many Australian businesses, with most sectors reporting that at least one in 10 businesses had experienced a security breach or incident. Wholesale and financial and insurance services reported the most frequent attacks with more than one in five firms in those sectors experiencing a security breach or incident (Figure 2.2). One of the most public cyber attacks was reported in 2019 when hackers attempted to break into Australian Parliament's computer network.

## Figure 2.2:
## Percentage of firms reporting security incidents or breaches by industry




Source: Australian Bureau of Statistics, 2017, Business Use of Information Technology 2015-16 financial year (latest release)

Australian organisations to date have fared better than the experience of governments and businesses internationally: according to a study commissioned by the UK government, 81 per cent of large British organisations suffered a security breach in 2014 (UK Department for Business Innovation and Skills, 2014); similarly, in 2015 over 21 million records stored by the US Office of Personnel Management were compromised, including 5.6 million fingerprints; and the Japanese Pension Service was impacted by a breach that affected 1.25 million people. Moreover, a 2014 Pew Research Centre poll reported 91 per cent of Americans agree that consumers have lost control of their personal information and data and a survey of European consumers indicated top concerns were misuse of personal data and the security of online payments.

These data point to a rising risk of cyber crime in Australia, which can have significant cost implications for businesses and governments alike. For example, the OECD estimates the costs of cyber crime range from 0.02 per cent of GDP in Japan to 1.6 per cent in Germany, 0.64 per cent in the United States and 0.63 per cent in China. Security breaches can result in costly litigation:

- ChoicePoint paid more than US$26 million in fees and fines following a security breach as a result of the action by the Federal Trade Commission
- One of the largest credit card processing companies in the United States, Heartland Payment Systems, was fined more than US$12 million in fines and fees for a security breach
- AT&T agreed to pay US$25 million to settle a US Federal Communications Commission investigation relating to data breaches involving almost 280,000 US customers
- Target Stores corporate filings for 2013-14 recorded US$252 million expenses related to the data breach, which after being offset by US$90 million in insurance proceeds left a balance of charges of US$162 million.

Security breaches have serious implications for top management: Target's CEO stepped down shortly after the incident was disclosed, as did Sony Pictures Entertainment's co-chair, and the Director of the US Office of Personnel Management.

Within the Australian context, Australian case studies revealed governments and businesses had seen a substantial improvement in security as a result of migration to more advanced software capabilities, with regular updates and patches delivered through SaaS improving the security environment.

A recent Australian report suggests that cyber security budgets are rising as a percentage of the overall ICT budget.  The average among larger organisations is 7.5 per cent, with the low being 5.7 per cent and the high being 8.3 per cent. This study found a lower security expenditure among the case studies: four per cent to eight per cent, with the average being 5.1 per cent. In many of the case studies, improving the cyber security stance without increasing the security budget was a factor for moving to SaaS.

**Impacts on energy usage and carbon footprint:**
Most of the installed data centre capacity is inefficient and carbon intensive, comprised of significant volume of small data centres. Modelling by E3 consulting for the Australian Government (available at energyrating.gov.au), found that a migration to the cloud would see a substantial reduction in Australia's carbon emissions. The modelling shows that an increase in cloud computing from 25 per cent to 40 per cent by 2025, enabling the retirement of these small, inefficient data centres, would see energy use reduce by 80 per cent and Australia avoid 4Mt CO2-e of emissions by 2030. Accelerating the adoption of cloud technologies has the potential to further improve Australia's carbon footprint by 2030. This is consistent with international data showing the emissions footprint of cloud services to be vastly greener than traditional on-premises solutions. The Lawrence Berkeley National Laboratory in the USA found a migration to cloud-based software results in an 87 per cent reduction in energy use. Moreover, NABERS analysis estimates there is an energy cost savings of $2.2 million per annum from migrating to a more efficient data centre, with an energy rating of five stars compared to three stars.

Locally, IBRS has tracked a marked decline in ICT executives' interest in sustaining computing over the past decade. In 2008, 59 per cent of ICT executives saw 'green IT' as a 'very important' priority. By 2019, this interest had decline to less than one per cent. However, IBRS predicts a sharp rise in businesses attention to sustainable computing as public attention returns to this issue, driven by cloud vendors meeting zero carbon emission targets, and as the costs of powering data centres continues to rise . Due to the efficiencies of cloud infrastructure and investments being made by cloud vendors to meet 2030 net zero carbon emissions targets, adopting SaaS is a beginning to be viewed as a rapid path for organisations to minimise their carbon footprint.

## 2.2 Direct impacts of Software as a Service for local government

**Current business context and key considerations for migration to SaaS by local governments: Australian case study insights**

During the last 18 months, there has been a significant increase in the number of councils adopting a cloud first strategy. This trend looks set to accelerate, particularly with the demands placed on local councils for digital services growing significantly during the COVID-19 pandemic. The pressing need for contactless services and citizen self- service was in full force by mid-2020. However, what was initially overlooked was the need for council workers to digitise processes to support their remote working activities. When workers are remote, manual, paper-intensive processes simply no longer work. In short, 2020 reset staff and citizens' expectations for the speed and simplicity of service delivery using (most often) SaaS solutions.

The most interesting fact is that many councils are now seeing a surge in demand for complex services, such as development applications. One council noted that January to March 2021 saw an increase of more than 37 per cent in development applications compared to the average from previous years. Another council noted a surge in online transactions (direct financial payments, requests for information, reporting asset maintenance needs) of more than 50 per cent over the previous years.

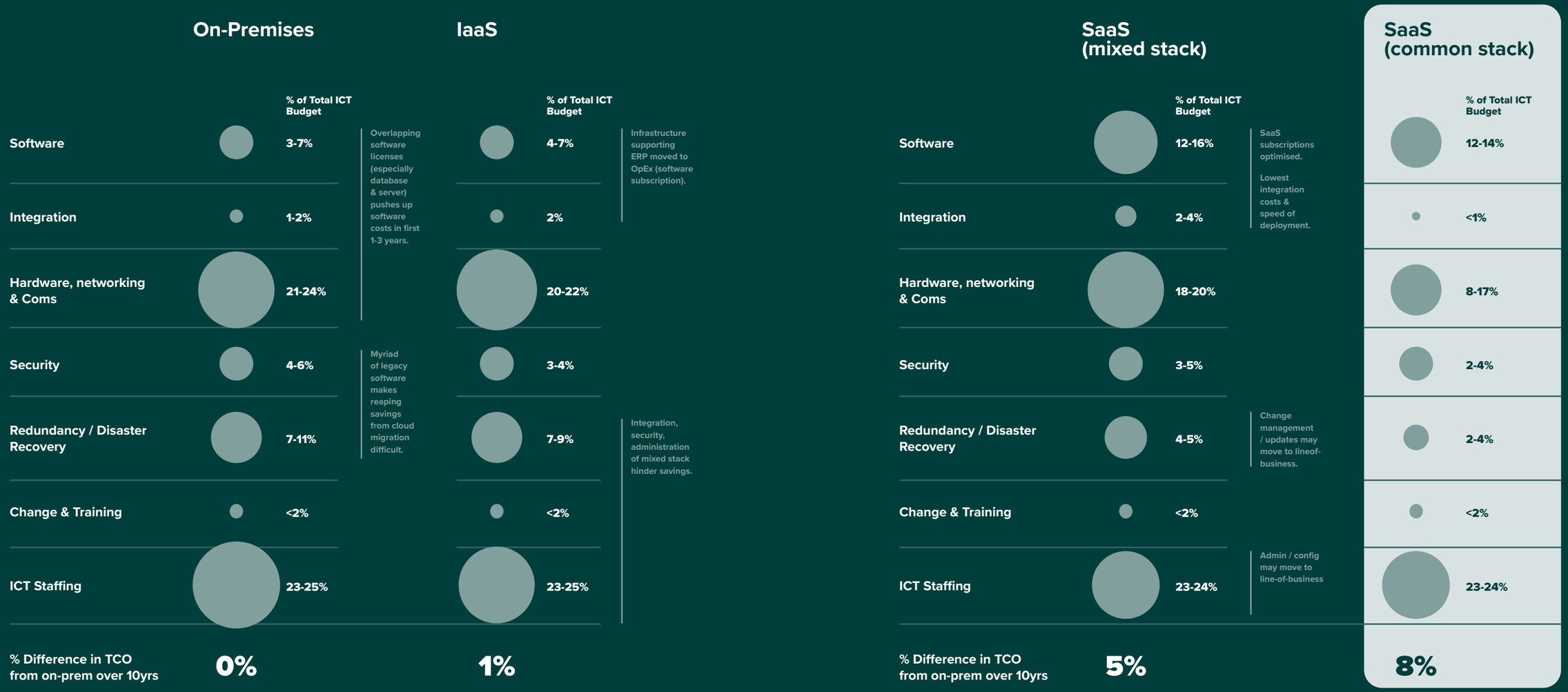
Most local council executives now recognise that SaaS plays well to this accelerated demand for digital service delivery. SaaS solutions are both elastic - able to handle rapid growth in usage - and natively public facing.

It is the availability of staff-led process digitisation features within SaaS enterprise solutions that make the biggest difference. These features allow non-IT staff to be directly involved in the development of forms and workflows to support council activities and require less input from ICT groups. Councils that have such capabilities within their SaaS enterprise solutions see up to 10 times more processes digitised annually than those running on-prem core enterprise solutions without such capabilities. The ability for councils to quickly digitise work processes for staff working from home was directly tied to low-code capabilities in their core enterprise systems. Now councils with these capabilities are looking to rapidly digitise citizen-facing services, leveraging non-technical staff in the process of digitising both internal and external processes.

In short, COVID-19 has been a proving ground for rapid, agile, digitisation of service delivery using SaaS.

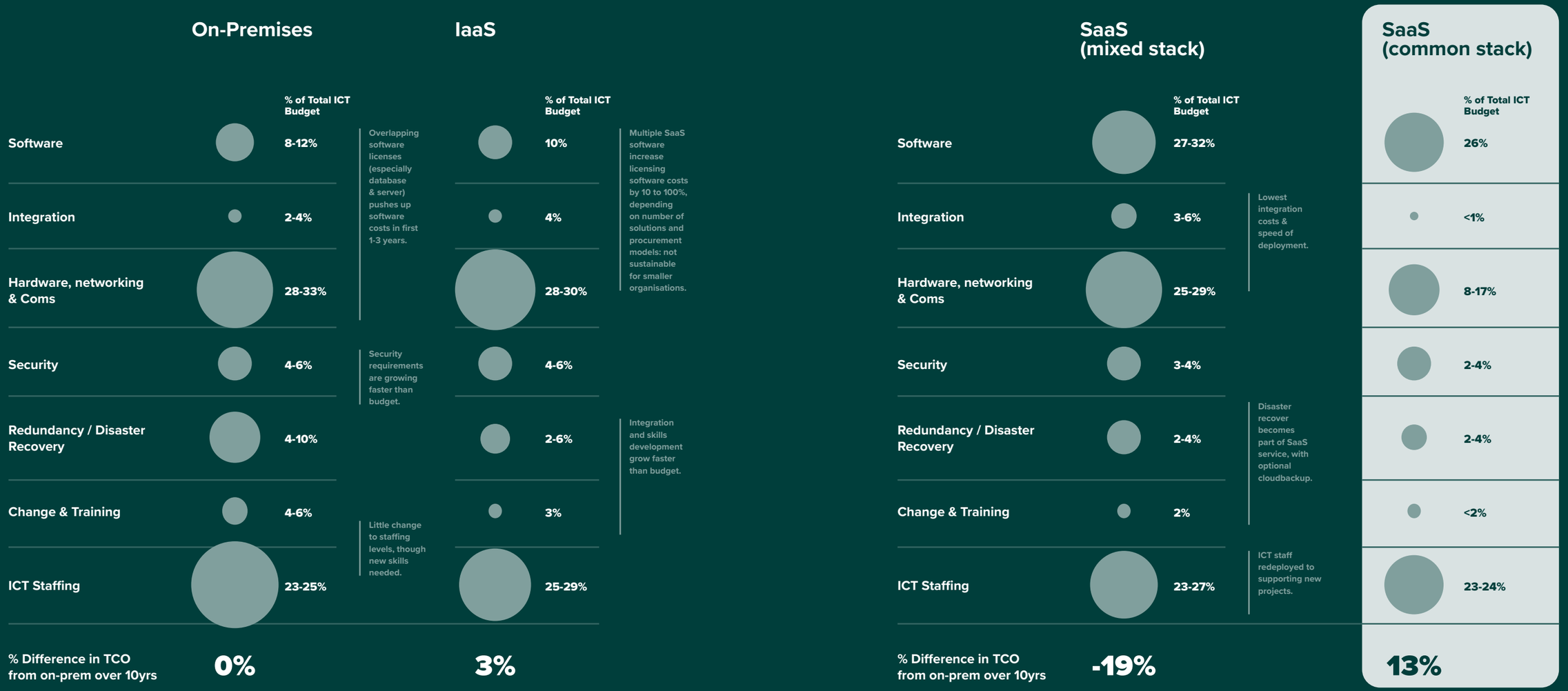
Many councils are looking at cloud services less to reduce the TCO, and more to free up ICT staff to address the growing needs of service delivery. Given the number of complex processes, it is not surprising that the cost of maintaining and integrating many different specialised applications is a significant consideration for councils. While large councils have the scale and ICT capacity for integration, mid-sized and smaller councils are finding the 'SaaS (Mixed Stack)' approach a budgetary challenge, being up to 19 per cent more costly than retaining legacy on-premises environments. Pre-integrated, SaaS appears to be more economically viable, with an average eight per cent saving compared to retaining legacy on-premises environments.

## Figure 2.3:
## TCO by delivery model – Large local councils




Source: IBRS based on commercial in confidence market data

## Figure 2.4:
## TCO by delivery model – Small to mid-sized local councils




Source: IBRS based on commercial in confidence market data

**Many councils are undergoing significant growth in both population and increased demand by citizens for services. Rate-capping means councils are unable to fully invest in preparation for growth. As a result, this study finds that council's productivity benefits stemming from more sophisticated SaaS solutions, and in particular process digitisation, are being consumed by the demands of growth.**

**Where councils were able to articulate clear productivity gains is with external facing activities, in particular development approvals, ratings, utility services and reporting maintenance issues.**

**Significant productivity improvements for development approvals were often called out as a benefit of advanced SaaS solutions. Development approvals are highly complex, time-consuming and thus expensive, have a high value to citizens and demand rigorous compliance and record keeping.**

**The introduction of cloud-based digital processes to not only manage the records and workflow of development applications internally, but also provide developers with portals and direct access to the status of the submissions, saw significant productivity gains: greater than 20 per cent labour cost avoidance, and saving external stakeholders (developers and citizens) a minimum of four hours in in-person interactions with the council. It is the ability to provide self-service portals that makes the biggest difference here.**

**Another 'quick win' with regards to labour productivity gains due to SaaS features is citizen requests for services and reporting of maintenance.**

## Australian case study: Local council experience in migration to SaaS

A large city council has significant existing investment in a myriad of on-premises solutions, plus a handful of SaaS solutions that had been procured by departments to meet their specific needs. The fragmented nature of the environment meant that the council was unable to obtain a comprehensive view of its citizens and made reporting difficult. Furthermore, lack of integration between the solutions meant that departments within the council were finding it difficult to create inter-departmental processes, effectively locking work into siloed functions. With departments looking to produce specialised SaaS at an increasing rate to meet their needs, it became clear that problems relating to fragmented processes would only grow.

The council developed and costed two business cases to determine the best way forward: a SaaS (Mixed Stack) approach, which would involve integrating the existing on-premises and SaaS solutions already in use, and a SaaS (Native Integration) solution, which would demand a migration from multiple systems into a single platform.

When the cost of licensing, support, maintenance and integration was factored, the single-stack approach provided to be significantly (17 per cent) less costly over a 5-year period than a mixed stack approach.

In mid-2019, the council migrated several business functions to a common SaaS platform: finance, human resources, and property and ratings. A self-service citizen portal was also planned on top of the new solution.

The introduction of the new SaaS platform resulted in several key benefits:

- A cross-departmental, single view citizen engagement, resulting in higher quality service levels, less manual rematching (with an estimated 2.5 FTE productivity gain)
- The ability to introduce a public portal for development applications, which resulted in reducing applications processing times by 47 per cent while also increasing compliance.

  It is also estimated that the portal saves the public a minimum of 75,000 hours annually.
- The rapid development of public-facing forms for citizens to report issues to the council, and request licenses or permits. This saw an estimated 4 FTE productivity gain, especially as COVID-19 saw a marked increase in digital engagement.
- Invoice and billing processing automation saw a 2 FTE productivity gain in the finance group.

The digitisation of over 5 million records, and the ongoing automatic digitisation of over 75,000 records each year, which in turn led to 1.5 FTE saving in responding to requests records relating to property, service and dispute resolutions.

## Direct impacts expected for the local government sector

Based desktop research and market data and interviews, it was estimated that 55 per cent of large councils currently operate using an on-premises software solution and a further 15 per cent use an IaaS model, with the balance having already migrated to a SaaS model, deploying either a mixed stack (10 per cent) or common stake model (20 per cent). Similarly, current take up of software solutions by small to mid-sized councils was estimated to be 45 per cent on-premises, 20 per cent IaaS, 15 per cent SaaS (Mixed Stack) and 20 per cent SaaS (Native Integration).

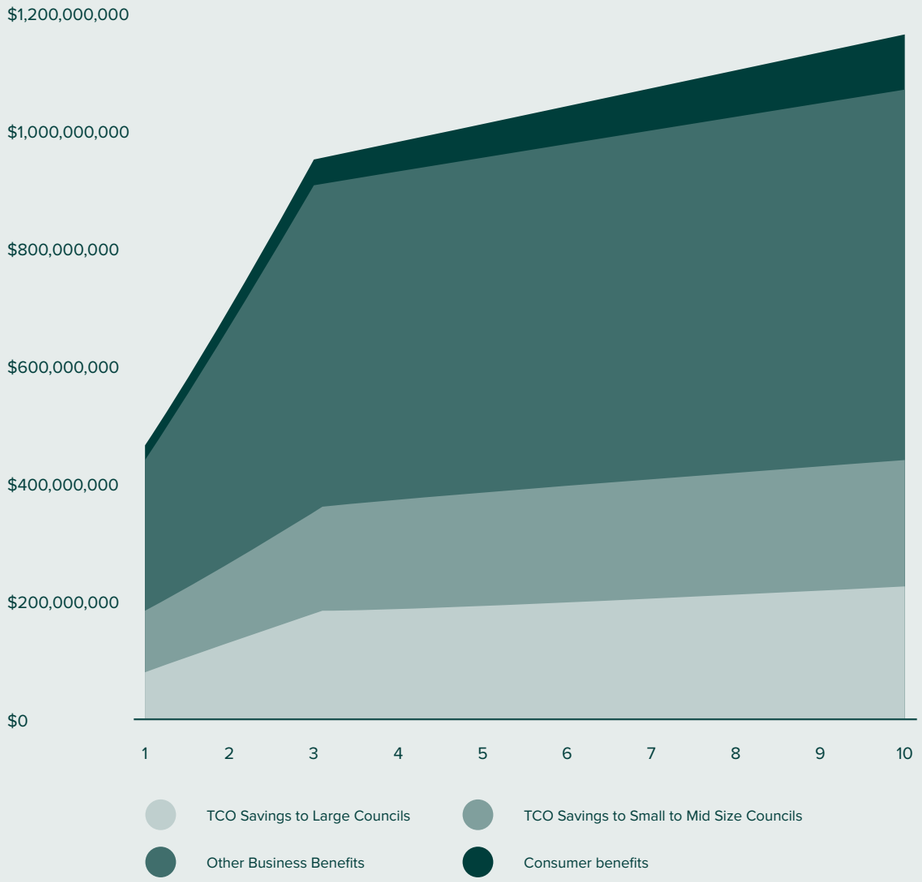
The organisational benefits potential for local councils was estimated based on a migration to a SaaS (Native Integration) solution by all councils within three years; the sources of savings included:

- TCO savings, with large councils expected to realise a TCO saving of 8.5 per cent on average in SaaS compared to an on-premises model and small to mid-sized councils expected to realise a TCO saving of 13.3 per cent on average in SaaS compared to an on-premises model
- Labour force productivity improvements of only two per cent based on real world evidence from Australian case studies, which is below the international case study expectations for a lower bound of five per cent productivity improvement
- Reduced staff turnover of two per cent based on improved employee satisfaction, bringing local government turnover in line with the national average
- Reducing call centre volumes and in-person attendance through online engagement capabilities
- Reducing mail costs to local councils and households
- Reducing time to present to councils by households
- Avoided financial auditing and consulting costs through improved financial reporting and management
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature.

Further details of the key assumptions and data sources are provided in Appendix A.

Based on these impact assumptions, the total direct benefits to local councils of moving to SaaS (Native Integration) model from current capability solutions is expected to be $8.4 billion in NPV2% terms including consumer time savings (Figure 2.5). Excluding consumer time savings, the benefits from lower TCO and the realisation of other business benefits would be $8.1 billion in NPV2% terms.

**Figure 2.5:**
**Opportunity costs in local government**




Source: IBRS and Insight Economics

## Opportunity costs of expenditure

The opportunity costs of these funds for each sector are significant. These funds could be usefully redirected towards other important investments and services, such as local road rehabilitation, new infrastructure programs or investment in community services that can improve the safety, health and wellbeing of Australian families (Figure 2.6).

### Figure 2.6:
### Opportunity costs in local government

**Rehabilitate more than 3,500 kms of two lane urban sealed roads**

**Rehabilitate of more than 9,900 kms of two lane rural sealed roads**

**Fund NSW local government's infrastructure backlog more than 2.4 times over**

**Fund more than 422,000 shade sails in urban spaces to reduce skin cancer**

**Fund construction of more than 1,400 new recreation centres**

Source: IBRS and Insight Economics



## 2.3 Direct impacts of Software as a Service for federal and state government

**Current business context and key considerations for migration to SaaS by federal and state government: case study insights**

While most government agencies interviewed articulated 'cloud first' strategies, interviews revealed something of a two-speed approach, which is further complicated by the role shared services play.

While larger agencies have all adopted cloud for some aspects of their ICT, the majority appear to be hindered in their cloud migration journeys. When larger agencies look at costing their cloud migration strategies, the TCO modelling returns marginal savings because of the need to continue supporting a large number of niche on-premises applications that cannot be easily migrated to cloud infrastructure due to licensing, compliance or technical factors. Given this complexity, it is not uncommon for larger agencies to see minimal, if any, TCO savings by moving to SaaS. Where there are many different SaaS solutions to consider (i.e., mixed stack SaaS), it can actually appear to be up to 13 per cent more costly than retaining legacy on-premises solutions. As a result, such agencies find themselves unable to draw upon the human capital savings cloud services deliver, and retain a need to continue running extensive on-prem infrastructure and disaster recovery.

