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Modelling the Economic Impact of Cloud Computing

Australian Information Industry Association

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Preface

Cloud computing is receiving an increasing level of attention, as evidenced by the rapidly growing number of qualitative surveys and analysis that has been published over the past two years, both in Australia and internationally and across private, public and third sector organisations.

This report, commissioned by the Australian Information Industry Association and the Department of Broadband Communications and the Digital Economy, seeks to build on this earlier qualitative analysis by undertaking a quantitative assessment of cloud computing and its potential impact on the Australian economy over the next decade.

The results of this analysis are intended to facilitate a more informed understanding of, and further discussion around, the current state of cloud computing in Australia and its potential impact.

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Modelling

Any economic estimates in this report of the impacts of possible events hold all other factors constant. They also rely on economic parameters that are subject to unavoidable statistical variation. Any economic projections or forecasts in this report rely on economic inputs that are subject to unavoidable statistical variation. They also rely on economic parameters that are subject to unavoidable statistical variation. While all care has been taken to ensure that statistical variation is kept to a minimum, care should be taken whenever using this information. Any estimates or projections will only take into account information available to KPMG up to the date of the deliverable and so findings may be affected by new information. Events may have occurred since we prepared this report which may impact on it and its findings.

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Executive summary

The Australian Information Industry Association (AIIA) engaged KPMG to analyse the potential impact of uptake of cloud computing services by private and public sector enterprises on the Australian economy.

The results of this analysis are intended to facilitate a more informed understanding of, and further discussion around, the current state of cloud computing in Australia and its potential impact over the next decade. The implications of this impact are expected to be of interest and significance to policy-makers, government agencies and decision-makers in business (including CEOs, CFOs, CIOs and Boards).

KPMG's research and analysis covered all sectors of the economy other than agriculture[1] , but with particular focus on early adopters including the financial services, property and business services, and education services sectors. KPMG found that ICT capital and operating expenditure across these sectors can be expected to significantly reduce over the long run (10 years plus). As a result, firms are able to produce greater amounts of output with the same level of input, or else the same level of output can be achieved with reduced ICT input thereby freeing up resources for use in other forms of production. Each outcome results in an increase in GDP as a result of productivity gains from cloud computing implementation.

It is clear from KPMG's analysis that, should Australian organisations adopt cloud platforms as expected across their ICT requirements – as more mature markets such as the US suggest is likely – then the benefits at both the enterprise and aggregate economy level could be substantial, lowering ICT operating and capital expenditures by up to 25 percent and 50 percent respectively. If realised, this cost reduction results in a sustained increase in annual GDP over the long run, after allowing for a period of adjustment (see Figure 3 below).

Based on the current level of Australian GDP, KPMG estimates that adoption of cloud services across 75 percent of relevant ICT spending[2], achieving opex and capex savings of 25 percent and 50 percent respectively, after 10 years would result in an increase in long-run GDP of A$3.32 billion per annum.

At 50 percent adoption levels, the GDP gain is A$2.16 billion per annum.

What is cloud computing?

'Cloud computing' is a concept that is broadly recognised by Australian businesses and government agencies, but not always well understood in detail. To some degree, this is due to the continuing rapid evolution of cloud computing service offerings. Indeed, 'cloud computing' is a catchall term that is often misused. The US National Institute of Standards and Technology (NIST) defines[3] cloud computing as:

> *a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released.*

In practice cloud computing describes three overarching and related service models, delivered over a network (typically the internet) to replace product models. Each of these service lines displays the same core criteria, as illustrated in Figure 1.

[1] Agriculture represents 2.5 percent of the total economy and has a low ICT intensity (refer to Appendix B).

[2] This is supported by the Ovum data which states that, up to 70 percent of ICT expenditure is potentially transferable to the cloud.

[3] Mell, P and Grance T, 2011, Recommendations of the National Institute of Standards and Technology, US Department of Commerce Special Publication 800-145

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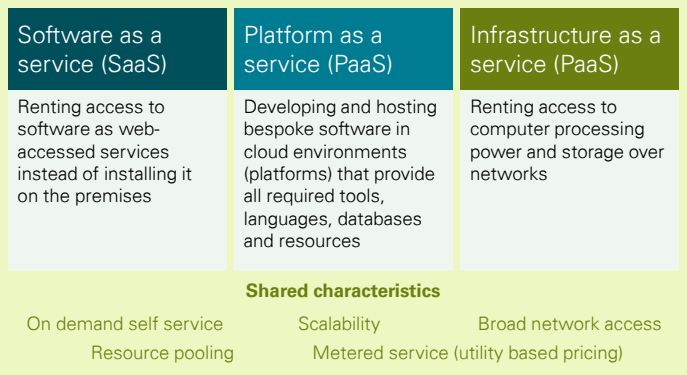
Figure 1: Cloud service offerings and features[4]



There are four deployment models for these cloud service offerings: Private, Public, Community and Hybrid. The features and benefits associated with each are shown in Table 1 below.