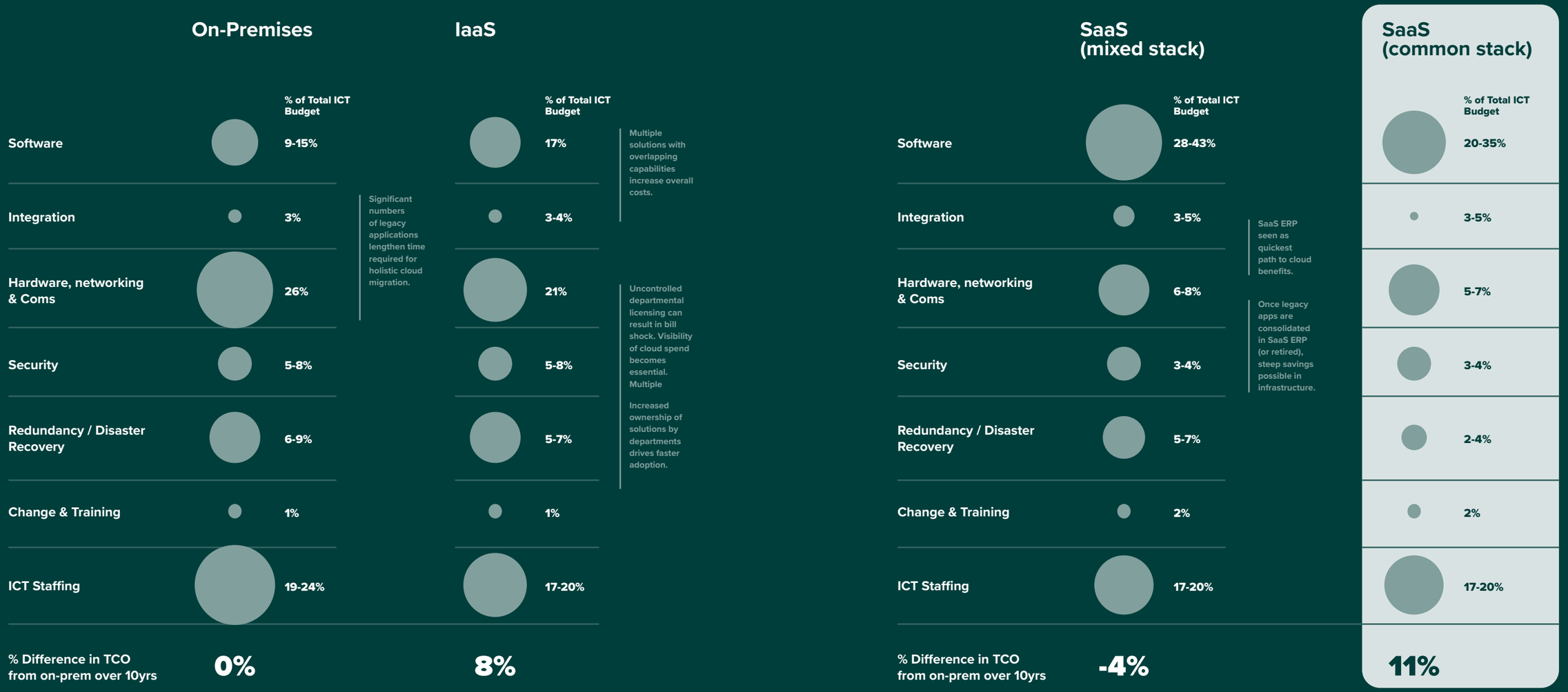
Because of the above, and the focus on 'cloudifying' existing applications, IaaS is the approach taken by larger agencies ICT groups to moving to the cloud. SaaS does come into planning considerations when core enterprise systems are up for replacement, though since most large agencies have sunk investments (in licensing, customisation, integration, skills and processes) in core systems, the SaaS options are often more vendor-driven than a pure cost decision.

However, this study also found that some divisional units are by-passing aspects of ICT governance and procuring SaaS solutions directly, or at a higher agility that normally afforded by traditional ICT procurement practices. The focus from these groups is less on the TCO as it is on the additional capabilities and agility promised by SaaS solutions.

In this respect, this study saw the emergence of a 'two speed' approach to adopting and taking advantage of SaaS.

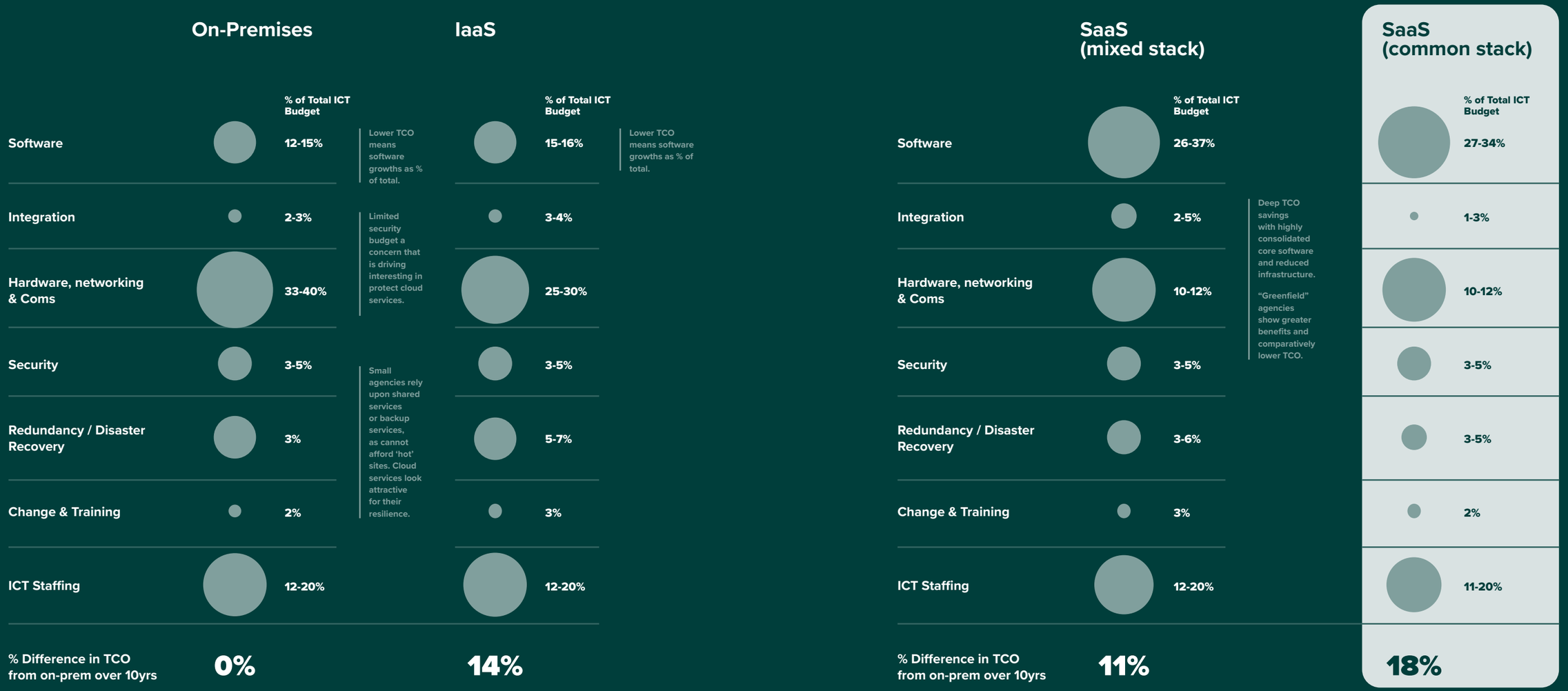
Mid-sized and smaller agencies, or greenfield agencies are less impacted by the above issues. They are more constrained when it comes to technical staff and generally have less technical debt. As a result, cloud services, in particular SaaS, are front and centre of future ICT planning. These agencies report up to 14 per cent total cost of operating savings when moving to SaaS (Native Integration).

## Figure 2.7:
## TCO by delivery model – Large government agency




Source: IBRS based on commercial in confidence market data

## Figure 2.8:
## TCO by delivery model – small to mid-sized agency




Source: IBRS based on commercial in confidence market data

**Larger agencies tended to only explore productivity gains for external facing services: that is, the speed and capacity to service citizens and the business community. In most cases, these agencies are not considering internal efficiencies unless they are directly addressing service delivery. One area such efficiencies are being tracked is call centres, with public-facing self-service processes significantly freeing up call centre staff to focus on 'more complex issues'. This is a trend also seen in the corporate sector.**

**In addition to service delivery efficiency, this study found significant productivity improvements in finance areas, especially where automation is applied to high-volume billing and invoicing. While optical character recognition has been available for some years both on-prem and in the cloud, recent improvements in accuracy due to cloud-based machine learning algorithms are reducing errors and the need for manual intervention.**

**An unexpected productivity gain comes from better analytics and reporting. This gain was called out by agencies with SaaS (Native Integration) solutions. It stemmed from dramatically reducing the need for periodic, manual preparation of reports from different data sets and different solutions. Instead, reporting and visualisation of key information is fully automated, while also providing 'citizen analytics' capabilities. Agencies report that from one to four people can be redeployed as a result of more efficient reporting processes. In addition, these agencies also reporting significant improvements in accuracy and currency of the reports generated.**

**Policy-setting agencies tend to be smaller than their service setting counterparts and are aggressively adopting SaaS core solutions. Cloud-based collaboration with their stakeholders is front and centre of their planning.**

## Australian case study: Federal agency experience in migration to SaaS

A small, highly specialised agency was formed to provide services to multiple national stakeholders. Being a greenfield operation, the agency was given a $5.8 million budget to deploy technology to support its operation. In addition to networking and end-user computing, the budget also needed to include a solution for financial services, billing and payments, stakeholder management, and sophisticated reporting.

The agency received quotes from a major on-premises enterprise solution vendor which was above the entire ICT budget, largely due to the infrastructure required to support the solutions. A well-known SaaS solution was then considered, and the SaaS approach was determined to be a cost-effective and fast way to deploy. However, the generic CRM solution would require extensive configuration and customisation to meet the agency's Australian-centric requirements. The agency then identified a locally developed solution that would not require the time or investment needed for extensive customisation and included all of the core enterprise requirements.

Furthermore, it could be deployed and operated at less than half of the cost of the previous SaaS environment.

The benefits of the investment included:

- The result of selecting the specialised Australian SaaS (Native Integration) was that the agency could deploy its core technologies at 40 per cent under the initial estimated budget.
- Savings from the core software were then used to create self-service capabilities, deploy collaboration infrastructure to ensure the agency and stakeholders could work together, and develop training resources to better support its stakeholders.

The result has been significant productivity gains, in excess of 20 per cent for internal operations, which has enabled the agency to maintain a small headcount, while increasing the quality and speed of services and allow time for greater stakeholder engagement:

- Within the agency there were labour force productivity gains of seven FTE in finance, two FTE in reporting and research, and five FTE in training and development.
- For the stakeholders, it is estimated that productivity gains exceed 30 FTE annually, and sees up to 75 weeks of training and onboarding activities reduced to 225 hours (from prior manual processes).

## Direct impacts expected for the federal and state sector

Based on desktop research and market data and interviews, it was estimated that:

- 40 per cent of policy departments use an on-premises software model, with 15 per cent using IaaS, 20 per cent using a SaaS (Mixed Stack) and 25 per cent using a SaaS (Native Integration) model
- 50 per cent of service departments use an on-premises software model, with 20 per cent using IaaS, 20 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model
- 55 per cent of large agencies use an on-premises software model, with 25 per cent using IaaS, 15 per cent using a SaaS (Mixed Stack) and five per cent using a SaaS (Native Integration) model
- 50 per cent of small to mid-sized agencies use an on-premises software model, with 20 per cent using IaaS, 20 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model.

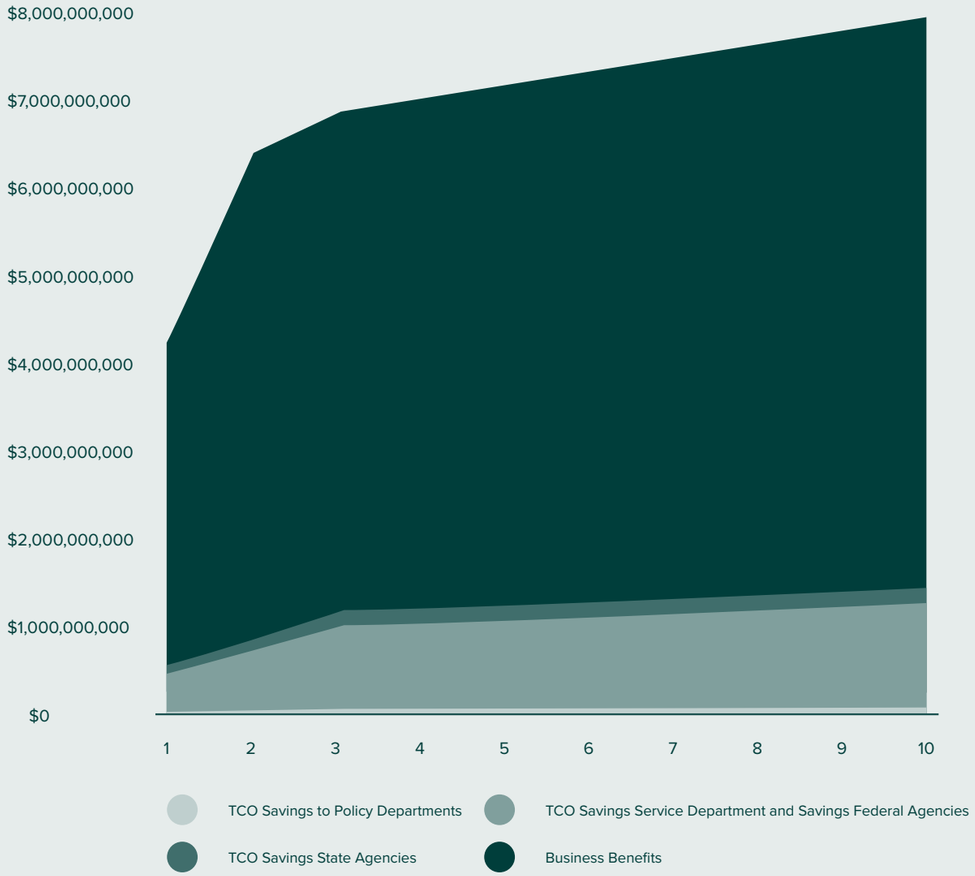
The organisational benefits potential for agencies was estimated based on a migration to a SaaS (Native Integration) solution by all agencies within three years; the sources of savings included:

- TCO savings in the range of 11 per cent to 20 per cent depending on organisational size and structure
- Labour force productivity improvements of seven per cent based on real world evidence from Australian case studies, which is in line with international case study expectations of five to 10 per cent productivity improvements
- Avoided financial auditing and consulting costs through improved financial reporting and management
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature.

Further details of the key assumptions and data sources are provided in Appendix A.

The total direct benefits to federal and state governments of moving to SaaS (Native Integration) from current capability solutions is expected to be $62 billion in NPV2% terms (Figure 2.9).

**Figure 2.9:**
**Direct impacts of migration to SaaS (Native Integration) in federal and state government**




Source: IBRS and Insight Economics

## Opportunity costs of expenditure

Critically, these savings could be redirected to fund critical investment in new road transport infrastructure, hospital services, nurses, aged care places, and teachers in classrooms (Figure 2.10).

### Figure 2.10:
### Opportunity costs in state and federal government

**Fund more than 11,500 kms of new roads**

**Fund more than 4 new Sydney Harbour tunnels**

**Fund more than 11 million hospital services over ten years, a 16% expansion in public hospital services per annum**

**Fund 90,000 additional registered nurses per annum for the next 10 years, a 33% expansion in the supply of registered nurses**

**Fund more than 883,000 residential aged care places over ten years, a 41% uplift in services**

**Fund 87,000 new teachers per annum for the next 10 years, a 45% uplift in teachers in Australia**

Source: IBRS and Insight Economics



## 2.4 Direct impacts of Software as a Service for health and aged care providers

**Current business context and key considerations for migration to SaaS by health and aged care providers: case study insights**

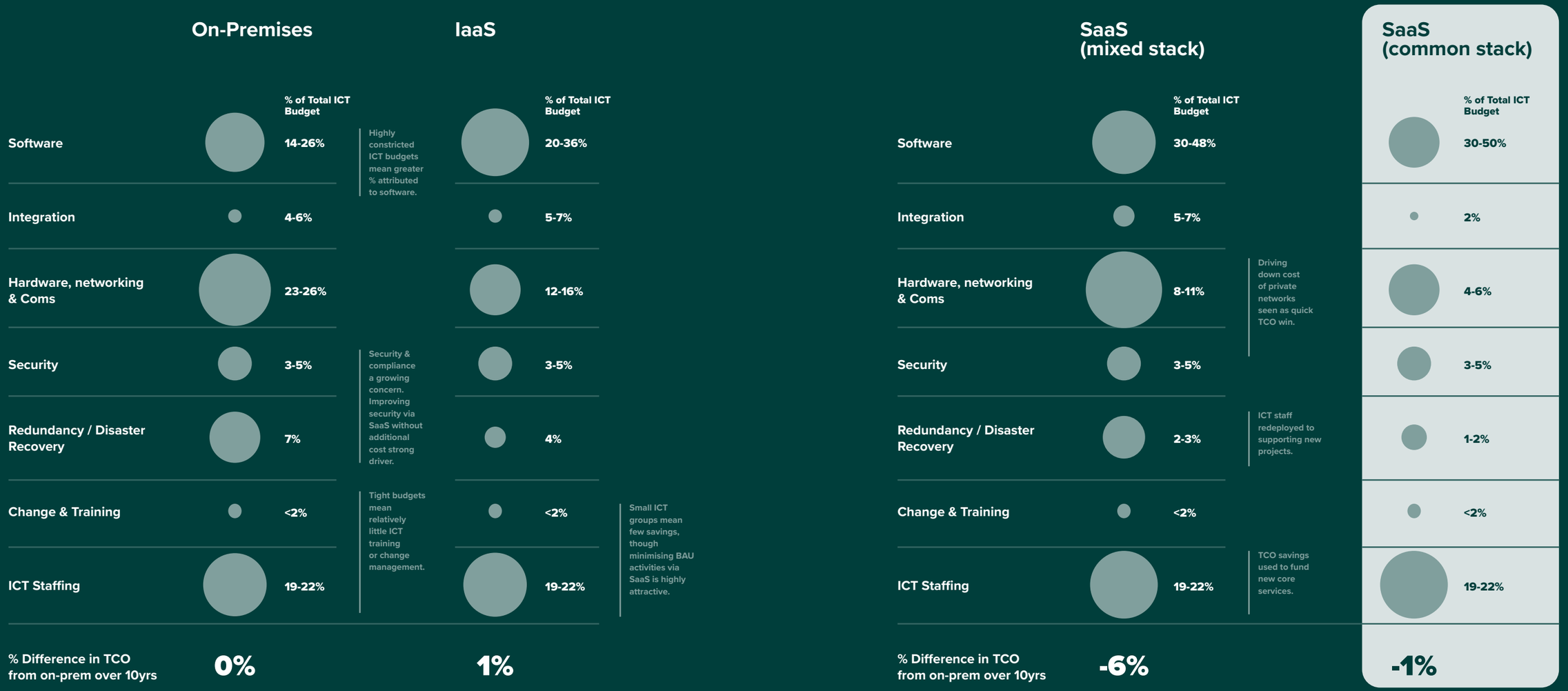
The aged care sector is undergoing massive consolidation, growth and scrutiny. In the past few years, the adoption of SaaS by aged care is being driven by the need to quickly merge newly acquired facilities into business operations. Margins are razor thin and compliance is under extensive scrutiny, so SaaS (Native Integration) are emerging as the preferred model. For aged care, bringing together core finance, human resources, training and workforce development, document management and reporting services is critical. That said, there are highly specialised solutions, such as clinical and patient management that sit alongside the core SaaS (Native Integration).

Given the rapid consolidation and growth, operational savings for aged care providers moving to IaaS or SaaS are consumed almost immediately to provide improved staff services (especially around roster and time management, contracting, onboarding and job training) and improve compliance. The result is while TCO is not reducing, even with the move to SaaS, significant productivity gains and business benefits are being identified.

Hospitals have complex and unique legacy solutions. They are highly risk averse and migrating to cloud services tends towards IaaS, where existing solutions are migrated to IaaS when software is due upgraded or, more commonly, to provide a second ‘virtual data centre’ data centre for reliance. There are significant operational cost savings for hospitals moving to IaaS, up to 16 per cent, largely due to avoiding ICT staff increase, stronger security stance without increased costs, and direct savings on disaster recovery facilities.

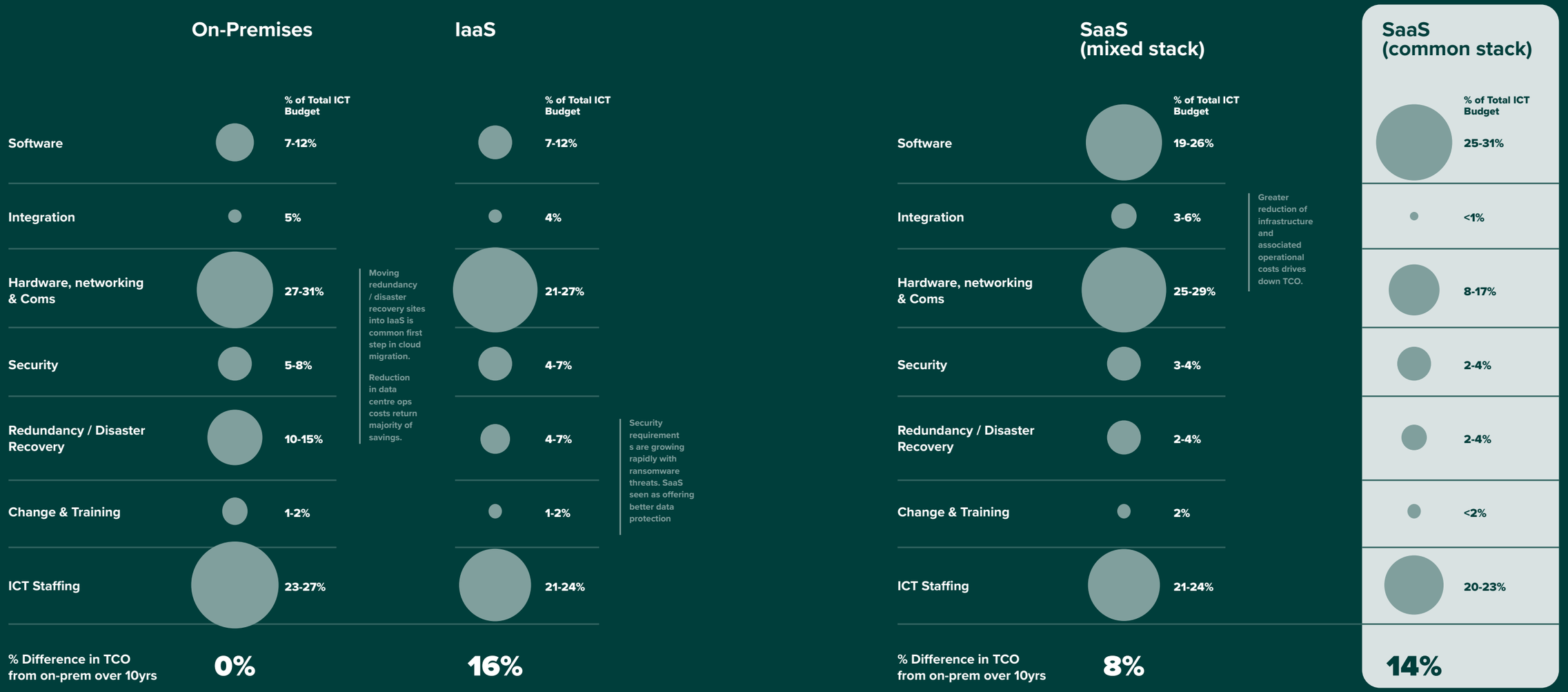
There are some opportunities for SaaS (Native Integration), but given the breadth of specialised services, SaaS (Mixed Stack) is more common.

## Figure 2.11:
## TCO by delivery model – Aged care




Source: IBRS based on commercial in confidence market data

## Figure 2.12:
## TCO by delivery model – Hospitals




Source: IBRS based on commercial in confidence market data

## Australian case study: Aged care provider experience in migration to SaaS

A rapidly growing aged care provider selected several SaaS solutions to allow it to quickly add new facilities it was acquiring to a common corporate environment. SaaS solutions were preferred due to the ease of use, not needing to deploy hardware to remote locations, and the inherent security. A SaaS (Native Integration) solution was preferred to limit the need for integration and to provide data in a unified manner for reporting and business analytics. However, there were highly specialised software, such as clinical management, that needed to be adopted alongside the typical finance, records management and reporting modules. To limit the complexity and cost of integration, the organisation chose a primary SaaS (Native Integration) solution, and added a clinical management solution and facilities management solution to provide the additional capabilities.

The organisation recognised that being able to show how it complied with all government requirements, and back up all claims with evidentiary records was not just a cost of doing business, but a competitive advantage for growth. It needed to leverage best-practice processes in finance, records management and have the ability to create custom forms for staff, residents and their families that would capture information efficiently for reporting purposes. The low-cost workflow tools of the SaaS (Native Integration) solutions were used to create the forms and workflows.

The impacts of adopting this SaaS strategy included:

- Enforcement of best practices in procurement saw a 10 per cent to 20 per cent reduction in critical expenditures, such as food and beverages. These savings were then used to improve the range and selection of services to residents, thereby increasing residential comfort and wellness.
- Facilities were able to put into place ‘safe work’ protocols quickly in response to COVID-19. This involved not both new work practices, but also deploying online training to all staff.
- Able to meet regulatory demands quickly, such as developing a complaints tracking, remediation and reporting system within the SaaS environment.
- Residents and family members provided with self-service portals to review status of accounts and confirm details of invoices. This not only improved satisfaction with the provider, but also saw 2-3 FTE productivity benefits in finance and administration.
- Online training saw a minimum of two hour saving per new employee, plus greater transparency in staffing.

## Direct impacts expected for the health and aged care sector

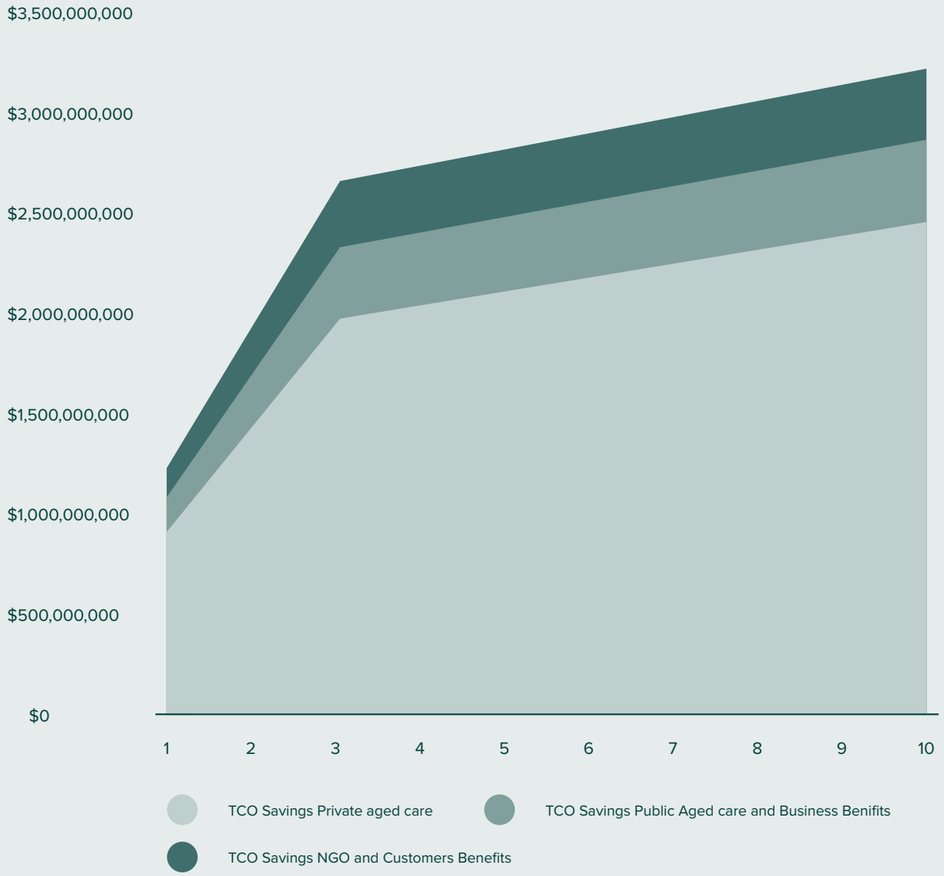
Based on desktop research and market data and interviews, it was estimated that across the Heath and Aged Care sector 50 per cent of organisations utilise an on-premises software model, with 20 per cent utilising an IaaS model, 20 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model.

The organisational benefits potential for health care providers was estimated based on a migration to a SaaS (Native Integration) solution by all providers within three years; the sources of savings included:

- TCO savings in the range of 14 per cent for hospitals but an increase in TCO for aged care providers of approximately one per cent
- Labour force productivity improvements of only one per cent based on real world evidence from Australian case studies, which is substantially below international case study lower bound expectations of five per cent productivity improvements
- Avoided financial auditing and consulting costs through improved financial reporting and management
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature
- Reduced supply chain and inventory management costs of two per cent, which is the lower bound of analysis reported in the literature.
- Further details of the key assumptions and data sources are provided in Appendix A.

The total direct benefits to health and community services providers of moving to SaaS (Native Integration) from current capability solutions is expected to be $23 billion in NPV2% terms excluding potential consumer benefits arising from improved quality and sustainability of residential aged care services (Figure 2.13). If there were a one-year improvement in life expectancy for 10 per cent of residential aged care residents, valued at $50,000, this would translate into a further $2.7 billion in benefit in NPV2% terms.

**Figure 2.13:**
**Direct impacts of migration to SaaS (Native Integration) in the health and aged care sector**




Source: IBRS and Insight Economics

## Opportunity costs of expenditure

Cost efficiencies in hospitals and aged care settings could translate into an expansion in services, leading to reduced waiting times for key services, and improved access to residential aged care (Figure 2.14). Case study interviews indicated advanced software had led to improved survival outcomes for residents in many cases; due to the uncertainty in the consistent realisation of these benefits they have not been quantified here.

### Figure 2.14:
### Opportunity costs in the health and aged care sector

**Fund more than 3.7 Million Hospital services**

**Fund more than 297,000 residential aged care places**

**Fund 34,000 additional registered nurses**

**Fund more than 883,000 residential aged care places over ten years, a 41% uplift in services**

Source: IBRS and Insight Economics



## 2.5 Direct impacts of Software as a Service for higher education providers

**Current business context and key considerations for migration to SaaS by higher education providers: case study insights**

The higher education sector has embraced SaaS in narrow domains. Vendors of student information management and learning information management solutions are aggressively driving their clients to SaaS versions, and most new features are designed to be internet accessible for both faculty and students.

However, many institutions are adopting IaaS. In part this is driven by the recognition of lower TCO (or the services ported) compared to on-premises infrastructure. However, drawing upon these savings are hindered by the institutions needing to retain data centre capabilities to support niche software and the faculty demands. This report found that the full potential of IaaS is not (yet) able to be realised by most high-education institutions.

Aside from the above, larger institutions and some K12 education networks are using the move to IaaS to rationalise sprawling ICT software environments. The process of migrating applications from on-premises to IaaS is an opportunity to identify legacy software that can be eliminated or replaced with features readily available in existing SaaS solutions. In one instance, the cost savings from rationalising software saw a greater than 17 per cent saving in licensing and operating costs. Institutions taking this approach to cloud migration also leverage SaaS solutions for deeper operations savings by consolidating disparate software, though they still retain a significant IaaS environment.

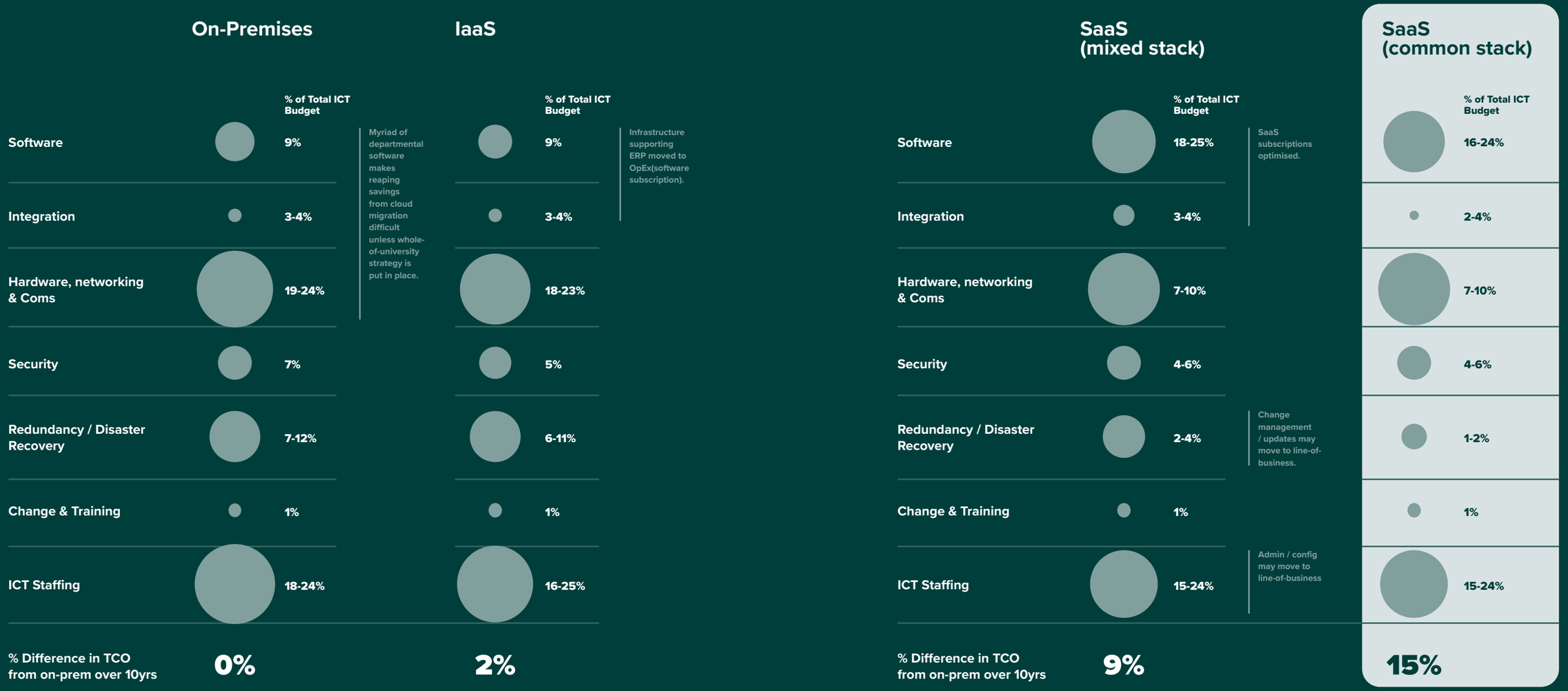
Unlike some other sectors explored in this report, the productivity savings within education are relatively well understood, though still under-estimated. The ongoing casualisation of and increased commercialisation of higher education has made measuring productivity a relatively high priority. The negative impact of COVID-19 has only heightened awareness of the need to find productivity gains.

Productivity gains were clearly identified in back-office automation and reporting. New capabilities in finance software - especially around billing - saw up to 25 per cent productivity gains. In addition, the new software capabilities also sped up student fee payment times by up to a week, improving cash flow and reducing additional administration tasks.

Expense reporting and facility budgeting tasks also saw significant productivity gains. Here, SaaS solutions shone by providing mobile capabilities for submitting expenses and timesheets. Several institutions reported savings of hundreds of hours annually for faculty and senior staff alone, and potentially multiple thousands of hours for casual staff.

SaaS solutions also provide for more student-facing services and workflow to process student services. The direct impact of these capabilities is a significant reduction in the need for temporary staff during the high-volume periods, such as the registration periods leading into each semester. One institution reported a 25 per cent productivity gain during these times (which resulted in a redeployment of staff to address special-needs and at-risk students).

## Figure 2.15:
## TCO by delivery model – University




Source: IBRS based on commercial in confidence market data

## Australian case study: University experience in migration to SaaS

In 2016, a mid-sized university's COO saw the need to rein-in costs from multiple, disparate and siloed information systems, and to focus new ICT investments solely on solutions that saved money, increased the reach of the university or boosted the productivity of staff. After extensive analysis, the university determined that all departments would migrate to a cloud-based platform. The strategic key was to bring all of the university's functions together on a common platform.

To start its transition to the cloud, the university migrated from its on-premises finance solution to the vendor's SaaS-based version. This immediately gave the university new functions and new ways to run financial operations. It also laid the foundations for new reporting.

The migration was led by the finance team, with ICT providing insights and governance, but not driving the project. While the migration was aided by the software vendor's consultants, much of the preparation and configuration was done hand-in-hand with the university's finance staff. The ability for non-technical staff to lead the charge on a software refresh was touted as a major factor for selecting SaaS and for the projects speedy implementation - it took just three months for the migration from the aging on-premises solution to the SaaS solution.

The impacts of the SaaS migration included:

- The university was able to refocus ICT resources. It is estimated that in just the financial module, the equivalent of two ICT staff were able to be redeployed to digital transformation efforts.
- An estimated two FTE productivity gain in the finance department as a result of automation and fewer errors.
- More recently, the university has begun using the low-code workflow and approvals to digitise both internal and external processes. This is resulting in an adding productivity gain in terms of temporary staff that are needed during peak times. A reduction of 25 per cent in temporary staff are now needed, largely as a result of the student self-service capabilities offered by the SaaS model.
- According to the university, one of the benefits of the approach taken during the move from on-premises to SaaS is that there is a stronger working relationship between the university's ICT group and other departments. The new SaaS environment is administered, maintained, and re-configured when needed by a new role within the finance group, rather than having ICT manage all aspects of the software. This has resulted in approving upgrades with usability testing taking a matter of days, not the several months required by ICT. It also means the finance team has control over new digital workflows and processes. In turn, ICT focuses its efforts on integrations (where needed) and developing new innovations for the university.

## Direct impacts expected for the higher education sector

Based on desktop research, market data and interviews, it was estimated that:

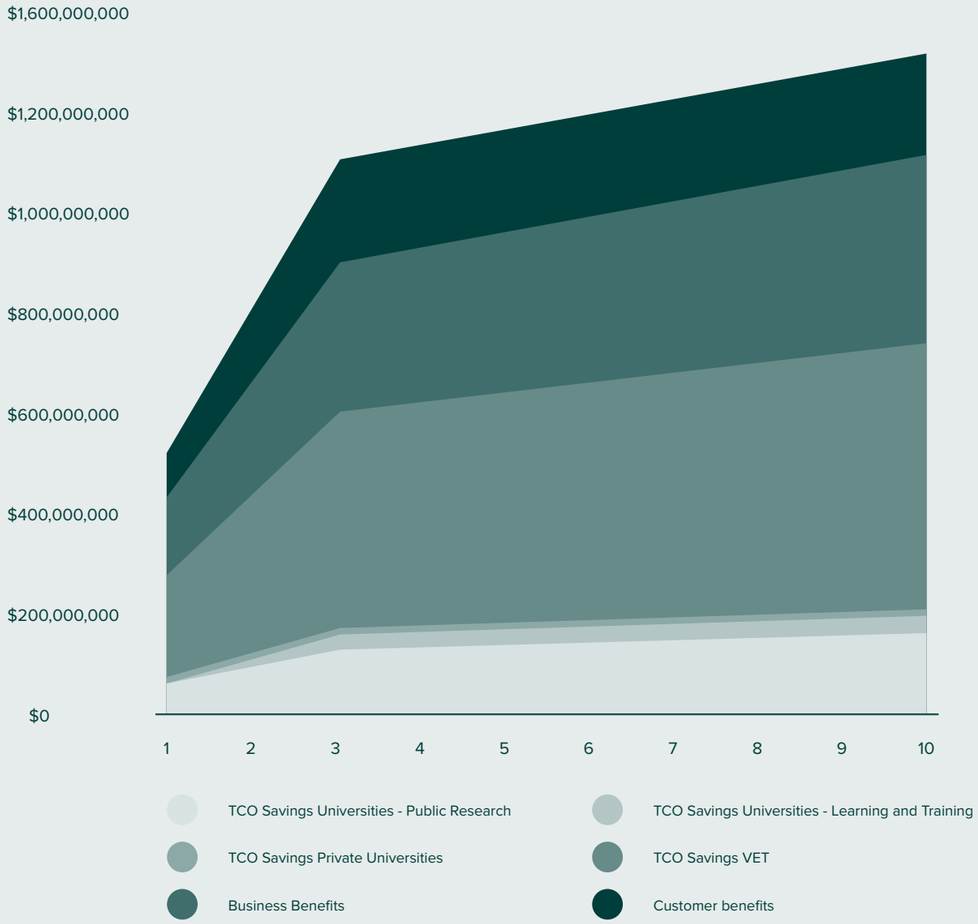
- 70 per cent of public research universities use an on-premises software model, with 10 per cent using IaaS, 15 per cent using a SaaS (Mixed Stack) and five per cent using a SaaS (Native Integration) model
- 50 per cent of public learning and training universities use an on-premises software model, with 30 per cent using IaaS, 10 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model
- 70 per cent of private universities use an on-premises software model, with 10 per cent using IaaS, 10 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model
- 60 per cent of VET providers use an on-premises software model, with 25 per cent using IaaS, 10 per cent using a SaaS (Mixed Stack) and five per cent using a SaaS (Native Integration) model.

The organisational benefits potential for local higher education providers was estimated based on a migration to a SaaS (Native Integration) solution by all providers within three years; the sources of savings included:

- TCO savings in the range of six per cent for private and learning and training universities, 15 per cent for public research universities and 37 per cent for VET providers
- Labour force productivity improvements of two per cent based on real world evidence from Australian case studies, which is below international case study expectations of five to 10 per cent productivity improvements
- Avoided casual labour requirements during peak administration periods
- Avoided financial auditing and consulting costs through improved financial reporting and management
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature.

Combined, the total direct benefits to higher education providers of moving to SaaS (Native Integration) from current capability solutions is expected to be $8.4 billion in NPV2% terms including consumer time savings (Figure 2.15). Excluding consumer time savings, the benefits from lower TCO and the realisation of other business benefits would be $9.4 billion in NPV2% terms.

**Figure 2.15:**
**Direct impacts of migration to SaaS (Native Integration) for higher education providers**




Source: IBRS and Insight Economics

## Opportunity costs of expenditure

These cost savings could be redirected to competition enhancing investments in research and education. The education sector alone could fund critical investment in new roads, public hospital services, aged care places, and more teachers in classrooms (Figure 2.16).

### Figure 2.16:
### Opportunity costs in higher education

**Fund more than $1.1 billion in new research per annum over the next ten years, or $11.5 billion in absolute terms over ten year horizon**

**Fund more than 5,600 new Professor roles each year for the next ten years**

Source: IBRS and Insight Economics



## 2.6 Direct Impacts of Software as a Service for the project and asset intensive sector

**Current business context and key considerations for migration to SaaS by project and asset intensive organisations: case study insights**

The asset and project intensive sector includes construction, ports and developers that own and manage large property assets. These organisations are difficult to generalise. There is a great deal of diversity in how they deploy technology, their technology investment and their priorities. While some organisations have a strategy to draw out investments in on-premises legacy software, others are 100 per cent SaaS.

Many asset intensive organisations run on razor thin margins. The cost associated with migrating to new cloud-based solutions is seen as a short-term hurdle that ICT departments of these organisations cannot overcome. In addition, many of these organisations have a preference for capital expenditure, which does not fit with a cloud first strategy.

The challenge here is less technical as it is financial. Investment pattern needed to migrate to the cloud requires near-term, upfront investment for longer term, sustained productivity benefits and cost savings. As a result, one of the key challenges for organisations resisting cloud, is a decision around at what point will senior executive approve the investment required, versus how long the decision can be put off.

The situation has fuelled enterprise shadow IT. Enterprise SaaS solutions are being procured by specific departments - most commonly field force and human capital management groups - using departmental budgets and with minimal IT governance. A previous study by IBRS revealed that HR departments now outspend the IT group with regards to human capital management software investments.

The result is an unplanned adoption of SaaS (Mixed Stack).

Unfortunately, TCO modelling suggests this is a less cost-effective operation model when compared to SaaS (Native Integration). While there are benefits in terms of the speed of deploying new field capabilities to workers and contractors, there is little, longer term cost savings, and the total cost of software is significantly higher over a 10-year period. On average, the total cost of ownership of this approach remains much the same as continuing with an on-premises legacy environment.

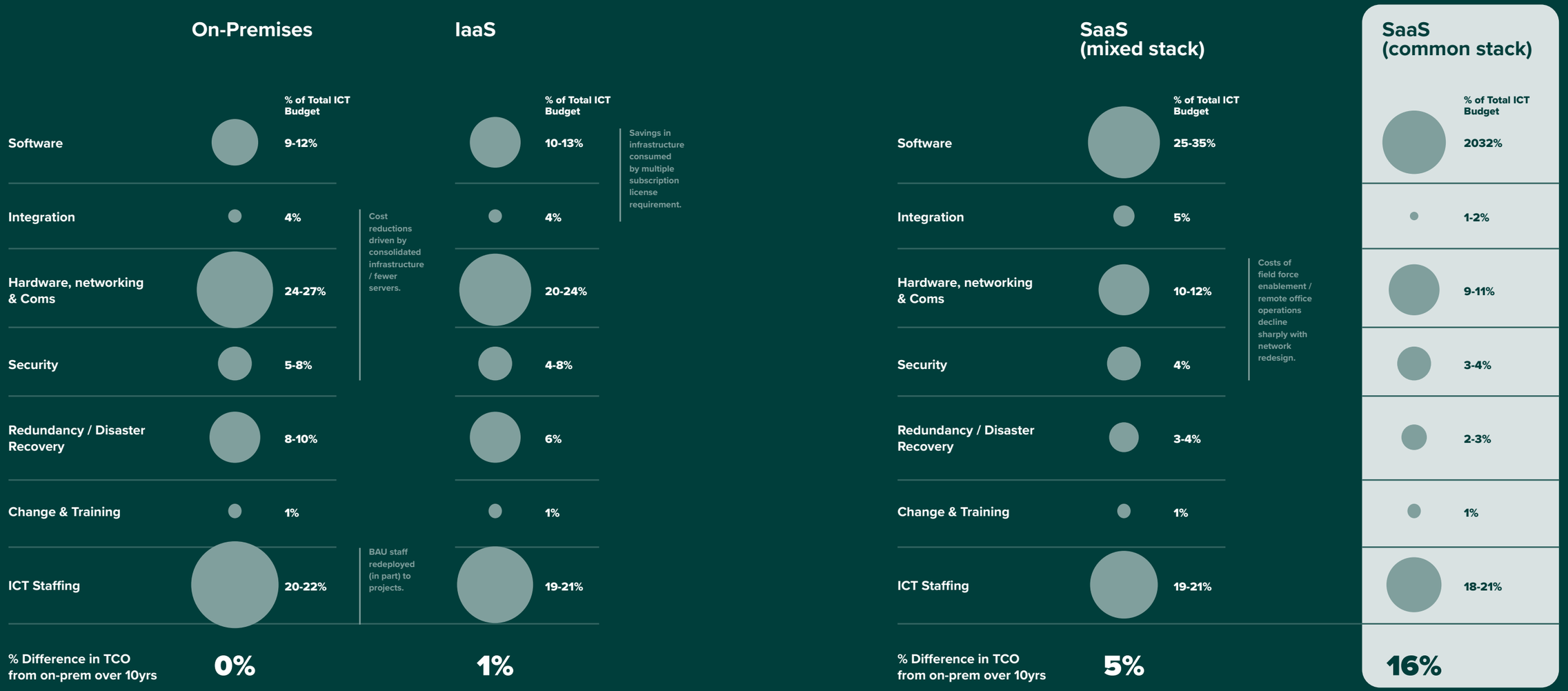
At the other extreme, the study found asset rich organisations fully adopted an ‘as-a- Service’ business model, not just for their IT but for all services within the organisation. Not only is the running of software relegated to cloud services, but so too are differential

business functions such as payroll, collections and so forth. The focus of these organisations is very much on how to leverage technologies to automate and drive down the costs of asset maintenance and maximise revenue from existing assets. IoT (Internet of Things) is an area of strong interest for these organisations. These organisations are leveraging IaaS (including Platform-as-a-Service technologies from the key hyper scale cloud vendors) to gain significant ICT operational efficiencies.