Table 1: Cloud deployment models

Cloud type	Features	Benefits
Public	For use by multiple organisations (tenants) on a shared basis and hosted and managed by a third party service provider. Computing resources accessed as external services, instead of as products that are purchased, installed and managed within an organisation.	Ability to rapidly scale the allocation of computing resources to match fluctuations in business demand. Utility-based pricing, so that users only pay for computing resources actually used (rather than full load capacity). Potentially large economies of scale.
Private	For exclusive use by a single organisation and typically controlled, managed and hosted in private data centres. The hosting and operation of private clouds may be outsourced to a third party service provider, but a private cloud remains for the exclusive use of one organisation. Currently, the most common form of cloud in Australia, and typically the first step in a company's cloud journey.	Considered the most secure option, but with reduced potential for economies of scale and productivity gains available through multi-tenant options.
Community	For use by a group of related organisations that wish to make use of a common cloud computing environment for example, local councils with a shared service offering. Effectively half way between private and public clouds.	Reduced economies of scale traded off for increased security.
Hybrid	Both private and public cloud models are adopted by a single organisation.	Allows for multiple deployment methods to meet specific business/agency needs.

[4] KPMG, Cloud Computing: Australian Lessons and Experiences, 2009

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Some analysts argue that private cloud is not a 'true' cloud service as the fundamental model posited by cloud computing assumes a shared utility. In any event, while the shared resource model can take place at an enterprise level, public cloud is where significant economies of scale can be gained and therefore cost/productivity benefits to both individual users and the economy as a whole are likely to be maximised. The potential exception to this rule is in the public sector, where sufficient economies of scale exist to potentially achieve similar benefits if services are shared across agencies.

Although at present public cloud appears to be less prevalent in Australia than private cloud, based on overseas experience and evidence from local service providers public cloud has the greatest growth potential over the coming decade. This analysis is therefore centred on the potential benefits of public cloud.

Benefits of cloud computing

> *Cloud computing represents a major departure from previous industry practice and may fundamentally change the nature of computing. While mainframes required expensive upfront capital investments and later client servers optimised agility for end users, the cloud offers the advantages of both approaches without the disadvantages of either and can improve efficiency by a factor of ten.*
>
> *Global Access Partners (GAP) Task Force on Cloud Computing Report (2011)*

The benefits of cloud computing can be grouped into three broad categories.

Direct cost savings (reduced cost per unit of output) — the largest and most identifiable economic benefit of cloud computing is the direct cost savings from changes within the organisation (e.g. reduced IT maintenance) and external economies of scale (e.g. large data centres housing the IT infrastructure).

Productivity improvements (increased output per unit of cost) — changes to business can be achieved without the need for detailed capacity planning, changes to installed technology or new technology purchases.

Innovation (ability to deliver new and evolving products) — organisations can gain further benefits in business flexibility and agility, collaboration, and taking new products and services to market.

Key cloud benefits are summarised in Table 2.

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Table 2: Potential cloud benefits

Benefit	Comment	Public	Private
Improved efficiency	Because both public and private cloud are based on grid computing[5] and virtualisation, both offer high efficiency and high utilisation due to sharing pooled resources, enabling better workload balance across multiple applications.	✓	✓
Increased availability	Another benefit of being based on grid computing is that applications can take advantage of a high availability of architecture that minimises or eliminates planned and unplanned downtime, improving user service levels and business continuity.	✓	✓
Elastic scalability	Grid computing provides public and if outsourced) private cloud with elastic scalability; that is, the ability to add and remove computing capacity on demand. This is a significant advantage for applications with a highly variable workload or unpredictable growth, or for temporary applications.	✓	✓
Fast deployment	Application deployment is greatly accelerated because both public and private cloud can provide self-service access to a shared pool of computing resources, and because the software and hardware components are standard, re-usable and shared.	✓	✓
Low upfront costs	Public clouds are faster and cheaper to get started, providing users with a low barrier to entry because there is no need to procure, install and configure hardware.	✓	X
Economies of scale	Large public clouds enjoy economies of scale in equipment purchasing power and management efficiencies. Savings may be passed on to consumers, and will increasingly be so as competition in the sector increases over time.	✓	X
Simpler to manage	Public clouds may require fewer IT personnel to manage and administer, update, patch, etc. Users rely on the public cloud service provider instead of an internal IT department.	✓	X
Operating expense	Public clouds are paid out of the operating expense budget, often by the users' line of business, rather than the IT department. Capital expense is avoided, which can provide a financial advantage for some organisations.	✓	X

Source: Oracle, Oracle Cloud Computing – An Oracle White Paper, 2010

[5] Refers to applying the resources of many computers in a network to a single problem at the same time.

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Barriers to uptake

While there is often a strong economic case for the adoption of cloud services, there are nevertheless several constraints that need to be overcome. The natural barriers to full adoption include, but are not limited to:

- speed/latency issues and reliance on telecommunications services providers
- compatibility of an organisation's internal processes with cloud offerings
- location of data and related security and data sovereignty issues
- business continuity/disaster recovery and integration
- (in Australia at present) limited knowledge of product offerings and lack of familiarity of businesses with opportunities.