In terms of productivity gains, asset and project rich organisations tend to only measure the direct benefits within the organisation: administration, financial operations, labour inputs from full-time staff members. However, with investments going into workforce management solutions there are additional external labour productivity benefits from contractors that are not being counted. In one example, a SaaS based workforce management application was said to be saving contractors up to 30 minutes a day from start work orders and required worksite inspection forms. In this instance, the organisation running the software explicitly did not count the contractors time-saving, stating that "the benefit was all there is, which means they can reduce their fees to us".

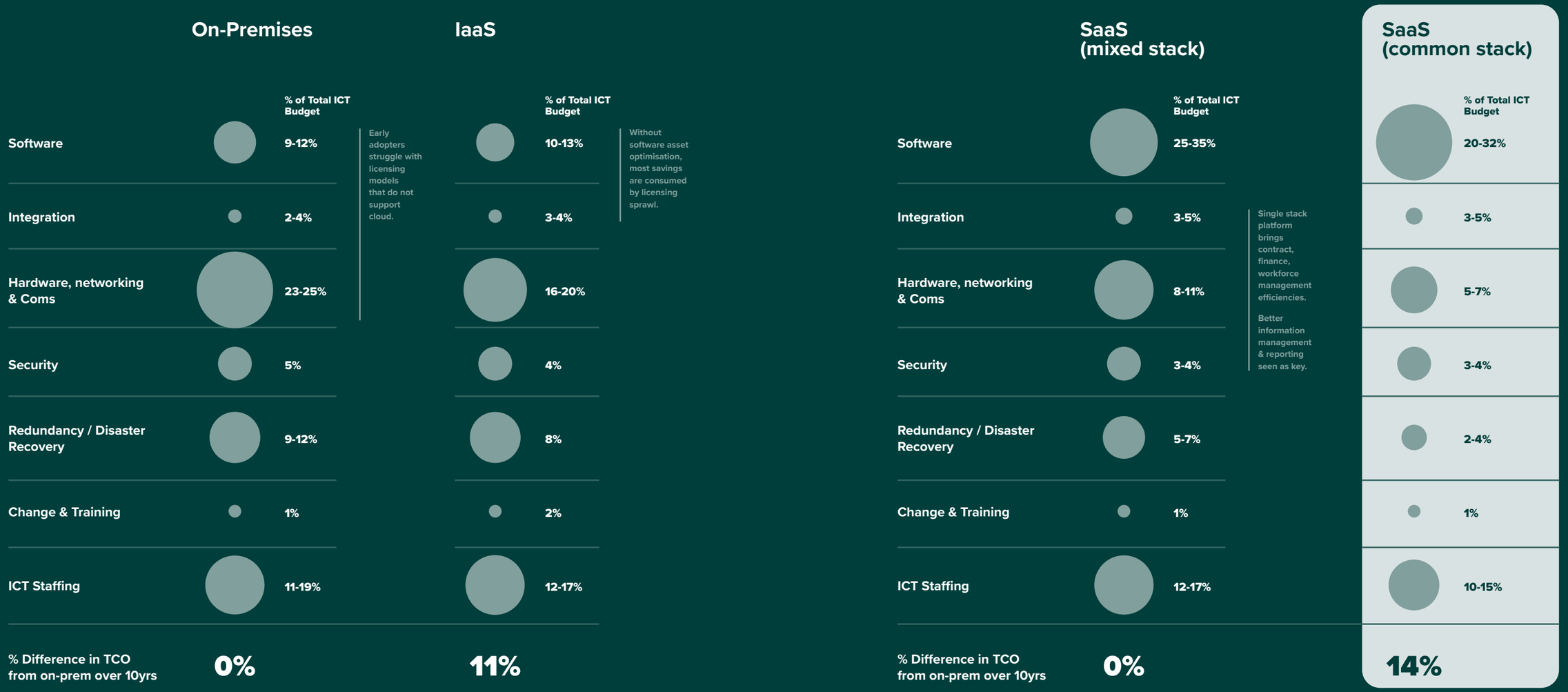
Surprisingly, better asset management was almost completely overlooked by the asset rich organisations interviewed for the study. While they recognise that better targeting of preventative maintenance can see significant returns in both labour savings, and extended asset life, none had measured these benefits. However, all are keen to use the emerging data analytics capabilities of SaaS products to identify where savings and improvements can be made in asset management. Unfortunately, the mixed stack approach to SaaS has hindered the ability of organisations to extract this level of reporting.

## Figure 2.17:
## TCO by delivery model – Own, operate and maintain business




Source: IBRS based on commercial in confidence market data

## Figure 2.18:
## TCO by delivery model – Design and build firms




Source: IBRS based on commercial in confidence market data

## Australian case study: Large construction firm experience in migration to SaaS

A large and fast-growing design and construction organisation with operations throughout Australia wished to bring disparate organisational units together and consolidate work processes. It has a variety of aging on-premises solutions, some inherited from recent mergers and acquisitions.

A decision was made to migrate all core business solutions to SaaS, in part to reduce complexity of the current ICT environment, but also to help bring all divisions to a common set of work processes.

Benefits from adoption of SaaS for core business solutions included:

- Enabled the organisation to achieve a far more accurate level reporting, leading to direct savings. As the organisation had a mandate to reduce operating costs by four per cent over five years, being able to track expenses and identify areas for improvement was critical. Over the 3 ½ years of the SaaS system being in place, the organisation has been able to reduce operating costs by close to 3.7 per cent as a result of right financial management, while still enabling the organisation to grow at almost twice the rate of its competitors.
- While the organisation did not measure direct productivity savings as a result of the SaaS environment, it did identify that it's contractors (over 5000 staff at any one time) benefit from improved rostering and digital forms. The organisation conservatively estimates contractors save 15min in manual processes each week, at a minimum saving of $2.50 for every work order, of which there are hundreds of thousands a year. Thus, the organisation's SaaS platform has significant productivity gains for external stakeholders
- An unexpected benefit of adopting a common SaaS platform across the organisation is that it has far greater visibility of information when responding to tenders. In one instance that was cited, stakeholder information held in the SaaS platform identified that the organisation was extremely unlikely to win a pitch, thus avoiding over a million dollars and wasted time. In another example, information in the SaaS platform identified information from multiple groups across the organisations that helped secure a project worth multiple hundreds of millions.

## Direct impacts expected for the project and asset intensive sector

Based on desktop research, market data and interviews, it was estimated that across the project and asset intensive sector 50 per cent of organisations utilise an on-premises software model, with 20 per cent utilise an IaaS model, 20 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model.

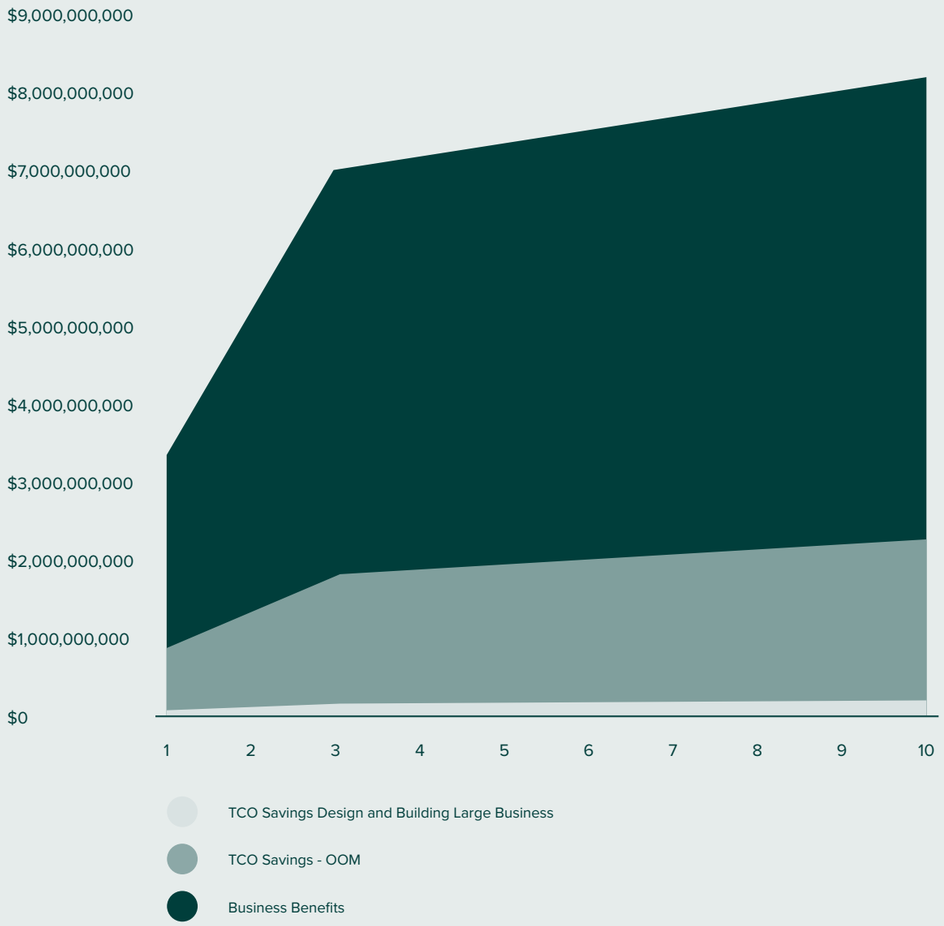
The organisational benefits potential was estimated based on a migration to a SaaS (Native Integration) solution within three years; the sources of savings included:

- TCO savings in the range of 14 per cent for large construction firms, three per cent for construction SMEs, and 16 per cent for organisations that own, operate and maintain major infrastructure assets
- Labour force productivity improvements of five per cent based on real world evidence from Australian case studies, which is in line with international case study lower bound expectations of five per cent productivity improvements
- Avoided financial auditing and consulting costs through improved financial reporting and management
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature
- Reduced supply chain and inventory management costs of two per cent, which is the lower bound of analysis reported in the literature
- Smoothing capital expenditure investments by privately held own, operate and maintain organisations.

Further details of the key assumptions and data sources are provided in Appendix A.

The total direct benefits to asset and project intensive organisations of moving to SaaS (Native Integration) from current capability solutions is expected to be $62 billion in NPV2% terms (Figure 2.19). Due to the capital-intensive nature of this sector, improvements in asset management translate into significant benefits for firms with the net improvement representing a four per cent improvement in expected maintenance costs per annum.

**Figure 2.19:**
**Direct impacts of migration to SaaS (Native Integration) in the project and asset intensive sector**




Source: IBRS and Insight Economics

## 2.7 Impact of Software as a Service for corporate and financial services

**Current business context and key considerations for migration to SaaS by financial services and corporate businesses: case study insights**

Interviews with corporates for this study focused largely on financial services and insurance, and was backed with research into the retail, media and wholesale subsectors. Australia is relatively unique, with strong regulation of the finance sector and a consolidated supermarket industry. However, outside of the large banks and duopoly of supermarkets, this study found similar patterns of cloud usages across many organisations.

In the financial services space, there is a strong push towards cloud services with both IaaS and SaaS being called upon. IaaS appears to be more heavily used by the upper end of the mid-sized finance market, while SaaS is being rapidly adopted by the mid-sized market. Larger financial institutions have a plethora of customised legacy solutions that support not only their day-to-day processes, but also provide the necessary guardrails to meet governance and regulations. Migrating from these systems would be both costly in the near term and risky.

Therefore, moving these solutions to IaaS is the preferred approach. The initial goal of the 'lift and shift' of existing solutions to IaaS is to support business growth while limiting the growth in ICT staffing and expenditure. Another benefit being sought by the move to IaaS is that it allows new bespoke services to be developed using Platform-as-a-Service technologies which are residing the same cloud infrastructure as the legacy core solutions.

In addition, business units within these mid-to-large financial institutions are exploring SaaS solutions to provide new services. Unlike observations from other sectors, the business units in financial services groups tend to engage their ICT groups fully in the selection of SaaS solutions, likely as a result of the knowledge that any systems procured meet all appropriate compliance requirements. The result of this is that mid-to-large financial services organisations pay more attention to the integration of SaaS to software that is on-premises and sitting in IaaS. The adoption of SaaS is also helping to drive the migration of legacy or highly customised solutions to IaaS.

Given the assertive IaaS migrations being undertaken by larger financial institutions, they see direct savings from moving to IaaS, though the majority of such savings are taken up by the development and running of new services. In short, as core legacy solutions are shifted to IaaS, they are doing more with slightly less budget. However, given their scale and staff sizes, SaaS is less cost effective than seen with other sectors, though still around six per cent more cost effective than maintaining on-premises legacy solutions.

Mid-sized financial services are adopting SaaS more aggressively, largely as a way to quickly gain new customer-facing services: sales, marketing capabilities and service delivery. Modernising the call centre experience to be more than just telephone support is a strong trend. Along with the shift to SaaS-based call centres, these organisations are adopting SaaS customer management solutions and, increasingly, SaaS records management. Given the constrained ICT resources of mid-sized financial organisations, there is greater adoption of SaaS (Native Integration). In particular, there is a desire to tightly couple records management (an essential aspect of regulatory compliance) with customer relationship management (CRM) solutions, with marketing and sophisticated reporting.

Mid-sized financial services institutions see far more significant cost of operation savings from SaaS, with SaaS (Mixed Stack) delivering nine per cent and Native Integration an impressive 15 per cent, even with the conservative calculations used in this report. With such clear savings, it is unsurprising that SaaS is being rapidly adopted by these organisations.

### Box 2.1: Australian banks – competition and the role of SaaS going forward

Much has been written about the slow adoption of cutting-edge fintech by Australian banks compared to North America. There is some truth to this claim: there is little experimentation with technologies such as cryptocurrency, the use of machine learning based and behaviour analytics for loan microloan approvals, and so forth. However, the Australian financial services landscape has different competitive pressures and governance than other markets. Competition is largely around improving customer experience with the goal of customer retention and reduction in customer churn, or to create new revenue streams from the existing customer base. It is for this reason that investments in customer-facing SaaS solutions are growing rapidly, and why larger organisations are looking to build rapidly scalable customised services on top of older solutions using IaaS.

Source: IBRS

Outside of the highly consolidated supermarket sub-sector, retail in Australia is rapidly adopting SaaS, and most often with the Native Integration model. Even prior to COVID-19, the key drivers for retailers are business agility and expanding sales channels. With COVID-19, online shopping exploded and shows little signs of slowing down in the near future.

SaaS (Native Integration) solutions provide an easier view of their financial position, inventory, projections on sales to an item level and, of increasing importance, digital sales and customer services. The overarching trend for mid-sized retailers is for on-premises legacy solutions to be migrated to SaaS (Native Integration), rather than upgraded.

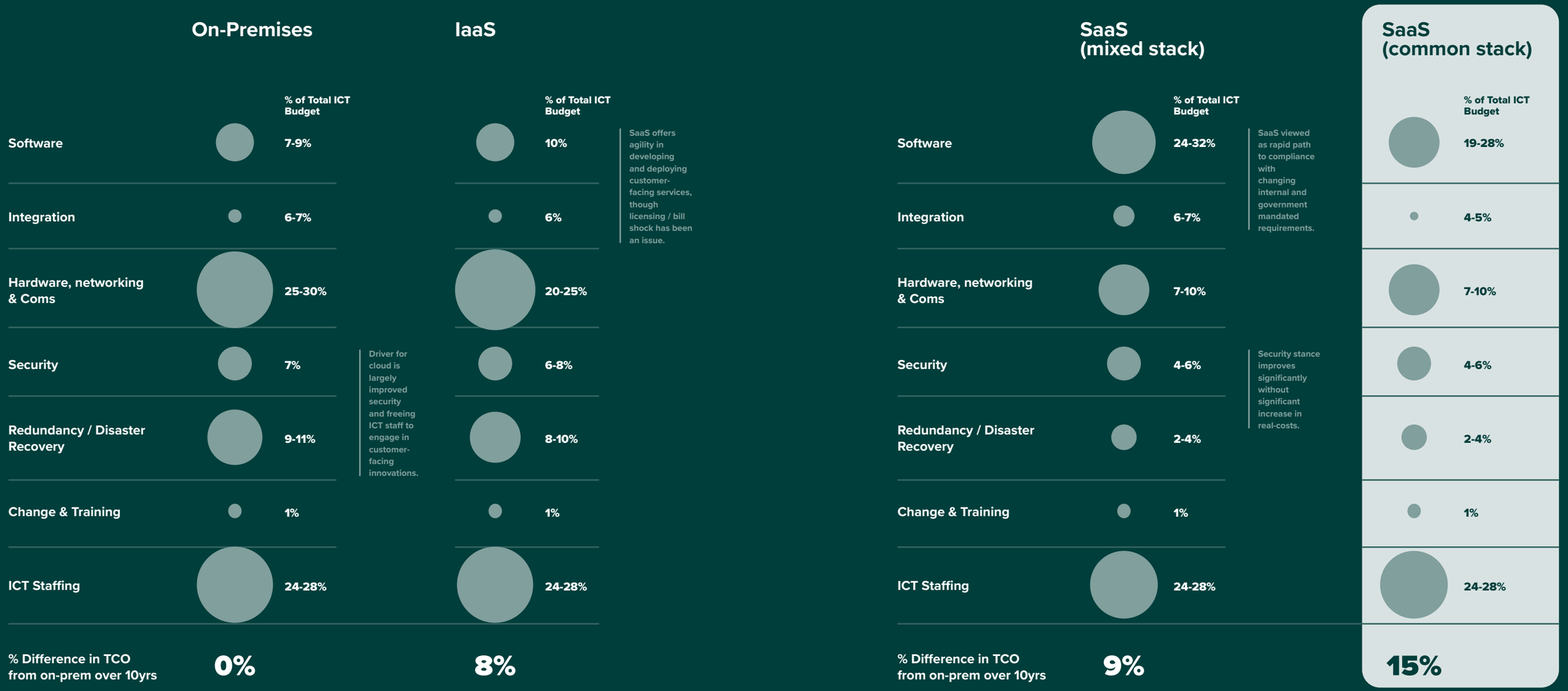
Operational cost savings are not the major consideration for retailers' cloud migrations. In most cases, these organisations are investing in new services to improve their operational efficiency, visibility, agility and to provide new sales channels. As a result, they see relatively small (a conservative four per cent) savings when moving to SaaS (Native Integration). However, the productivity benefits they received from these new investments are considerable.

Of all the sectors explored in this study, mid-sized manufacturers in Australia are slowest to adopt cloud solutions. Manufacturers are similar to asset rich organisations, in that they have a preference to continue seating on-premises legacy software investments. However, their focus is very much on inward-facing financial, asset and human resources management, with customer-facing solutions and analytics being far less important.

A common approach for manufacturers looking to modernise their ICT operations is to combine the upgrade of existing on-premises solutions with a migration to IaaS. There is considerable cost avoidance in terms of ICT staff, networking and storage in this scenario. Cost of operations can be reduced by 14 per cent with a move to IaaS.

The biggest challenge called out by manufacturers is the need for consolidated financial, sales, inventory, and production information, with reporting. The ability to handle recall, and asset and plant maintenance, were also called out. For this reason, manufacturers see the lowest total operation costs with SaaS (Native Integration), approximately 19 per cent.

## Figure 2.20:
## TCO by delivery model – Financial services




Source: IBRS based on commercial in confidence market data

## Australian case study:
## Private health insurer experience in migration to SaaS

A mid-sized private health insurance service has adopted a SaaS-first principle, where industry regulars allow. The goal for adopting SaaS whenever possible is not about reducing ICT operating costs but gaining business agility.

After a detailed market evaluation, the organisation had adopted a mid-tier Australian SaaS financial solution as the foundation for its digital services. The decision to adopt an Australian vendor was largely based on its ability to meet local regulations and expectations that a local vendor would be incentivised to quickly address any changes to Australia's regulatory environment. In the past, adapting to regularity changes and reporting demands had meant customisation of multiple on-premises, a time-consuming and costly activity, and one that risks missing compliance requirements.

The move to SaaS was to reduce the need for the organisation to have multiple data centres, to support disaster recovery and help business continuity. The organisation also wished to leverage the SaaS vendor's cyber security skills, opting for a solution that has been IRAP (Information Security Registered Assessors Program) certified for PROTECTED information.

The organisation also adopted a SaaS call centre solution and SaaS customer engagement platform. These were integrated to the core finance solution using a SaaS based integration platform and 'out of the box' connectors. The cost of such integration is now roughly 10 per cent of the SaaS environment. Benefits of the SaaS-first strategy include:

- By allowing SaaS vendors to manage the infrastructure needed to support their sophisticated software, the insurer was able to maintain an ICT group of just seven people while supporting a more than 30 per cent growth in demand for digital services.
- The rapid adoption of new capabilities and recording keeping to meet evolving compliance demands via the vendor's upgrades.
- Ability to change and adopt new processes quickly using a common workflow platform enabled a rapid response to COVID-19 and the move to digital self-service.
- Adopting cloud-based digital sales and customer service processes saw a productivity gain of 20 per cent for the sales teams.
- Peak and surge periods of work were handled more efficiently, resulting in 25 per cent lower temporary/shift-worker staffing demands.
- Enabled the organisation to grow its customer base 25 per cent faster than the industry average, while retaining staffing levels.
- New processes to on-board customers, based on analysis of customer needs, has resulted in higher 3 per cent retention rates.

## Direct impacts expected for the financial services and corporate sector

Based on desktop research, market data and interviews, it was estimated that:

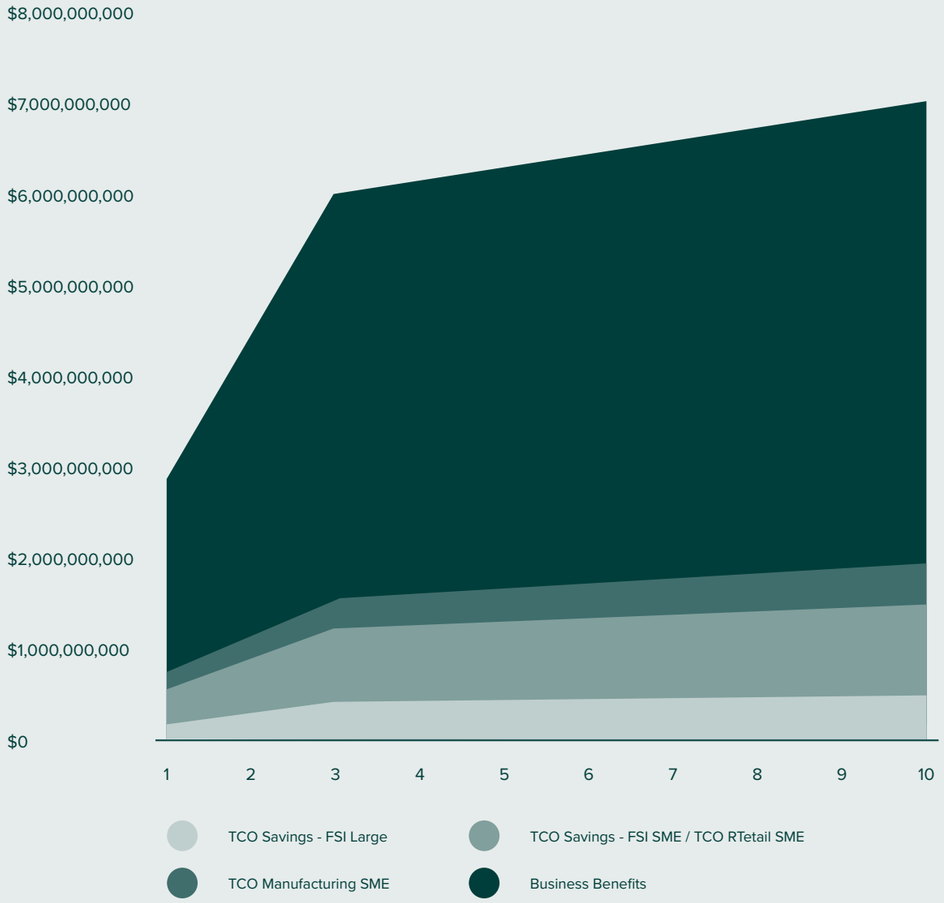
- 40 per cent of businesses in the FSI vertical use an on-premises software model, with 15 per cent using IaaS, 25 per cent using a SaaS (Mixed Stack) and 20 per cent using a SaaS (Native Integration) model
- 30 per cent of major supermarkets and food retail use an on-premises software model, with 25 per cent using IaaS, 35 per cent using a SaaS (Mixed Stack) and 10 per cent using a SaaS (Native Integration) model
- 20 per cent of other major corporate and retail businesses use an on-premises software model, with 10 per cent using IaaS, 40 per cent using a SaaS (Mixed Stack) and 30 per cent using a SaaS (Native Integration) model
- 30 per cent of other SME retail and manufacturing businesses use an on-premises software model, with 25 per cent using IaaS, 25 per cent using a SaaS (Mixed Stack) and 20 per cent using a SaaS (Native Integration) model.

The organisational benefits potential was estimated based on a migration to a SaaS (Native Integration) solution by within three years; the sources of savings included:

- TCO savings in the range of four per cent to 19 per cent depending on the specific industry vertical and organisational size
- Labour force productivity improvements of five per cent based on real world evidence from Australian case studies, which is in line with lower bound expectations for productivity improvements based on literature reviews
- Avoided financial auditing and consulting costs through improved financial reporting and management for a small proportion of firms
- Reduced costs of maintenance as a result of reduced reactive maintenance, conservatively based on the lower bound improvement (eight per cent) estimated in the literature
- Improvements in supply chain and inventory management.

The total direct benefits to corporate and financial services firms of moving to SaaS (Native Integration) from current capability solutions is expected to be $59 billion in NPV2% terms (Figure 2.21). Improvements in the costs of inventory management and the cost of goods sold, delivers the most significant benefit within this sector.

**Figure 2.21:**
**Direct impacts of migration to SaaS (Native Integration) in the financial services and corporate sector**

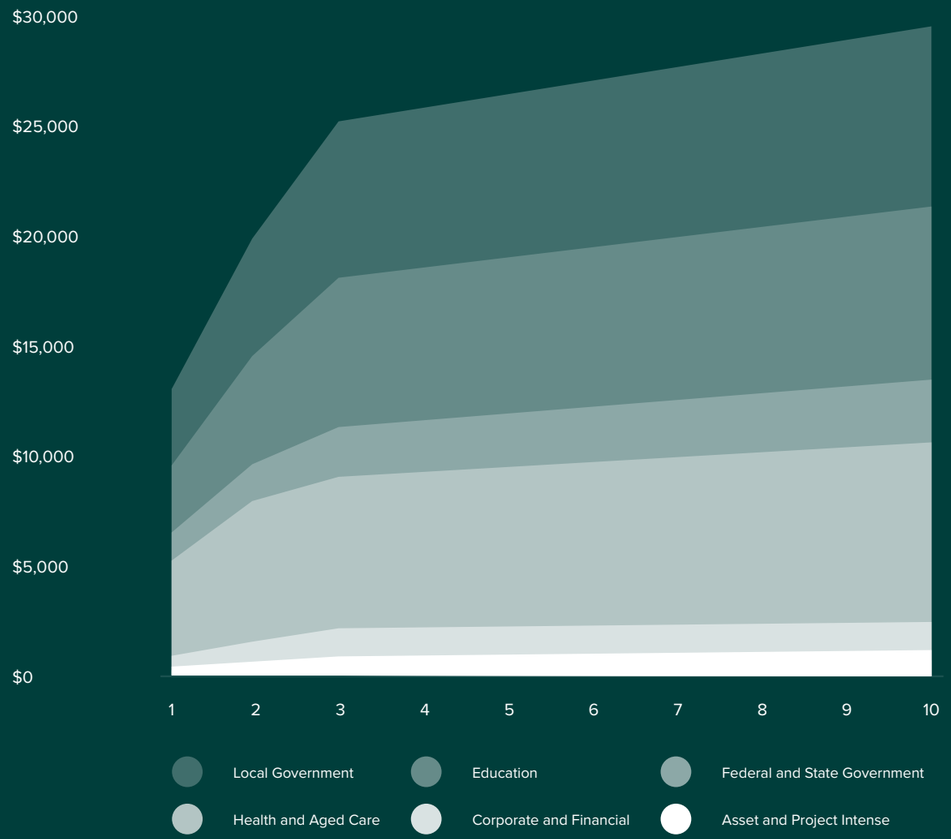



Source: IBRS and Insight Economics

## 2.8 Total direct impact to Australian economy

**In aggregate across all sectors, the direct benefit potential of moving to a SaaS solution compared to Australia's current software capability would be expected to be in the order of $252 billion dollars over the next ten years, allowing for a three-year ramp up of investment, or $224 billion in NPV2% terms (Figure 2.22).**

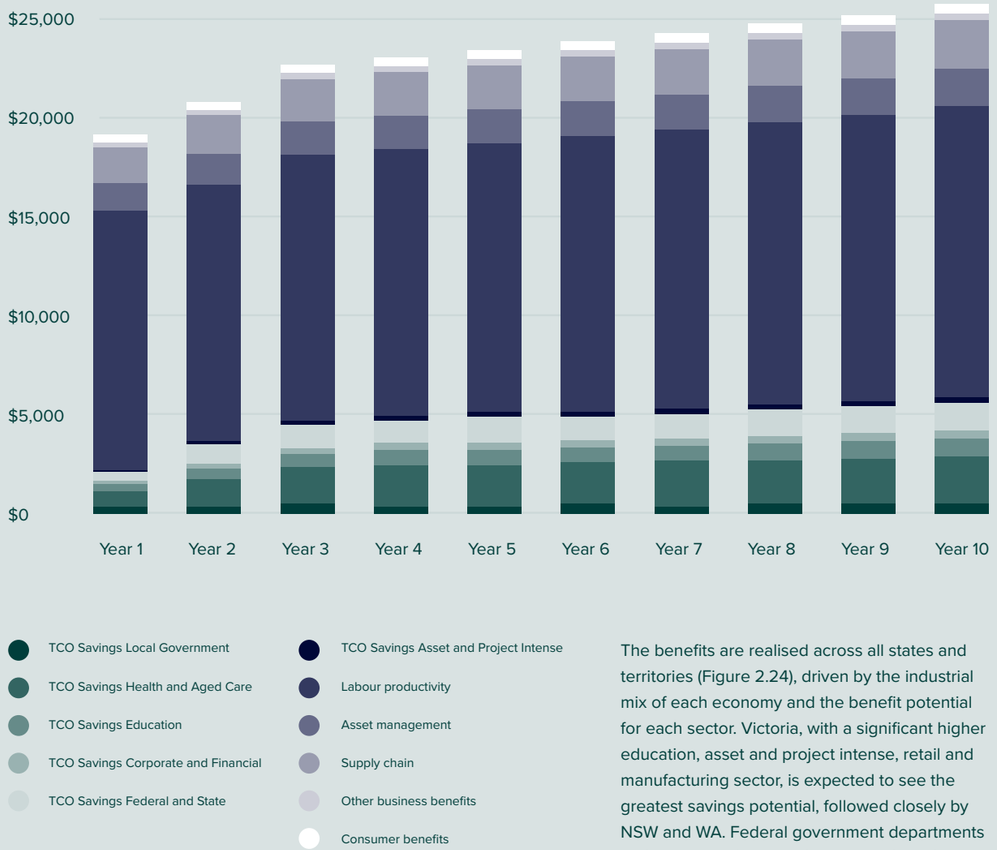
### Figure 2.22:
### Direct impacts of migration to SaaS (Native Integration) across all sectors (A$1000s)




Source: IBRS and Insight Economics

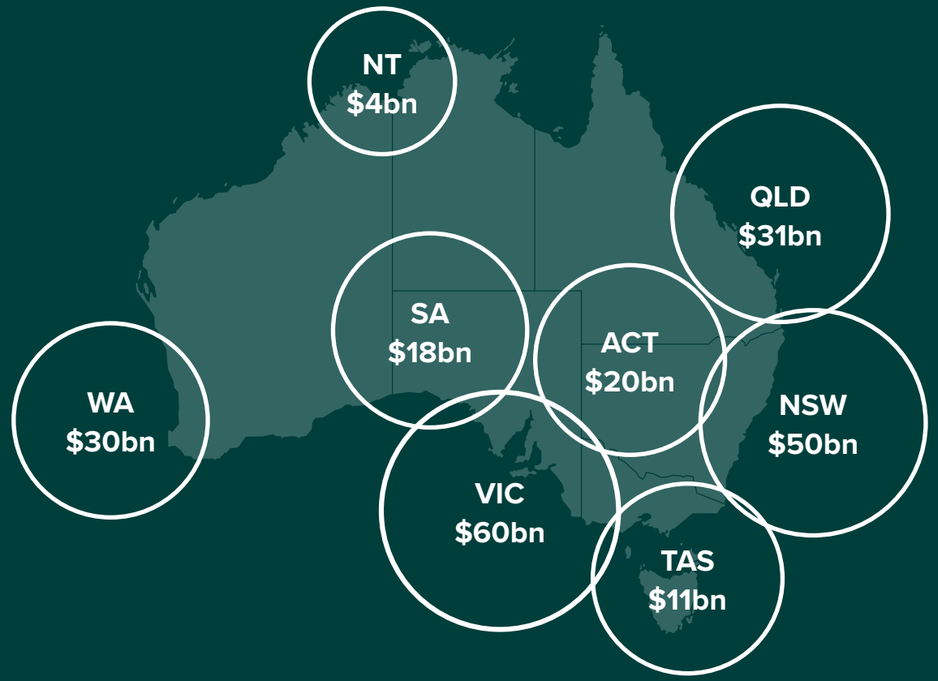
**A majority of benefits are derived from TCO savings, which account for 32 per cent of the benefits on average, and labour force productivity, which accounts for a further 54 per cent of the benefit potential from a migration to SaaS on average across all sectors (Figure 2.23). Critically, labour productivity represents an increase in output capacity for a given level of labour inputs; this allows organisations to meet growth in demand without expanding staff levels compared to what would have been required if a traditional on-premises software strategy had been continued.**

## Figure 2.23: Direct impacts of migration to SaaS (Native Integration) by benefit type (in A$1000s)




The benefits are realised across all states and territories (Figure 2.24), driven by the industrial mix of each economy and the benefit potential for each sector. Victoria, with a significant higher education, asset and project intense, retail and manufacturing sector, is expected to see the greatest savings potential, followed closely by NSW and WA. Federal government departments and agencies also contribute strongly to the savings potential for the ACT.

## Figure 2.24: Direct impacts of migration to SaaS (Native Integration) by state and territory

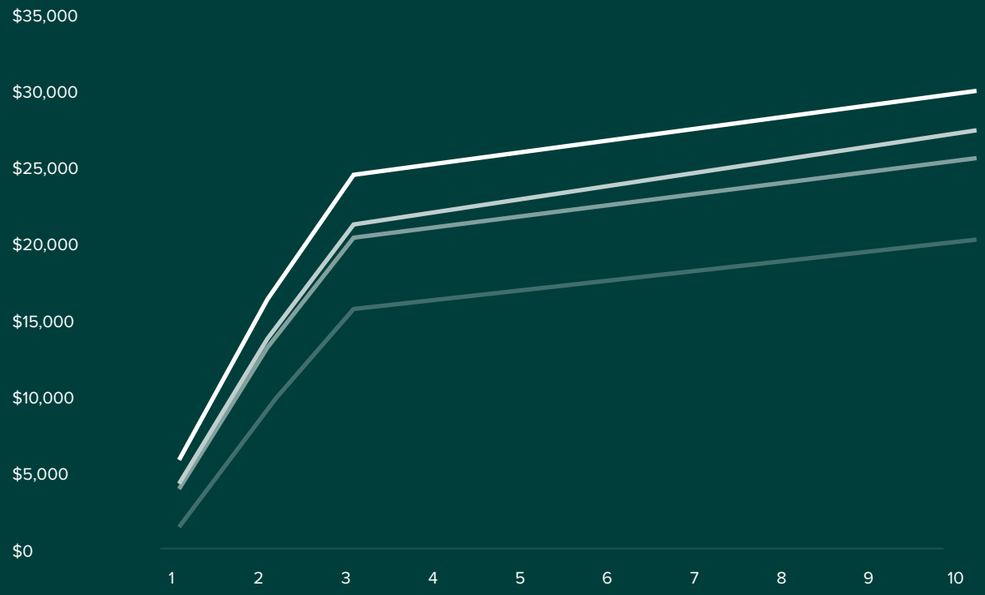



In undertaking sensitivity analysis of the long run outcomes, three alternative benefits realisation scenarios were considered:

- Sensitivity Analysis Scenario 1: No consumer time savings realised
- Sensitivity Analysis Scenario 2: No benefits from asset, supply chain or consumer time savings are realised
- Sensitivity Analysis Scenario 3: Higher labour productivity benefits are realised in line with international lower bound expectations across all sectors.

As outlined above, the expected benefits realisation for the Australian government, businesses and consumers was expected to be in the order of $224 billion in NPV2% terms. If benefits realisation in key categories were lower, such as in sensitivity analysis scenarios 1 and 2, the total direct benefits to Australia would be expected to fall to $218 billion (three per cent lower than the expected case) and $188 billion (16 per cent lower than the expected case) in scenarios 1 and 2, respectively, in NPV2% terms (Figure 2.25).

## Figure 2.25: Sensitivity analyses of key variables




If benefits realisation in key categories were higher than expected, such as in Sensitivity Analysis Scenario 3, the total direct benefits to Australia would be expected to increase to $242 billion (eight per cent higher) in NPV2% terms. Taken together, it is expected the total organisational impacts to Australia are likely to be within a range of $188 billion to $242 billion, depending on the realisation of benefits in practice.

Source: IBRS and Insight Economics

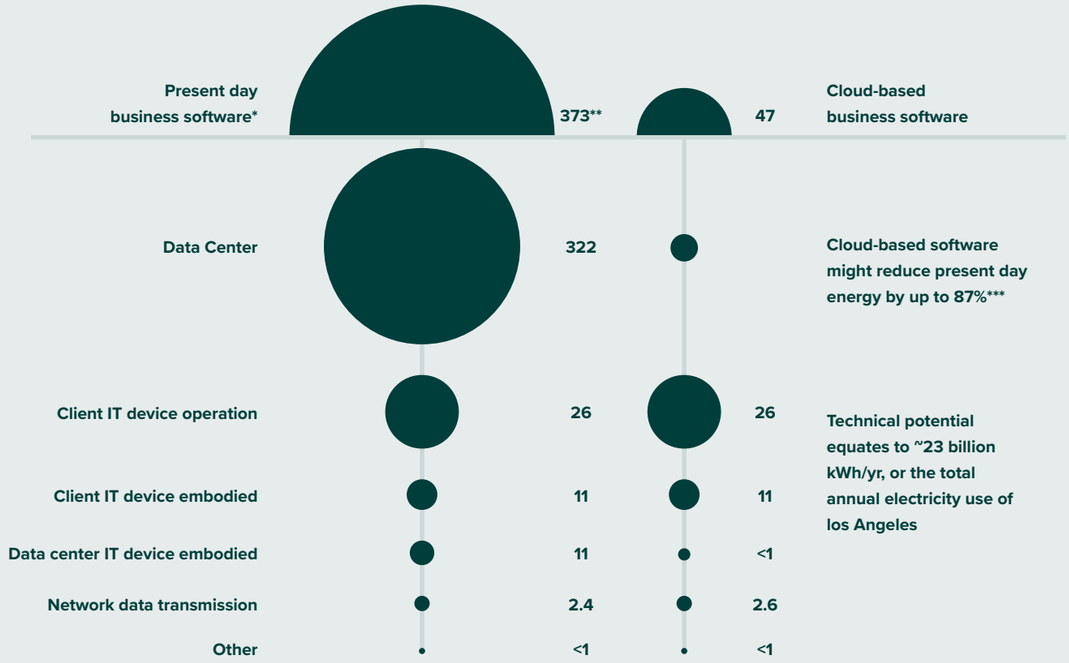
## Other effects: environmental impacts

In addition to direct economic effects, a transition away from on-premises solutions to SaaS will have an environmental impact through lower carbon emissions and energy savings compared to current software solution.

Most of the installed data centre capacity is inefficient and carbon intensive, comprised of significant volume of small data centres. Modelling by E3 consulting for the Australian Government (available at energyrating.gov.au) found that a migration to the cloud would see a substantial reduction in Australia's carbon emissions. The modelling shows that an increase in cloud computing from 25 per cent to 40 per cent by 2025, enabling the retirement of these small, inefficient data centres, would see energy use reduce by 80 per cent and Australia avoid 4Mt CO2-e of emissions by 2030. Accelerating the adoption of cloud technologies has the potential to further improve Australia's carbon footprint by 2030 (Figure 2.26).

This is consistent with international data showing the emissions footprint of cloud services to be vastly greener than traditional on-premises solutions. The Lawrence Berkeley National Laboratory in the USA found a migration to cloud-based software results in an 87 per cent reduction in energy use.

## Figure 2.26: Environmental impacts




Source: E3, 2014, Energy Efficiency Policy Options for Australian and New Zealand Data Centres, Consumer Research Associates, report to the Department of Industry, and Masanet, E, 2013, The Energy Efficiency Potential of Cloud-Based Software: A U.S. Case Study, Lawrence Berkeley National Laboratory.

# 2.9 Conclusions

**The direct impact analysis reveals that the organisational impact potential of SaaS technologies for Australian organisations is significant, with very different outcomes by sector and firm size. Overall, the estimates based on Australian experience are more conservative than the benefits typically reported in the literature.**

# Chapter 3. The wider economic potential of Software as a Service to Australia

**This chapter presents the net economic impact of SaaS to Australia measured in the increase in GDP compared to the counterfactual of keeping core software on-premises.**

## 3.1 Understanding the wider, multiplier economic potential of Software as a Service for the national and state economies

Chapter 2 presented the ‘direct’ or ‘first round’ economic potential of SaaS over the next decade.

Critically, however, these impact assessments represent only a partial analysis of the impact of SaaS because these ‘first round’, ‘direct’ impacts go on to have wider ‘second round’ or ‘multiplier’ impacts across the Australian economy. Second round, multiplier impacts can include upstream production multiplier effects, such as increasing demand for supplier services, or downstream consumption multiplier effects, reflecting more monies (capital), resources (labour) or productivity within the economy.

To evaluate the full economic impact potential of SaaS, the direct impacts identified in Chapter 2 were input into the MMRF computable general equilibrium (CGE) model of the Australian economy operated by the Centre of Policy Studies at Victoria University. The MMRF CGE model allows for an evaluation of the wider multiplier effects of SaaS through the Australian economy over time.

Two scenarios were developed to explore the economic benefit potential of SaaS:

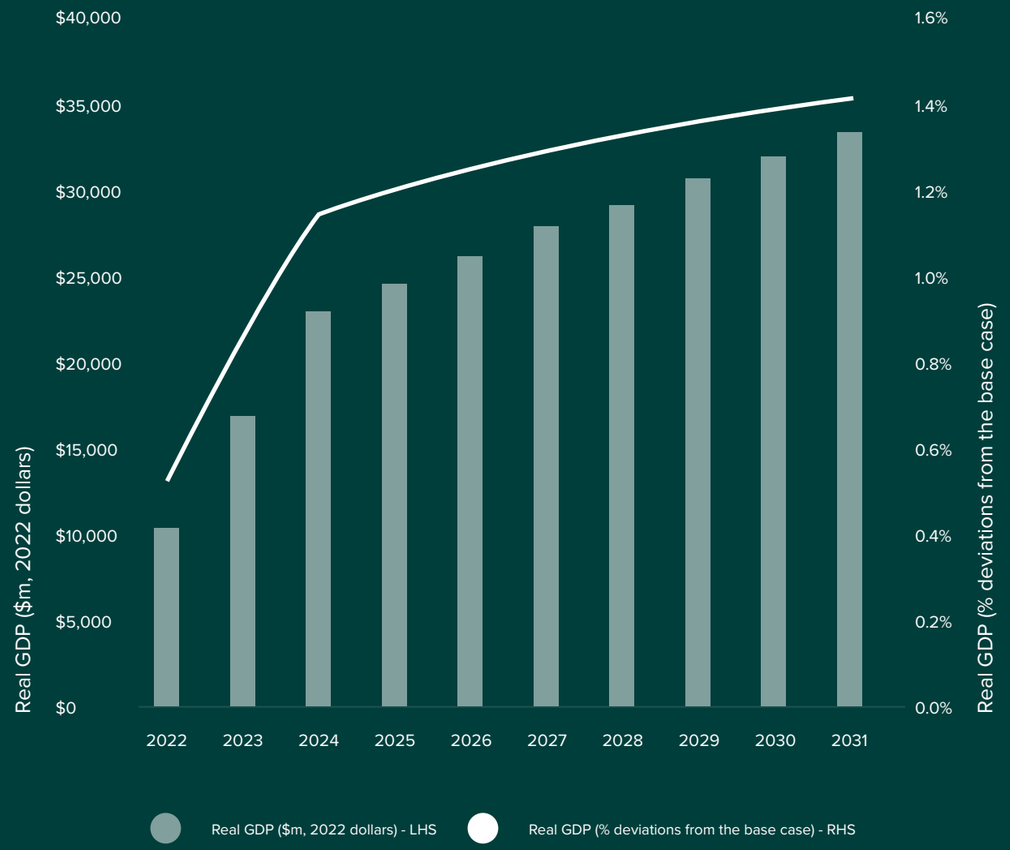
- **Scenario 1 – The economic impact potential of SaaS:** This scenario evaluated the impacts to total output (GDP and GSP), consumption and investment at a national and a state level arising from the migration organisations to SaaS solution over the next three years.
- **Scenario 2 – The economic impact of increased local purchasing of SaaS:** This scenario evaluated the impacts to GDP, GSP, consumption and investment arising from not only a migration of organisations to a SaaS solution over the next three years, but also the effects of a 10 per cent uplift in local purchasing.

This chapter presents the results of those scenarios in turn.

## 3.2 Scenario 1: Economic impact of Software as a Service

The CGE modelling shows that GDP is expected to be more than $226 billion greater in NPV2% terms over the next decade as a result of better use of scarce funding by the Australian government and businesses (Figure 3.1). This translates into an expansion in the economy of more than $26 billion per annum, or an increase of more than 1.2 per cent on average over the ten year forward period (1.3 per cent once operational, e.g., excluding the three-year transition period).

**Figure 8:**
**Expected growth in GDP over time, Scenario 1 ($2021, 2022-2032)**




Source: Centre of Policy Studies, Victoria University

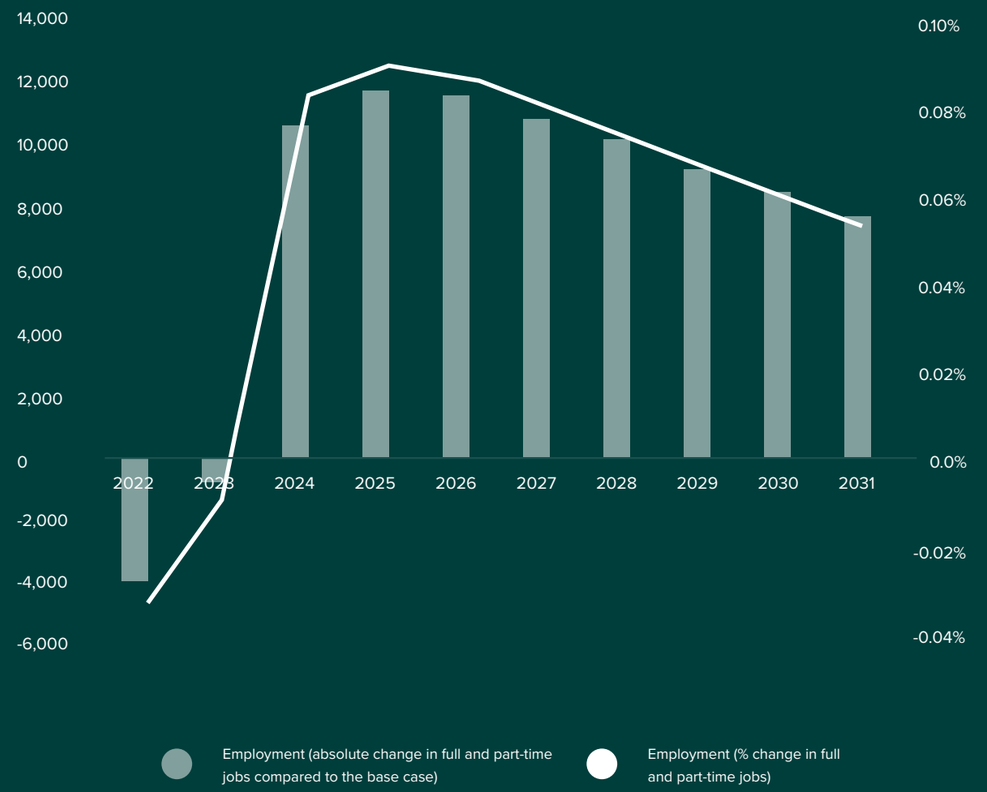
## Table 3.1:
## Economic impacts of SaaS (Scenario 1, $2022, millions)

| Metric | Total Years 1-10 | NPV2%,Years 1-10 | Average increase per annum | % change from base case expectations |
|---|---|---|---|---|
| Real GDP | $255,144 | $225,860 | $25,514 | 1.2% |
| Real household consumption | $158,695 | $140,474 | $15,870 | 1.1% |
| Real government consumption | $65,883 | $58,684 | $6,588 | 0.7% |
| Real investment | $33,852 | $29,868 | $3,385 | 1.6% |
| Jobs creation (FTE) | | | 7,500 | 0.6% |

On net, an additional 7,500 jobs are created (0.6 per cent increase) as the labour productivity savings are more than offset by expanded activity arising from increased competitiveness (Table 3.1).

Source: Centre of Policy Studies, Victoria University and Insight Economics

## Figure 3.2:
## Expected growth in employment over time, Scenario 1 ($2022, 2022-2032)




Source: Centre of Policy Studies, Victoria University

At a state and territory level, each jurisdiction would expect total output expand (Table 3.2). NSW, Victoria, Queensland and WA see the biggest gains relative to the base case as these states have a greater proportion of the industry sectors that expand. For some of the smaller states and territories, such as South Australia, Tasmania and the ACT the net gains are more muted because government services accounts for a relatively greater share of their economy.

## Table 3.2: Scenario 1 – GSP effects by state ($2022, millions)

| Jurisdiction | Average annual change | % change from base case expectations | NPV2%, Years 1-10 |
|---|---|---|---|
| NSW | $6,504 | 0.9% | $57,632 |
| VIC | $7,579 | 1.5% | $67,085 |
| QLD | $4,634 | 1.2% | $41,043 |
| SA | $1,713 | 1.3% | $15,158 |
| WA | $3,416 | 1.2% | $30,212 |
| TAS | $822 | 2.2% | $7,267 |
| NT | $442 | 1.3% | $3,911 |
| ACT | $340 | 0.5% | $2,966 |

## 3.3 Scenario 2: Economic impact of Software as a Service with an uplift in local purchasing

**The second CGE scenario considers the additional economic effects that could be realised through an uplift in purchasing from Australian software vendors.**

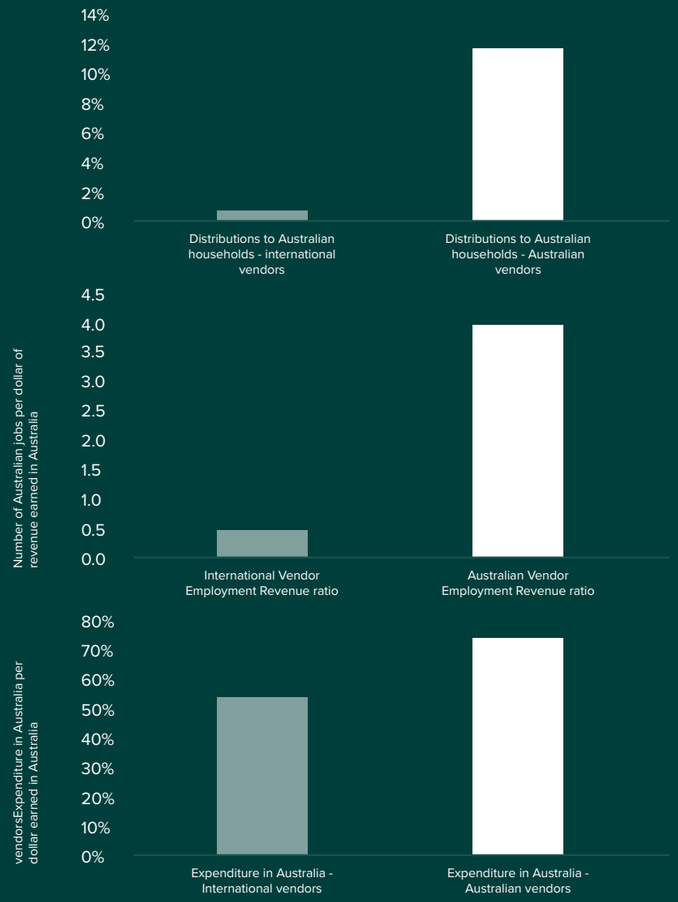
### Understanding the market for software in Australia

Market data indicate that international vendors currently dominate the market for SaaS products, enjoying market share in the order of 85 per cent of all sales, with Australian vendors accounting for the balance of industry turnover.

Among cost and quality equals, purchasing from local vendors will have significant implications for Australian economic outcomes as international and Australian vendors operate in the Australian market in significantly different ways, which would have a number of second round effects on the Australian economy. In particular, data show that Australian vendors spend more money in Australia, employ more Australians per dollar of revenue earned, distribute a greater proportion of profits to Australian households and pay more tax to the Australian government (Figure 3.3):

- Australian expenditure – Custom requested ATO data for the software industry and McKinsey analysis and company reporting, indicate that companies domiciled in Australia spend more money in Australia for each dollar of revenue earned compared to international vendors; this makes sense both due to scale and the capacity of international vendors to leverage key corporate functions residing in overseas domiciles. ATO data show that international vendors distribute royalties in the order of 17 per cent of income and spend half as much on local vendors as Australian supplying firms relative to income, and half as much on wages relative to income as Australian suppliers. It was expected Australian vendors expended 73 per cent of every dollar earned in Australia, whereas international vendors were likely to expend 52 per cent of every dollar earned.
- Australian employment – Australian companies are also found to employ more people per dollar earned. While Australian companies account for only 25 per cent of total market share, IBIS World data and company reporting indicate they account for 50 per cent of total employment. Australian vendors employ more Australians by a factor of 11:1.
- Revenue and market share – Generally, subsidiaries of companies incorporated overseas will be treated as foreign residents under Australian tax law. Australian companies are taxed at 21 per cent.
- Profit – McKinsey and company data indicate that international vendors realise profit margins of 25 per cent while Australian firms realise profit margins around 13 per cent.
- Share ownership – Thomson's Reuters Eikon ownership summary data for international and Australian peers shows that Australian households account for roughly 0.5 per cent of share ownership of international software vendors, whereas Australian households account for 11.6 per cent of Australian software vendors.

**Figure 3.3:**
**Key differences between Australian and international vendors**



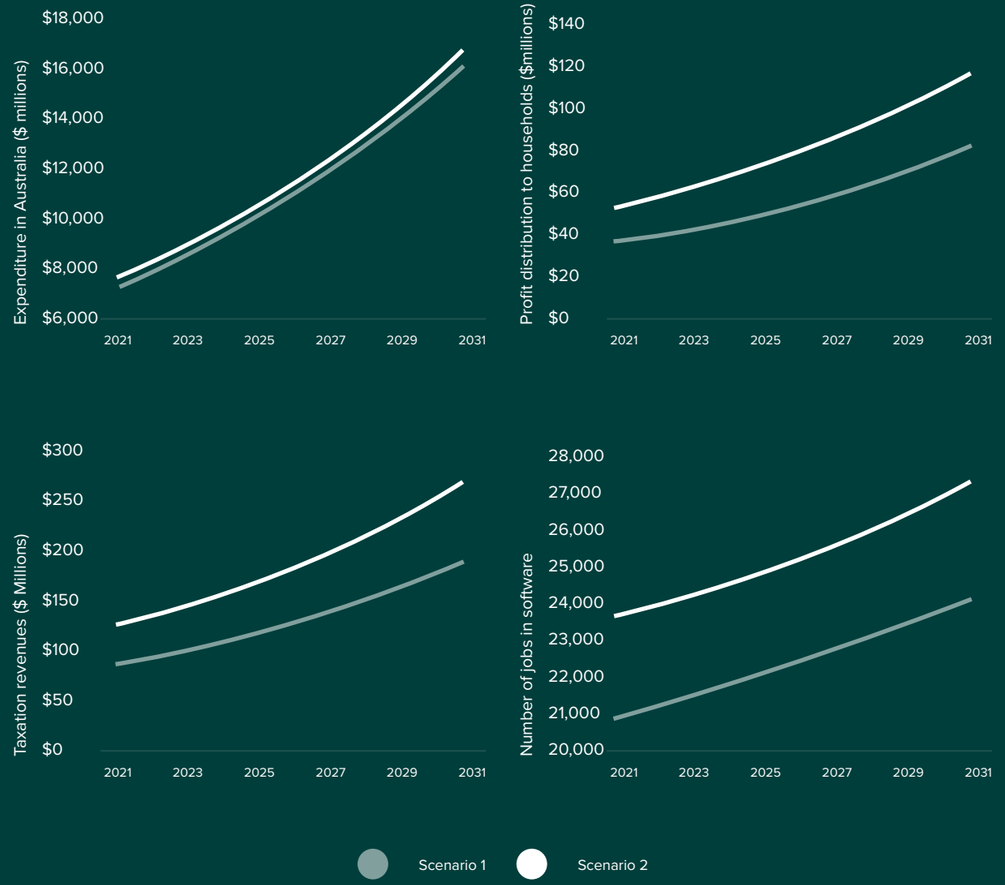

Source: Thomson's Reuters Eikon ownership summary data for Microsoft, Salesforce, Oracle, ServiceNow, Alphabet, and Adobe (international vendors) and TechnologyOne, Atlassian, WiseTech Global, Altium, Xero, IRESS, ELMO, Link Group. Note that MYOB and Nintex are privately held; Custom requested ATO taxation statistics for the software industry; financial statements for Microsoft, Salesforce, Oracle, ServiceNow, Alphabet, and Adobe (international vendors) and TechnologyOne, Atlassian, WiseTech Global, Altium, Xero, IRESS, ELMO, Link Group.

## Key CGE assumptions for Scenario 2

Holding expectations for turnover, growth and key economic ratios constant, a 10 per cent uplift in local purchasing (bringing Australian vendor market share from 15 per cent to 25 per cent) would have the following effects over the 2022-2032 period (Figure 3.4):

- Revenue to Australian vendors would increase by $19.1 billion in NPV2% terms
- Expenditure in Australia would increase by $14.0 billion in NPV2% terms
- Tax revenues would increase by $524.1 million NPV2% terms
- Profit distributions to Australian households would increase by $229.1 million NPV2% terms
- Total industry employment would be expected to see a net increase by just over 3,000 jobs.

## Figure 3.3:
## Key differences between Australian and international vendors



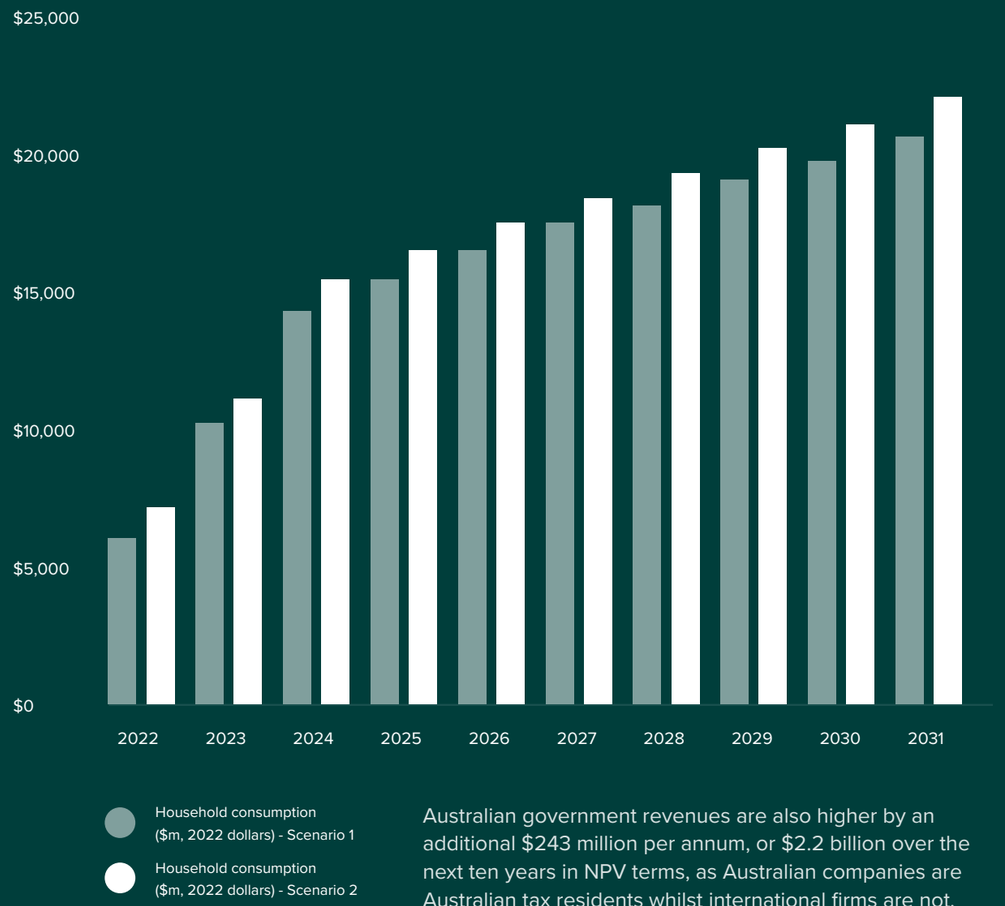

Source: Insight Economics

## CGE results for Scenario 2

In Scenario 2, the increased purchasing with local vendors translates to higher economic output than is expected in Scenario 1, holding constant cost and quality (Table 3.3).

Total economic output is $571 million higher per annum, or roughly $5.1 billion over the 10-year horizon in NPV2% terms, and within this Australian household wealth is expected to substantially expand compared to Scenario 1 outcomes by an additional $1.1 billion per annum, or an additional $9.7 billion in economic output over the 10-year horizon in NPV terms as a result of increased local purchasing (Figure 3.5). This is driven by increased share ownership of Australian companies by Australian households and an increase in real wages due to upward pressure on employment demand arising from increased local purchasing.

**Figure 3.3:**
**Key differences between Australian and international vendors**




Australian government revenues are also higher by an additional $243 million per annum, or $2.2 billion over the next ten years in NPV terms, as Australian companies are Australian tax residents whilst international firms are not.

Source: Centre of Policy Studies, Victoria University

## Table 3.3:
## Economic impacts of SaaS (Scenario 2, $2022, millions)

| Metric | Total Years 1-10 | NPV2%, Years 1-10 | Average increase per annum | % change from base case expectations |
|---|---|---|---|---|
| Real GDP | $260,850 | $230,974 | $26,085 | 1.2% |
| Real household consumption | $169,542 | $150,170 | $16,954 | 1.2% |
| Real government consumption | $68,314 | $60,894 | $6,831 | 0.7% |
| Real investment | $35,800 | $31,608 | $3,580 | 1.7% |
| Jobs creation (FTE) | | | 8,341 | 0.6% |

Source: Centre of Policy Studies, Victoria University

Total jobs growth in aggregate is slightly higher, with an additional 793 jobs created nationally in Scenario 2 compared to Scenario 1 over the ten year forward horizon. This is because it is expected that Australian employment is constrained in part by population levels, with real wages moving people to industries that are seeing expansion in output due to increased competitiveness.

At an industry level, there is significant jobs creation, however, with the modelling showing increased local purchasing would be expected to create 3,900 additional jobs in the ICT sector in Scenario 2 compared to Scenario 1. This reflects that Australian firms retain key corporate and other functions in Australia, whereas international firms utilise a global business model whereby these jobs exist in other regions. Total ICT output would also be $4.2 billion higher in Scenario 2 compared to Scenario 1, due to increased local purchasing.

At a state and territory level, similar to Scenario 1, each jurisdiction would expect total output to expand (Table 3.4).

## Table 3.4:
## Scenario 2 – GSP effects by state ($2022, millions)

| Jurisdiction | Average annual change | % change from base case expectations | NPV2%, Years 1-10 |
|---|---|---|---|
| NSW | $6,697 | 1.0% | $59,354 |
| VIC | $7,800 | 1.5% | $69,054 |
| QLD | $4,774 | 1.2% | $42,298 |
| SA | $1,800 | 1.4% | $15,932 |
| WA | $3,312 | 1.2% | $29,300 |
| TAS | $836 | 2.3% | $7,389 |
| NT | $452 | 1.3% | $3,996 |
| ACT | $391 | 0.6% | $3,423 |

Source: Centre of Policy Studies, Victoria University

# 3.4 Conclusions

**The CGE modelling shows that the economic potential of SaaS technologies for Australian economic futures is significant, with economic output expected to expand by 1.2 per cent above base case expectations as a result of increased competitiveness of Australian firms and productivity of the Australian government. The economic potential of Australia is maximised with increased local purchasing, assuming equivalent cost and quality outcomes for Australian purchasers.**

# Chapter 4. Implications for governments and businesses

**This chapter presents key considerations for governments and business leaders in light of the findings of economic impacts of SaaS cloud technologies.**

## 4.1 Key Considerations: Policy makers

When developing policy to shape ICT investments, attention should be paid to not just how to encourage technology investments, but the wider productivity gains that can be realised which enhance Australian businesses competitiveness. It is the wider economic, environmental and social outcomes of technology investments that matter the most. Encouraging organisations to take up enterprise software that offers new and more efficient processes, especially online self-services and fully integrated reporting and analytics, will return significant gains to the wider Australian community.

While over time, on-premises software can deliver many of the features of SaaS, this study suggests that adopting such new features with on-premises solutions lags that of SaaS by years. Furthermore, innovations based on artificial intelligence, big data analytics, IoT, and customer experience design are not easily available with most on-premises solutions, as they require the scale and elasticity of cloud services. Certainly, the fastest way to enable new and innovative services is SaaS, and with SaaS (Native Integration) being not just one of most cost-effective approaches, but also the fastest path to realising and maximising potential productivity improvements.

While this study reports productivity gains organisations are already identifying and tracking, it also reveals that many gains are not considered and unreported. Australian organisations may lack the frameworks and education needed to fully analyse their return on investment for technology. Governments can provide leadership in the development and dissemination of technology investment business cases frameworks that encourage organisations to evaluate potential impacts beyond the typical 'business as usual, cost savings' approach.

Moreover, among cost and quality equals, local purchasing by Australian vendors will increase the wider economic impact of the migration to SaaS.

## 4.2 Key Considerations: The board

The focus of technology investment business cases needs to move from an IT focus to a productivity focus. During this study, it was noted that few organisations identify and track the productivity gains associated with technology investment. While vendors tout significant productivity gains, obtaining these gains required careful attention to the discipline of benefits realisation.

Australia's executives need to work with line managers and ICT executives to identify where new technology capabilities can improve productivity. Traditionally, this has been relegated to the realm of 'business process modelling' (BPM), itself a lengthy and costly process. This traditional approach to streaming business processes is at least partly superseded by the SaaS operating model, where new capabilities are introduced several times a year. In addition, many enterprise SaaS solutions have low-code forms and workflow tools that enable non-technical staff to quickly digitise manual processes while maintaining a central and pre-integrated repository of organisational information. SaaS flips the notion of designing work processes from a top-down approach to that of continual improvement.

Therefore, a critical precondition for realising the benefits of SaaS is the adoption of a work culture, where digitisation of processes and adoption of new digital capabilities sits at the coalface of the business: the line of business managers and their teams.

This study found that organisations which had shifted the configuration, administration and usability testing of SaaS solutions out of IT and to functional business units reported significantly greater productivity gains. This observation suggests that the greater ownership business stakeholders have over their digital platform, the more they will leverage its capabilities to solve their day-to-day operational challenges. However, this observation should be tempered: it is likely that the business units reported higher productivity gains than ICT groups because they were more aware of such gains and closer the positive changes.

Since the introduction of enterprise SaaS solutions favours a continual improvement business model, being able to track improvements to processes becomes increasingly important. This demands greater use of analytics to measure productivity gains and, ideally, associate direct savings or cost avoidance. When putting in place SaaS, executives should identify the key areas of the business that would benefit and set tangible measures. These measures should be pertinent to the desired outcomes: what is measured shapes behaviour. Native Integration enterprise SaaS solutions generally have reporting and analytics capabilities, and these can be leveraged to provide dashboards and KPIs relating to these outcomes.

Finally, SaaS enables greater stakeholder (customer, citizen, student, etc) engagement and self-service. Many enterprise SaaS solutions include capabilities to create public-facing forms and portals. Self-service should be viewed as more than just an internal labour-saving exercise; it also benefits stakeholders and improves stakeholder satisfaction. When considering new solutions, even if they would traditionally be viewed as internal only services, consider how these may be expanded to offer self-service.

In summary, SaaS holds the potential for deep productivity gains, but organisations need to be prepared to adopt a continual improvement culture in order to get the most out of them.

## 4.3 Key Considerations: ICT executives

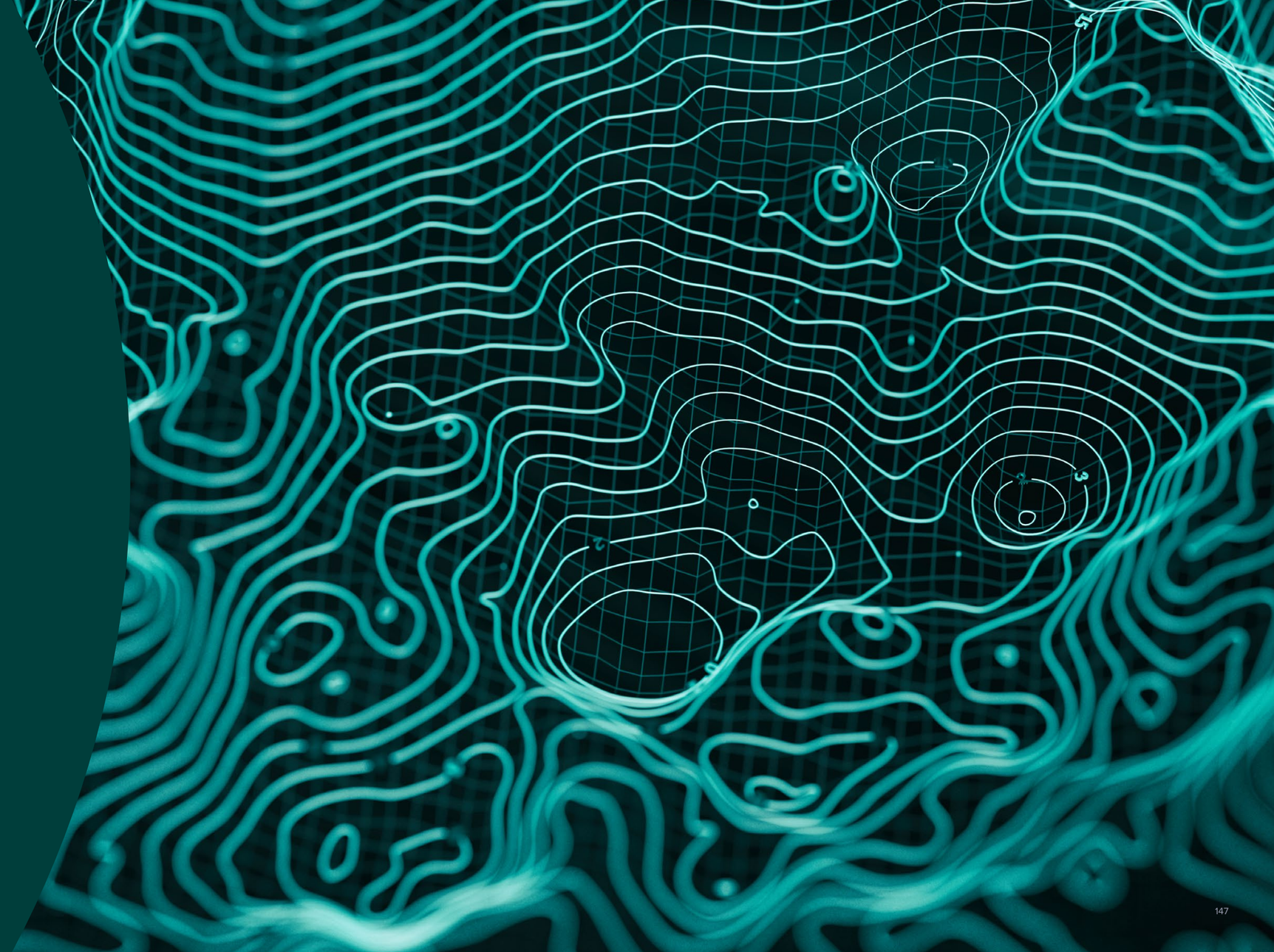
It is now well recognised that cloud computing, and SaaS in particular, is the optimum model for deploying enterprise software. This study confirms that TCO of enterprise solutions is generally less costly over a decade when compared to running software on-premises. However, the TCO savings may not be as steep as some claim and vary greatly based upon the pre-existing infrastructure.

Organisations with multiple data centres, many hundreds of applications and servers, and a 'sweat the assets' approach to reigning in ICT costs will, ironically, find it most difficult to justify the costs of adopting SaaS. This is because even with moving to the cloud, there remains a significant number of on-premises solutions which demand infrastructure and skilled staff. As a result, the ability to claw back operational costs is hindered due to the lock-in of 'technical debt'.

The challenge for organisations in these situations becomes how to justify short-term (three years) increases in budgets while untangling the technical debt which is holding back the organisation.

One option is to allow functional business groups to take the lead on procuring next-generation enterprise SaaS solutions (which is what is happening organically in many organisations anyway) with ICT acting to provide advice, guidance and governance. However, the danger here is that this can lead to a complex, SaaS (Mixed Stack) environment, which increases overall ICT operating costs and demands far greater resources be put into integration.

Another better option is for the ICT group to take the lead on a Native Integration SasS platform though still with satellite SaaS applications to provide niche or highly industry-specific solutions around the core SaaS platform. Administration of this core SaaS and satellite solutions may still shift to functional units, with ICT supporting (fewer) integrations where needed. ICT's role evolves to working with function business units to evaluate, prioritise new 'low-code' digital processes, and assist staff in leveraging newly released capabilities when the SaaS vendors deliver them. In short, the ICT group moves to support 'IT-as-a-Service' across the organisation.



# Appendix A. Key assumptions and data

# A.1 Key assumptions and data sources: Local government

| Variable | Assumption | Source |
|---|---|---|
| Number of large or very large councils | 229 | ABS Cat No. 3235 |
| Number of small to mid-size councils | 315 | ABS Cat No. 3235 |
| Number of households - large or very large councils | 39,965 | ABS Cat No. 3235 |
| Number of households - small to mid-size councils | 2,199 | ABS Cat No. 3235 |
| Number of FTE | 186,000 | ABS Employment and Earnings, Public Sector, Australia |
| Salary costs – average | $72,800 | ABS Employment and Earnings, Public Sector, Australia |
| Current software model uptake – large councils | 50% On-prem, with paper based systems<br>10% IaaS<br>10% SaaS BoB<br>20% SaaS (Native Integration) | Interviews & market data, LGAQ 2020 Digital Productivity Report |
| Current software model uptake – mid-size to small councils | 45% On-prem, with paper based systems<br>20% IaaS<br>15% SaaS BoB<br>20% SaaS (Native Integration) | Interviews and market data, LGAQ 2020 Digital Productivity Report |
| Rate of council requests per household per annum | 65% households | Ratio based on average of data from three councils case studies |
| TCO large councils | Total cost of on-prem – legacy $10,342,998<br>Total cost of IaaS software $10,417,600<br>Total cost of SaaS (Mixed Stack) $10,814,400<br>Total cost of SaaS (Native Integration) $9,466,400 | Case studies and market data |
| TCO mid-size to large councils | Total Cost of on-prem - legacy $4,053,337<br>Total Cost of IaaS software $3,949,000<br>Total Cost of SaaS (Mixed Stack) $4,826,000<br>Total Cost of SaaS (Native Integration) $3,514,000 | Case studies and market data |
| Growth rate in TCO | 3.1% | IBIS World |
| Proportion of councils without other business benefit capabilities | 65% | Interviews & market data |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |
| Assets under management | $423 billion | Local Government Financial Statements |

| Variable | Assumption | Source |
|---|---|---|
| Maintenance budget – planned | 4.1% | NSW Office of Local Government |
| Actual maintenance expenditure | 2% | NSW Office of Local Government |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting |
| Reduction in reactive maintenance through asset management | 8% | (Low range of 8%-30%) |
| Avoided costs financial and audit | $20,000 per council | Interviews |
| Reduction in in-person engagement through online | 50% | Case studies |
| Avoided time per household per annum | 30 minutes | Case studies |
| Value of avoided time | $19.48 | Australian Fair Work Ombudsman |
| Labour force productivity | 5% | OECD, 2017 and interview data |
| Cost of mail and printing to households | $1.80 x 3 = $5.40 per household per year | Interviews, Officeworks bulk printing costs and Australia Post letter rates |
| Reduction in turnover | 2% | Centre of Excellence in Local Government found LGA turnover at 12% compared to national average of 10% |
| Costs of recruitment | $9,750 per role | Costs of position advertisement, interviews, and training |
| Cost of rehabilitation of one lane km urban sealed | $1.159 million | Tasmanian Transport |
| Cost of rehabilitation of one lane km rural sealed | $406,000 | Tasmanian Transport |
| Cost of one km new road | $5.4 million | BIS Shrapnel, Road Maintenance in Australia 2011 – 2026, 2011 and Infrastructure Partnerships Australia, Road Maintenance: Options for Reform, 2011 |

## A.2 Key assumptions and data sources: Federal and state government

| Variable | Assumption | Source |
|---|---|---|
| Federal and state policy departments | 64 | Government registries |
| Federal and state service departments | 46 | Government registries |
| Federal agencies* | 242 | Government registries |
| State agencies (excluding utilities)* | 613 | Government registries |
| Number of FTE – Federal Government | 246,000 | ABS Employment and Earnings, Public Sector, Australia |
| Number of FTE – State Governments | 1,609,100 | ABS Employment and Earnings, Public Sector, Australia |
| Federal Govt salary costs – average | $91,115 | ABS Employment and Earnings, Public Sector, Australia |
| Federal Govt salary costs – average | $85,871 | ABS Employment and Earnings, Public Sector, Australia |
| Labour force productivity | 7% | OECD, 2017, case studies and market data |
| Assets under management (buildings, equipment and infrastructure excluding specialised military equipment) – Federal | $115 billion | Consolidated financial statement Australian Government |
| Assets under management (buildings, equipment and infrastructure) | $964 billion | Consolidated financial statements 2020 for each State and Territory |
| Maintenance budget | 4.8% | NSW Office of Local Government |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting |
| Reduction in reactive maintenance through asset management | 8% | (Low range of 8%-30%) |
| Avoided costs financial and audit | $20,000 per organisation | Interviews |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |
| Current software model uptake – policy departments | 40% on-prem, with paper-based systems<br>15% IaaS<br>20% SaaS Mixed Stack<br>25% SaaS (Native Integration) | Interviews & market data, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, NSW's 2020 Government Cloud strategy |
| Current software model uptake – service departments | 50% on-prem, with paper-based systems<br>20% IaaS<br>20% SaaS Best of Breed<br>10% SaaS (Native Integration) | Interviews & market data, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, NSW's 2020 Government Cloud strategy |
| Current software model uptake – federal agencies* (Large agency cost assumptions applied to this population at the moment, may revise by size) | 55% on-prem, with paper-based systems<br>25% IaaS<br>15% SaaS Best of Breed<br>5% SaaS (Native Integration) | Interviews & market data, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, NSW's 2020 Government Cloud strategy |
| Current software model uptake – state agencies* (small agency cost assumptions applied to this population at the moment, may revise by size) | 50% on-prem with paper-based systems<br>20% IaaS<br>20% SaaS Best of Breed<br>10% SaaS (Native Integration) | Interviews & market data, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, NSW's 2020 Government Cloud strategy |
| TCO policy departments | Total cost of on-prem - legacy $7,142,000<br>Total cost of IaaS software $6,455,280<br>Total cost of SaaS (Mixed Stack)$6,963,660<br>Total cost of SaaS (Native Integration) $5,675,764 | Case studies and market data |
| TCO service departments | Total cost of on-prem - legacy $2,252,421<br>Total cost of IaaS software $1,792,500<br>Total cost of SaaS Best of Breed$ 2,100,250<br>Total cost of SaaS (Native Integration) $1,970,650 | Case studies and market data |
| TCOs large agencies | Total cost of on-prem - legacy $58,311,532<br>Total cost of IaaS software $53,525,500<br>Total cost of SaaS (Mixed Stack)$60,357,500<br>Total cost of SaaS (Native Integration) $51,836,300 | Case studies and market data |
| TCO small agencies | Total cost of on-prem - legacy $2,141,087<br>Total cost of IaaS software $1,832,500<br>Total cost of SaaS (Mixed Stack)$1,910,000<br>Total cost of SaaS (Native Integration) $1,756,650 | Case studies and market data |
| Growth rate in TCO | 3.1% | IBIS World |
| Average cost per episode of in-patient care | $5,597 (growing at 2.2% per annum) | Independent Hospital Pricing Authority (IHPA), NHCDC, National Efficient Price Determination 2021-2022 |
| Average cost per residential aged care place | $70,700 | AIHW, GEN Aged Care Data, 2020, Aged Care Service Information March 2021 |

## A.3 Key assumptions and data sources: Higher education

| Variable | Assumption | Source |
|---|---|---|
| Universities – public, research | 15 | List of Australian Universities, Go8 and IRU members |
| Universities – public, learning and training | 22 | List of Australian Universities |
| Universities – private | 5 | List of Australian Universities |
| VET | 59 | List of Australian VET institutes |
| Number of students –public, research (avg) | 41,879 | University data |
| Number of students – public, learning and training (avg) | 37,029 | University data |
| Number of students – private (avg) | 27,100 | University data |
| Number of students – VET (avg) | 20,339 | University data |
| Number of students, all universities | 1,405,780 | University data |
| Number of students, VET | 1,200,000 | NCVER, funded places |
| Number of staff – public, research (avg) | 4,988 | University data |
| Number of staff – public, learning and training (avg) | 3,370 | University data |
| Number of staff – private (avg) | 2,830 | University data |
| University data | 8% | (Low range of 8%-30%) |
| Number of staff – VET (avg) | 2,124 | |
| Non-academic staff as proportion of total staff | 50% | University data |
| University non-academic staff salary costs – average | $104,804 | NSW Level 6, 38 hours per week, major research university |
| VET salary costs – average | $60,873 | Payscale, VET Teacher |
| Casual labour rate | $60 / hour | NSW, Casual Labour rate, major research university |

| Variable | Assumption | Source |
|---|---|---|
| ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years | 50% on-prem with paper-based systems<br>20% IaaS<br>20% SaaS Best of Breed<br>10% SaaS (Native Integration) | Interviews & market data, Commonwealth's Digital Transformation Agency's Secure Cloud strategy, NSW's 2020 Government Cloud strategy |
| Annual repairs and maintenance, tertiary education and adult education | $45 million | |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting |
| (Low range of 8%-30%) | Total cost of on-prem - legacy $58,311,532<br>Total cost of IaaS software $53,525,500<br>Total cost of SaaS (Mixed Stack)$60,357,500<br>Total cost of SaaS (Native Integration)<br>$51,836,300 | Case studies and market data |
| Avoided casual labour | 12 FTE, 1.5 weeks, 4 times per annum | Interviews |
| Avoided costs financial and audit | $20,000 per organisation | Interviews |
| Labour force productivity | 2% | OECD, 2017 and interview data |
| Current software model uptake – public university, research | 70% on-prem, with paper based systems<br>10% IaaS<br>15% SaaS Best of Breed<br>5% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – public university, learning and training | 50% on-prem, with paper based systems<br>30% IaaS<br>10% SaaS Best of Breed<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – Private Uni | 70% on-prem, with paper based systems<br>10% IaaS<br>10% SaaS Best of Breed<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake VET | 60% on-prem, with paper based systems<br>25% IaaS<br>10% SaaS Best of Breed<br>5% SaaS (Native Integration) | Interviews and market data |

| Variable | Assumption | Source |
|---|---|---|
| TCO – Public Uni, Research | Total cost of on-prem - legacy $77,101,818<br>Total cost of IaaS software $75,864,000<br>Total cost of SaaS (Mixed Stack)$69,792,000<br>Total cost of SaaS (Native Integration) $65,760,000 | Case studies and market data |
| TCO – Public Uni, Learning and Training | Total cost of on-prem - legacy $28,801,697<br>Total cost of IaaS software $28,319,120<br>Total cost of SaaS (Mixed Stack)$28,845,420<br>Total cost of SaaS (Native Integration) $26,940,860 | Case studies and market data |
| TCO, private university | Total Cost of on-prem - legacy $28,801,697<br>Total cost of IaaS software $28,319,120<br>Total cost of SaaS (Mixed Stack)$28,845,420<br>Total cost of SaaS (Native Integration) $26,940,860 | Case studies and market data |
| TCO, VET | Total Cost of on-prem - legacy $29,510,000<br>Total Cost of IaaS software $23,394,000<br>Total Cost of SaaS (Mixed Stack)$20,014,000<br>Total Cost of SaaS (Native Integration) $18,676,000 | Case studies and market data |
| Growth rate in TCO | 3.1% | IBIS World |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |

## A.4 Key assumptions and data sources: Health and aged care

| Variable | Assumption | Source |
|---|---|---|
| Private hospitals, number | 657 | ABS, Private Hospitals, Australia, 2016-17 financial year \| Australian Bureau of Statistics (abs.gov.au), Table 1.1 |
| Public hospitals, number | 659 | Australian Institute of Health and Welfare, Australian hospital statistics |
| Aged care, public, number | 11 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Aged care, private, number | 278 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Aged care, NGO, number | 463 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Aged care, public, number of clients | 11,487 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Aged care, private, number of clients | 89,439 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Aged care, NGO, number of clients | 119,493 | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| FTE Aged care | 375,000 | ABS, Jobs in Australia, 2011-12 to 2017-18 \| Australian Bureau of Statistics (abs.gov.au) |
| FTE private hospitals | 69,229 | ABS, Private Hospitals, Australia, 2016-17 financial year \| Australian Bureau of Statistics (abs.gov.au), Table 1.1 |
| FTE public hospitals | 365,000 | Australian Institute of Health and Welfare, Australian hospital statistics |
| Health and aged care salary cost | $55,252 | ABS, Jobs in Australia, 2011-12 to 2017-18 \| Australian Bureau of Statistics (abs.gov.au) |
| Avoided costs financial and audit | $20,000 per organisation | Interviews |
| Annual repairs and maintenance, private hospitals and residential aged care | $184 million | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting |

| Variable | Assumption | Source |
|---|---|---|
| Reduction in reactive maintenance through asset management | 8% | (Low range of 8%-30%) |
| Labour force productivity | 1% | OECD, 2017 and interview data |
| Cost of purchases, private hospitals and residential aged care | $1,271 million | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Reduction in supply chain and inventory costs | 2.2% | Wharton School of Management, 2010 (lower bound of 2.2%-3.4%, with maximum of 13.8% observed) |
| Additional business benefits – proportion of organisations realising additional benefit from SaaS | Labour force productivity, 70%<br>Avoided financial consulting costs, 50%<br>Avoided reactive maintenance costs, 70%<br>Supply chain improvements, inventory management, 70% | Interviews and market data |
| Current software model uptake – hospitals | 50% of on-prem with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – public aged care | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – private aged care | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – NGO aged care | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – Hospitals | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – public aged care | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |

| Variable | Assumption | Source |
|---|---|---|
| TCO – hospitals | Total cost of on-prem - legacy $17,601,784<br>Total cost of IaaS software $14,819,673<br>Total cost of SaaS (Mixed Stack)$16,166,916<br>Total cost of SaaS (Native Integration) $15,128,553 | Case studies and market data |
| TCO – public aged care | Total cost of on-prem - legacy $630,000<br>Total cost of on-prem – upgrade $630,000<br>Total cost of IaaS software $625,725<br>Total cost of SaaS (Mixed Stack)$670,650<br>Total cost of SaaS (Native Integration) $634,050 | Case studies and market data |
| TCO – private aged care | Total cost of on-prem - legacy $630,000<br>Total cost of IaaS software $625,725<br>Total cost of SaaS (Mixed Stack)$670,650<br>Total cost of SaaS (Native Integration) $634,050 | Case studies and market data |
| TCO – NGO aged care | Total Cost of on-prem - legacy $630,000<br>Total cost of IaaS software $625,725<br>Total cost of SaaS (Mixed Stack)$670,650<br>Total cost of SaaS (Native Integration) $634,050 | Case studies and market data |
| Growth rate in TCO | 3.1% | IBIS World |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |

## A.5 Key assumptions and data sources: Project and asset intensive

| Variable | Assumption | Source |
|---|---|---|
| Design and build - large | 107 private businesses | Market data |
| Design and build - SME | 1594 private businesses | Market data |
| Own Operate Maintain, public | 107 public organisations | Market data |
| Own Operate Maintain, private | 338 private businesses | Market data |
| Annual repairs and maintenance, construction and private electricity, water, gas, waste collection and treatment | $2.576 billion | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting (Low range of 8%-30%) |
| Reduction in reactive maintenance through asset management | 8% | AIHW, GEN Aged Care Data, Aged Care Service List - Australia - as at 30 June 2020 |
| Labour force productivity, design and build | 5% | OECD 2017, lower bound of range |
| Labour force productivity, OOM | 1% | Interview data |
| Cost of purchases, construction and private electricity, water, gas, waste collection and treatment | $125 billion | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Reduction in supply chain and inventory costs | 2.20% | Wharton School of Management, 2010 (lower bound of 2.2%-3.4%, with maximum of 13.8% observed) |
| Reduction in capital works – OOM | 10% | Market data and interviews |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |
| Additional business benefits – proportion of organisations realising additional benefit from SaaS | Labour force productivity, 65%<br>Avoided reactive maintenance costs, 90%<br>Supply chain improvements, inventory management, 50%<br>Capital works 35% OOM only | Interviews and market data |
| Current software model uptake – Design and Build | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – OOM | 50% on-prem, with paper based systems<br>20% IaaS<br>20% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| TCO – Design and build large | Total cost of on-prem - legacy $14,326,144<br>Total cost of IaaS software $12,791,900<br>Total cost of SaaS (Mixed Stack)$14,388,000<br>Total cost of SaaS (Native Integration) $12,379,400 | Interviews and market data |
| TCO – Design and build SME | Total cost of on-prem - legacy $307,000<br>Total cost of IaaS software $305,000<br>Total cost of SaaS (Mixed Stack)$306,400<br>Total cost of SaaS (Native Integration) $298,900 | Interviews and market data |
| TCO – OOM | Total cost of on-prem - legacy $29,610,000<br>Total cost of IaaS software $26,300,000<br>Total cost of SaaS (Mixed Stack)$28,072,800<br>Total cost of SaaS (Native Integration) $24,775,200 | Interviews and market data |
| Growth rate in TCO | 3.10% | IBIS World |

## A.6 Key assumptions and data sources: Corporate and financial services

| Variable | Assumption | Source |
|---|---|---|
| FSI – large, number of businesses | 131 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| FSI - SME, number of businesses | 558 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| Major supermarkets and fruit and veg, number of businesses | 50 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| Other major retailers and corporates, number of businesses | 1607 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| Retail SME, number of businesses | 1221 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| Manufacturing SME, number of businesses | 4046 | ABS Business Counts 8165.0 and ATO, Tax statistics 2017-2018, Table 4, ABS Business Counts |
| Avoided costs financial and audit | $20,000 per organisation | Interviews |
| Annual repairs and maintenance, retailers and manufacturing | $2.1 billion | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Reactive maintenance | 55% | US Department of Energy, Operations and Maintenance Best Practice, Schnieder Electric White Paper, Journal of Engineering Studies and Research 2012, University of London Condition Based Maintenance, + 3 case studies supporting (Low range of 8%-30%) |
| Reduction in reactive maintenance through asset management | 8% | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Labour force productivity, retail, manufacturing, information technology | 5% | OECD 2017 (low end of range, 5%-10%) |
| Cost of purchases, retail and manufacturers | $350 billion | ATO, Tax statistics 2017-2018, Key items, by fine industry, 2009–10 to 2017–18 income years |
| Current software model uptake – FSI | 40% on-prem, with paper based systems<br>15% IaaS<br>25% SaaS (Mixed Stack)<br>20% SaaS (Native Integration) | Interviews & market data |
| Current software model uptake – major supermarkets and food | 30% on-prem, with paper based systems<br>25% IaaS<br>35% SaaS (Mixed Stack)<br>10% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – major corporate and retail | 20% on-prem, with paper based systems<br>10% IaaS<br>40% SaaS (Mixed Stack)<br>30% SaaS (Native Integration) | Interviews and market data |
| Current software model uptake – retail and manufacturing SMEs | 30% on-prem, with paper based systems<br>25% IaaS<br>25% SaaS (Mixed Stack)<br>20% SaaS (Native Integration) | Interviews and market data |
| Growth in value of other business and customer benefits | 2% | Inflation, ABS CPI key categories 1%-2% |
| Reduction in supply chain and inventory costs | 2.20% | Wharton School of Management, 2010 (lower bound of 2.2%-3.4%, with maximum of 13.8% observed) |
| Additional business benefits – proportion of organisations realising additional benefit from SaaS | Labour force productivity, 55%<br>Avoided financial consulting costs, 10%<br>Avoided reactive maintenance costs, 90%<br>Supply chain improvements, inventory management, 10% | Interviews and market data |
| TCO – FSI Large | Total cost of on-prem - legacy<br>$47,767,667<br>Total cost of on-prem - upgrade<br>$48,880,000<br>Total cost of IaaS software<br>$46,586,400<br>Total cost of SaaS Best of Breed<br>$50,421,600<br>Total cost of SaaS (Native Integration)<br>$44,715,800 | Interviews and market data |
| TCO – FSI SME | Total cost of on-prem - legacy<br>$8,540,000<br>Total cost of on-prem - upgrade<br>$8,640,000<br>Total cost of IaaS software<br>$7,868,000<br>Total cost of SaaS Best of Breed<br>$7,804,000<br>Total cost of SaaS (Native Integration)<br>$7,260,000 | Interviews and market data |

## A.6 Key assumptions and data sources: Corporate and financial services

| Variable | Assumption | Source |
|---|---|---|
| TCO – major supermarkets and food | Total cost of on-prem - legacy<br>$85,506,667<br>Total cost of on-prem - upgrade<br>$88,640,000<br>Total cost of IaaS software<br>$78,704,000<br>Total cost of SaaS Best of Breed<br>$78,833,600<br>Total cost of SaaS (Native Integration)<br>$74,360,240 | Interviews and market data |
| TCO – major corporate and retail | Total cost of on-prem - legacy<br>$7,590,000<br>Total cost of on-prem - upgrade<br>$7,755,000<br>Total cost of IaaS software<br>$7,290,250<br>Total cost of SaaS Best of Breed<br>$7,700,000<br>Total cost of SaaS (Native Integration)<br>$7,304,000 | Interviews and market data |
| TCO – retail and manufacturing SMEs | Total cost of on-prem - legacy<br>$671,000<br>Total cost of on-prem - upgrade<br>$683,000<br>Total cost of IaaS software<br>$578,000<br>Total cost of SaaS Best of Breed<br>$631,000<br>Total cost of SaaS (Native Integration)<br>$544,000 | Interviews and market data |
| Growth rate in TCO | 3.10% | IBISWorld |



# Appendix B. The Monash Multi-Regional Forecasting (MMRF) Model

## B.1 MMRF Overview

The Monash Multi-Regional Forecasting (MMRF) model is a multi-regional Computable General Equilibrium (CGE) model of Australia's eight regional economies — the six States and two Territories.

Each region is modelled as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. There are four types of agent: industries, households, governments and foreigners. In each region, there are 58 industries and 63 commodities recognised in the standard database, although the database may be disaggregated to many more industry/commodity pairs if required.

The industries can produce a variety of commodities, and each creates a single type of capital. Capital is sector and region specific. In each region, there is a single household and a regional government. There is also a Federal government. Finally, there are foreigners, whose behaviour is summarised by demand curves for regional international exports and supply curves for regional international imports.

MMRF consists of a general equilibrium core, which determines regional supplies and demands of commodities through optimising behaviour of agents in competitive markets. Optimising behaviour also determines industry demands for labour and capital. Labour supply at the national level is determined by demographic factors, while national capital supply responds to rates of return. Labour and capital can cross regional borders so that each region's stock of productive resources reflects regional employment opportunities and relative rates of return.

# Appendix C. Bibliography


Ali, MM, and Haseebuddin, M, 2015, Cloud Computing for Retailing Industry: An International Journal of Computer Trends and Technology (IJCTT) 19(1), Jan 2015

Altmann, J, and Kashef, MM, 2014, Cost model based service placement in federated hybrid clouds, Future Generation Computer Systems 41 (2014) 79–90

Arboleda, N, 2021, Australian Government IT spending to reach $13 billion: Gartner, CRN, accessed at: https://www.crn.com.au/news/australian-government-it-spending-to-reach-13-billion-gartner-561450

Attaran, M, Attaran, S, and Gokhan Celik, B, 2017, Promises and Challenges of Cloud Computing in Higher Education: A Practical Guide for Implementation, Journal of Higher Education Theory and Practice Vol. 17(6) 2017

Australian Bureau of Statistics, Business Counts 8165.0

Australian Bureau of Statistics, Business Use of Information Technology 2015-16 financial year

Australian Bureau of Statistics, Cat No. 3235

Australian Bureau of Statistics, Employment and Earnings, Public Sector, Australia

Australian Bureau of Statistics, Summary of IT Use and Innovation in Australian Business, 2016-17

Australian Institute for Health and Welfare, 2021, Commonwealth Government expenditure on aged care services, 2019–20 financial year(a), GEN Aged Care Data.

Australian National Audit Office, 2010, Capitalisation of Software, Case studies: Australian Bureau of Statistics, Civil Aviation Safety Authority, IP Australia

Australian Taxation Office (ATO, 2021, Taxation statistics 2017-18)

Bakhshi, H, Bravo-Biosca, A, and Mateos-Garcia, J, 2014, “Inside the datavores: Estimating the effect of data and online analytics on firm performance”, Nesta, www.nesta.org.uk/sites/default/files/inside_ the_datavores_technical_report.pdf

Bakhshi, H., A. Bravo-Biosca and J. Mateos-Garcia (2014), “Inside the datavores: Estimating the effect of data and online analytics on firm performance”, Nesta, www.nesta.org.uk/sites/default/files/inside_ the_datavores_technical_report.pdf (accessed 13 May 2015).

Balasooriya, PN, Wibowo, S and Wells, M, 2016, Green Cloud Computing and Economics of the Cloud: Moving towards Sustainable Future, GSTF Journal on Computing (JOC), doi: 10.5176/2251-3043_4.4.347

Barratt, M, 2007, Proactive Reliability Maintenance, IPPTA J. 19(3).

Barua, A, Mani, D, and Mukherjee, R, 2013, Impacts of effective data on business innovation and growth, University of Texas at Austin.

Barua, A., D. Mani and R. Mukherjee (2013), “Impacts of effective data on business innovation and growth”, Chapter 2 of a three-part study, University of Texas at Austin (accessed 20 May 2015).

Benlian, A, and Hess, T, 2011, Opportunities and risks of Software as a Service: Findings from a survey of IT executives, Decision Support Systems 52 (2011) 232–246

Billentis, 2019, The e-invoicing journey 2019-2025, accessed at: www.billentis.com

Billentis, 2019, The e-invoicing journey 2019-2025, accessed at: www.billentis.com

Brynjolfsson, E., L.M. Hitt and H.H. Kim (2011), “Strength in numbers: How does data-driven decisionmaking affect firm performance?”, Social Science Research Network, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1819486.

Cachon, GP, and Fisher, M, 2000, Supply Chain Inventory Management and the Value of Shared Information, Management Science 46(8):1032-1048. https://doi.org/10.1287/mnsc.46.8.1032.12029

Cachon, GP, and Fisher, M, 2000, Supply Chain Inventory Management and the Value of Shared Information, Management Science 46(8):1032-1048. https://doi.org/10.1287/mnsc.46.8.1032.12029

Camara, SB, et al, Supply chain integration through community cloud: Effects onoperational performance, Journal of Purchasing & Supply Management, 22:141-153.

Daugherty, P. et al. (2015), “Driving unconventional growth through the industrial Internet of Things,” Accenture Technology, www.accenture.com/us-en/labs-insight-industrial-internet-of-things (accessed 21 April 2017).

Daugherty, P. et al. (2015), “Driving unconventional growth through the industrial Internet of Things,” Accenture Technology, www.accenture.com/us-en/labs-insight-industrial-internet-of-things.

Davis, P, Sullivan, E,Marlow, D, Marney, D, 2013, A selection framework for infrastructure condition monitoring technologies in water and wastewater networks, Expert Systems with Applications, 40(6): 1947-1958, doi: 10.1016/j.eswa.2012.10.004.

Deloitte, 2019, Benefits of small Business Digital Engagement, report to the Department of Employment, Skills, small and Family Business, p8.

Department of Infrastructure, Regional Development and Cities, 2017, Road Construction Cost and Infrastructure Procurement Benchmarking, 2017 update

Digital Transformation Agency, 2017, Secure Cloud Strategy, https://dta-www-drupal-20180130215411153400000001.s3.ap-southeast-2.amazonaws.com/s3fs-public/files/cloud/secure-cloud-strategy.pdf

E3, 2014, Energy Efficiency Policy Options for Australian and New Zealand Data Centres, Consumer Research Associates, report to the Department of Industry

Gartner, 2021, Forecast: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2018-2024, 3Q20 Update, accessed at: https://www.gartner.com/en/newsroom/press-releases/2020-10-29-gartner-forecasts-australian-enterprise-it-spending-to-grow-3-point-6-per cent-in-2021.

Hemmerdinger, R, 2011, Predictive Maintenance Strategy for Building Operations: A Better Approach, Schneider Electric White Paper

Herbert, L and Erickson, J, 2011, The ROI of Cloud Apps: A Total Economic Impact Analysis Uncovers Long-Term Value In Cloud Apps, Forrester Consulting, June.

Hitt, LM, Wu, DJ, and Zhou, X, 2002, ERP Investment: Business Impact and Productivity Measures, Journal of Management, Information Systems, doi: 10.1080/07421222.2002.11045716.

Hitt, LM, Wu, DJ, and Zhou, X, 2002, Investment in Enterprise Resource Planning: Business Impact and Productivity Measures, Journal of Management Information Systems, 19(1): 71–98.

IBISWorld, 2020, Software Suppliers in Auxtralia, Specialised Industry Report OD5463, December.

Independent Hospital Pricing Authority (IHPA), NHCDC, National Efficient Price Determination 2021-2022

Local Government Association of Queensland, 2020, Digital Productivity Report, accessed at: https://www.lgaq.asn.au/downloads/file/196/2020-digital-productivity-report

Masanet, E, 2013, The Energy Efficiency Potential of Cloud-Based Software: A U.S. Case Study, Lawrence Berkeley National Laboratory.

Mathew S, 2012, Implementation of Cloud Computing in Education – A Revolution, International Journal of Computer Theory and Engineering, Vol. 4, No. 3, June 2012

McKinsey Quarterly, 2007, Delivering Software as a Service, The McKinsey Quarterly.

McKinsey, 2016, Industry 4.0: how to navigate digitization of the manufacturing sector. World mobility leadership form, September 28–29, 2016, Detroit. Michigan, USA.

Mitra, A, O'Regan, N, and Sarpong, D, 2018, Cloud resource adaptation: A resource based perspective on value creation for corporate growth, Technological Forecasting & Social Change, 130: 28-38

Nasarwanji, A. et al. (2009), "The impact of manufacturing execution systems on labor overheads", Proceedings of the World Congress on Engineering 2009, Vol. I, WCE, London, www.iaeng.org/publication/WCE2009/WCE2009_pp734-737.pdf.

NSW Government, 2015, NSW Government as a Service, ICT Sourcing Guide, Finance Services and Innovation

NSW Government, 2020, NSW Government Cloud Strategy, accessed at: https://www.digital.nsw.gov.au/sites/default/files/NSW%20Government%20Cloud%20Strategy%20v1.1.pdf

OECD (2014), "Cloud Computing: The Concept, Impacts and the Role of Government Policy", OECD Digital Economy Papers, No. 240, OECD Publishing, Paris, https://doi.org/10.1787/5jxzf4lcc7f5-en.

OECD, 2014, Cloud Computing: The Concept, Impacts and the Role of Government Policy, doi: 10.1787/5jxzf4lcc7f5-en

OECD, 2015, Data-Driven Innovation: Big Data for Growth and Well-Being, doi: 10.1787/9789264229358-en.

OECD, 2017, Benefits and challenges of digitising production, The Next Production Revolution: Implications for Governments and Business, doi: 10.1787/9789264271036-en.

OECD, 2021, Measuring Cloud Services Use by Businesses, OECD Digital Economy Papers, No. 304.

Pacific Northwest Laboratory, 2010, Operations & Maintenance Best Practices – A Guide to Achieving Operational Efficiency (Release 3.0), report to the US Department of Energy.

Pocock, D, 2019, Smart Infrastructure and Construction, International Conference on Smart Infrastructure and Construction (ICSIC) 2019, 172(4): 160-165, doi: 10.1680/jsmic.20.00010

Rødseth H, et al, 2017, Deep digital maintenance, Adv. Manuf. 5, pp. 299–310

Ruhul, A, McLennan, P, and Pitt, M, 2012, Condition Based Maintenance: a UK pilot study, University College London

Rüssmann, M. et al. (2015), "Industry 4.0: The future of productivity and growth in manufacturing industries", Boston Consulting Group, www.bcgperspectives.com/content/articles/engineered_products_ project_business_industry_40_future_productivity_growth_manufacturing_industries/ (accessed 8 February 2016).

Sharwood, S, 2019, Australian cloud is 66 per cent SaaS: IDC, CRN, accessed at: https://www.crn.com.au/news/australian-cloud-is-66-per cent-saas-idc-527689

Simatupang, TM, 2017, 'The network business model of cloud computing for end-to-end supply chain visibility', Int. J. Value Chain Management, 8(1): 22–39.

Suherman, A.G. and

Susarla, A, Barua, A, and Whinston, AB, 2014, A Transaction Cost Perspective of the "Software as a Service" Business Model, Journal of Management Information Systems, doi: 10.2753/MISO742-12222260209.

Sweeney, J, 2019, CRM modernisation, Part 5: Microsoft Dynamics vs Salesforce total cost of service, IBRS Advisory.

Tambe, P. (2014), "Big data investment, skills, and firm value", Management Science, http://ssrn.com/abstract=2294077 (accessed 10 June 2015).

Tasmanian Grants Commission, 2012, Review of Road Maintenance Costs.

Tiwari, A, and Jain, M, 2013, Analysis of Supply Chain Management in Cloud Computing, International Journal of Innovative Technology and Exploring Engineering, 3(5): 2278-3075.

U.S. Department of Energy, 2010, "Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency," Federal Energy, Management Program, August 2010.

VMware, 2011, Business Agility and the True Economics of Cloud Computing, Business White Paper.

Xu, E, Wermus, M, and Blythe Bauman, B, 2011, Development of an integrated medical supply information system, Enterprise Information Systems, 385-399, doi: 10.1080/17517575.2011.566630

# Endnotes.


1. See for example: OECD, 2014, Cloud Computing: The Concept, Impacts and the Role of Government Policy, OECD Digital Economy Papers, No. 240, OECD Publishing, Paris, doi: 10.1787/5jxzf4lcc7f5-en; Susarla, A, Barua, A, and Whinston, AB, 2014, A Transaction Cost Perspective of the "Software as a Service" Business Model, Journal of Management Information Systems, doi: 10.2753/MISO742-12222260209; Herbert, L and Erickson, J, 2011, The ROI of Cloud Apps: A Total Economic Impact Analysis Uncovers Long-Term Value In Cloud Apps, Forrester Consulting, June; McKinsey Quarterly, 2007, Delivering Software as a Service, The McKinsey Quarterly; Ali, MM, and Haseebuddin, M, 2015, Cloud Computing for Retailing Industry: An International Journal of Computer Trends and Technology (IJCTT) 19(1), Jan 2015; Ali, MM, and Haseebuddin, M, 2015, Cloud Computing for Retailing Industry: An International Journal of Computer Trends and Technology (IJCTT) 19(1), Jan 2015; Mitra, A, O'Regan, N, and Sarpong, D, 2018, Cloud resource adaptation: A resource based perspective on value creation for corporate growth, Technological Forecasting & Social Change, 130: 28-38; Attaran, M, Attaran, S, and Gokhan Celik, B, 2017, Promises and Challenges of Cloud Computing in Higher Education: A Practical Guide for Implementation, Journal of Higher Education Theory and Practice Vol. 17(6) 2017; Benlian, A, and Hess, T, 2011, Opportunities and risks of Software as a Service: Findings from a survey of IT executives, Decision Support Systems 52 (2011) 232–246; Altmann, J, and Kashef, MM, 2014, Cost model based service placement in federated hybrid clouds, Future Generation Computer Systems 41 (2014) 79–90.
2. See Australian Government, Treasury, 2011, Appendix A - Modelling framework, at https://treasury.gov.au/publication/p2011-sglp-report/appendix-a-modelling-framework
3. Gartner, 2021, Forecast: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2018-2024, 3Q20 Update, accessed at: https://www.gartner.com/en/newsroom/press-releases/2020-10-29-gartner-forecasts-australian-enterprise-it-spending-to-grow-3-point-6-per cent-in-2021.
4. IBISWorld, 2020, Software Suppliers in Australia, Specialised Industry Report OD5463, December.
5. Gartner, 2021, Forecast: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2018-2024, 3Q20 Update, accessed at: https://www.gartner.com/en/newsroom/press-releases/2020-10-29-gartner-forecasts-australian-enterprise-it-spending-to-grow-3-point-6-per cent-in-2021.
6. Ibid.
7. Deloitte, 2019, Benefits of Small Business Digital Engagement, report to the Department of Employment, Skills, Small and Family Business, p8.
8. Australian Bureau of Statistics, 2017, Business Use of Information Technology 2015-16 financial year (latest data release).
9. See: OECD, 2015, Data-Driven Innovation: Big Data for Growth and Well-Being, doi: 10.1787/9789264229358-en; OECD, 2017, Benefits and challenges of digitising production, The Next Production Revolution: Implications for Governments and Business, doi: 10.1787/9789264271036-en. OECD, 2021, Measuring Cloud Services Use by Businesses, OECD Digital Economy Papers, No. 304.
10. Digital Transformation Agency, 2017, Secure Cloud Strategy, https://dta-www-drupal-20180130215411153400000001.s3.ap-southeast-2.amazonaws.com/s3fs-public/files/cloud/secure-cloud-strategy.pdf
11. NSW Government, 2020, NSW Government Cloud Strategy, accessed at: https://www.digital.nsw.gov.au/sites/default/files/NSW%20Government%20Cloud%20Strategy%20v1.1.pdf
12. Local Government Association of Queensland, 2020, Digital Productivity Report, accessed at: https://www.lgaq.asn.au/downloads/file/196/2020-digital-productivity-report.
13. RBA, 2021, Ten-year Commonwealth bonds, accessed at: https://www.rba.gov.au/chart-pack/interest-rates.html
14. See for example: OECD, 2014, Cloud Computing: The Concept, Impacts and the Role of Government Policy, OECD Digital Economy Papers, No. 240, OECD Publishing, Paris, doi: 10.1787/5jxzf4lcc7f5-en; Susarla, A, Barua, A, and Whinston, AB, 2014, A Transaction Cost Perspective of the "Software as a Service" Business Model, Journal of Management Information Systems, doi: 10.2753/MISO742-12222260209; Herbert, L and Erickson, J, 2011, The ROI of Cloud Apps: A Total Economic Impact Analysis Uncovers Long-Term Value In Cloud Apps, Forrester Consulting, June; McKinsey Quarterly, 2007, Delivering Software as a Service, The McKinsey Quarterly; Ali, MM, and Haseebuddin, M, 2015, Cloud Computing for Retailing Industry: An International Journal of Computer Trends and Technology (IJCTT) 19(1), Jan 2015; Ali, MM, and Haseebuddin, M, 2015, Cloud Computing for Retailing Industry: An International Journal of Computer Trends and Technology (IJCTT) 19(1), Jan 2015; Mitra, A, O'Regan, N, and Sarpong, D, 2018, Cloud resource adaptation: A resource based perspective on value creation for corporate growth, Technological Forecasting & Social Change, 130: 28-38; Attaran, M, Attaran, S, and Gokhan Celik, B, 2017, Promises and Challenges of Cloud Computing in Higher Education: A Practical Guide for Implementation, Journal of Higher Education Theory and Practice Vol. 17(6) 2017; Benlian, A, and Hess, T, 2011, Opportunities and risks of Software as a Service: Findings from a survey of IT executives, Decision Support Systems 52 (2011) 232–246; Altmann, J, and Kashef, MM, 2014, Cost model based service placement in federated hybrid clouds, Future Generation Computer Systems 41 (2014) 79–90.
15. OECD, 2015, Data-Driven Innovation: Big Data for Growth and Well-Being, doi: 10.1787/9789264229358-en; Brynjolfsson, E, Hitt, LM, and Kim, HH, 2011, Strength in numbers: How does data-driven decisionmaking affect firm performance?, Social Science Research Network, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1819486.
16. Firms that adopt ERP realise productivity improvements of between 1.7 per cent and 4.2 per cent, depending on the specification, compared to firms that do not utilise ERP software. See Hitt, LM, Wu, DJ, and Zhou, X, 2002, ERP Investment: Business Impact and Productivity Measures, Journal of Management, Information Systems, doi: 10.1080/07421222.2002.11045716.
17. Bakhshi, H, Bravo-Biosca, A, and Mateos-Garcia, J, 2014, "Inside the datavores: Estimating the effect of data and online analytics on firm performance", Nesta, www.nesta.org.uk/sites/default/files/inside_the_datavores_technical_report.pdf
18. Barua, A, Mani, D, and Mukherjee, R, 2013, Impacts of effective data on business innovation and growth, University of Texas at Austin.
19. Billentis, 2017, Business Case for E-Invoicing and E-Billing, accessed at www.billentis.com.
20. Deloitte, 2019, Benefits of Small Business Digital Engagement, report to the Department of Employment, Skills, Small and Family Business, p8.
21. Salesforce, 2021, Small Business CRM Growth Kit, p13
22. Schniederjans, DG, and Hales, DN, 2016, Cloud computing and its impact on economic and environmental performance: A transaction cost economics perspective, Decision Support Systems, 86: 73-82
23. BIAP & IBRS, conference attendee data set, 2016-2021.
24. Simatupang, TM, 2017, 'The network business model of cloud computing for end-to-end supply chain visibility', Int. J. Value Chain Management, 8(1): 22–39.
25. Cachon, GP, and Fisher, M, 2000, Supply Chain Inventory Management and the Value of Shared Information, Management Science 46(8):1032-1048. https://doi.org/10.1287/mnsc.46.8.1032.12029
26. Camara, SB, et al, Supply chain integration through community cloud: Effects on operational performance, Journal of Purchasing & Supply Management, 22:141-153.
27. Commercial in confidence Australian case study
28. IBRS, Local Government Enterprise Solutions: What's working, what's now and what's next. (2020)
29. Barratt, M, 2007, Proactive Reliability Maintenance, IPPTA J. 19(3).
30. Rødseth H, et al, 2017, Deep digital maintenance, Adv. Manuf. 5, pp. 299–310
31. Pocock, D, 2019, Smart Infrastructure and Construction, International Conference on Smart Infrastructure and Construction (ICSIC) 2019, 172(4): 160-165, doi: 10.1680/jsmic.20.00010
32. Pacific Northwest Laboratory, 2010, Operations & Maintenance Best Practices – A Guide to Achieving Operational Efficiency (Release 3.0), report to the US Department of Energy.
33. Ruhul, A, McLennan, P, and Pitt, M, 2012, Condition Based Maintenance: a UK pilot study, University College London
34. For example, a deferral of just 10% of the current estimated annual investment in such assets for Australia, which would correspond

to a cost avoidance of A$60 million/year. See Davis, P, Sullivan, E,Marlow, D, Marney, D, 2013, A selection framework for infrastructure condition monitoring technologies in water and wastewater networks, Expert Systems with Applications, 40(6): 1947-1958, doi: 10.1016/j.eswa.2012.10.004.

35. Daugherty, P. et al. (2015), “Driving unconventional growth through the industrial Internet of Things,” Accenture Technology, www.accenture.com/us-en/labs-insight-industrial-internet-of-things.
36. McKinsey, 2016, Industry 4.0: how to navigate digitization of the manufacturing sector. World mobility leadership form, September 28–29, 2016, Detroit. Michigan, USA.
37. ABS, 2017, Business Use of Information Technology (latest release).
38. OECD, 2016, Managing Digital Security and Privacy Risk, OECD Digital Economy Papers, No. 254, 2016 Ministerial Meeting on the Digital Economy, Background Report.
39. Ibid.
40. Ibid.
41. CISO Lens Benchmark 2020, CISO Lens, 2020, pg 12.
42. E3, 2014, Energy Efficiency Policy Options for Australian and New Zealand Data Centres, Consumer Research Associates, report to the Department of Industry
43. NABERS, 2020, Data Centres Fact Sheet.
44. IBRS, 2008, The Status of Green IT in Australian and New Zealand, 2008
45. IBRS, 2020, BIAP ICT conference attendee data set (2016-2020)
46. IBRS, 2021, Cloud Vendors will Push New Wave of Sustainable ICT Strategies
47. IBRS, 2010, Data centre electricity costs set to rise sharply
48. The Centre of Excellence in Local Government found LGA turnover at 12% compared to national average of 10%.

**IBRS**
ACN: 107 618 404
ABN: 98 107 618 404

**Insight Economics Pty Ltd**
ACN: 141 097 565
ABN: 29 627 712 906



# The economic impact of Software as a Service in Australia.

# It's too big to ignore.

Insight Economics
Public Policy Corporate Strategy

IBRS | ANALYSIS INSIGHT JUDGEMENT

## About TechnologyOne.

TechnologyOne (ASX: TNE) is Australia's largest enterprise software company and one of Australia's top 150 ASX-listed companies, with locations across six countries. We provide a global SaaS ERP solution that transforms business and makes life simple for our customers. Our deeply integrated enterprise SaaS solution is available on any device, anywhere and any time and is incredibly easy to use.

Over 1,200 leading corporations, government agencies, local councils and universities are powered by our software. For more than 34 years, we have been providing our customers enterprise software that evolves and adapts to new and emerging technologies, allowing them to focus on their business and not technology.

**Visit technologyonecorp.com**

technologyone

Transforming business, making life simple