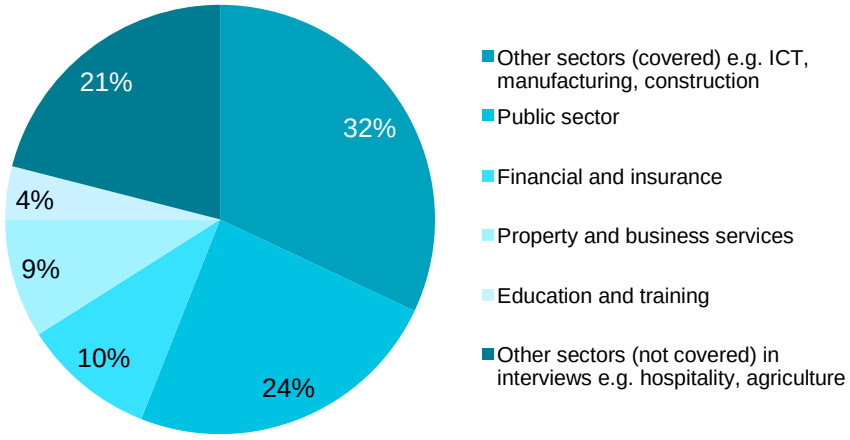
For the purpose of this project, KPMG has assumed that over time the above challenges to adoption are at least in part overcome, as is being seen in early adopter countries such as the US.

Findings

Between August 2011 and March 2012, KPMG interviewed 29 organisations covering sectors accounting for 80 percent of GDP (see Figure 2 below) and ranging in size from 20 employees up to many thousands.

Of those interviewed, KPMG found that the financial services, property and business services, education services, and media information and telecommunications sectors had the most robust results. This study used evidence gathered from organisations in these and other sectors through interviews, together with an extensive Australian and international literature review to develop a credible scenario for the uptake of, and likely productivity increase resulting from, cloud computing services across the Australian economy.

Figure 2: KPMG consultations: Industries covered (and relative sector size)



A 2011 survey by Frost and Sullivan[6] found that the level of respondents using some form of cloud services had increased to 43 percent, from 35 percent in the previous year.

KPMG's in-house Computable General Equilibrium (CGE) model of the Australian economy was then employed to estimate the potential productivity impacts of cloud computing adoption on long run GDP.

[6] Frost and Sullivan, 2011, Not all data centres are equal – Understanding the global best practices of data centres that power the cloud, Report for Macquarie Telecom

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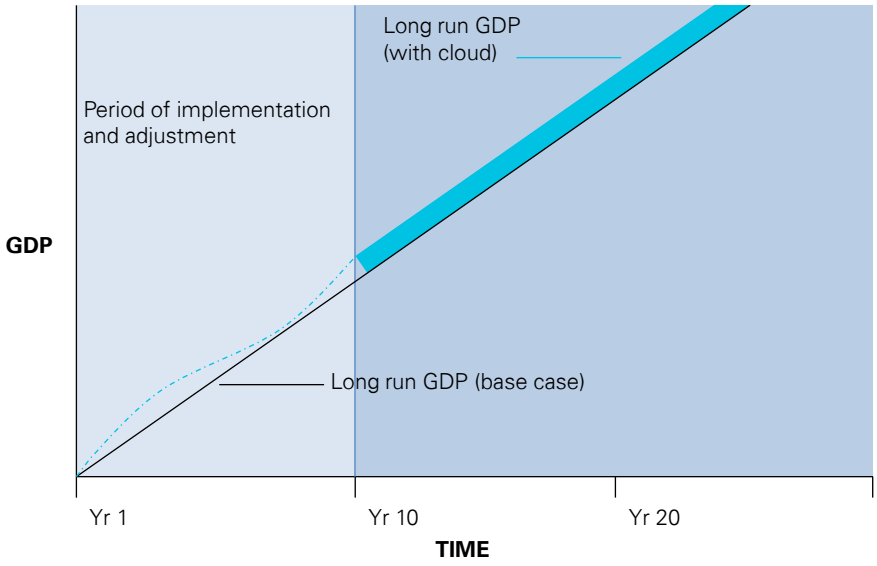
In essence, organisations' capital and operating expenditures on ICT are measured before and after implementation of the cloud. Any reduction in cost per unit of production is then incorporated into the model, which effectively replaces the relevant spending on a unit of ICT with spending on a new input that is cloud computing services. As a result of the productivity gains from cloud computing, firms either produce an increase in output from the same level of inputs, or output in the implementing enterprise is held steady freeing up resources for alternate forms of production. KPMG's CGE model allows for these changes to occur over a 10-year period of adjustment, after which time the impact on GDP is then measured. This process is illustrated in Figure 3.

Figure 3: Long run impact on GDP of cloud computing adoption



Source: KPMG

Based on consultations and an international literature review, KPMG estimates that ICT capital (capex) and operating (opex) expenditures will significantly reduce over the 10-year period modelled: for each unit of output opex is modelled to decline by 25 percent and capex by 50 percent[7]. The smaller percentage reduction for opex takes into account some offsetting impacts from costs due to new activities associated with cloud computing.

The long-run GDP results for the economy are summarised in Table 3.

Table 3: Potential GDP impact of cloud computing adoption

Expenditure	Annual GDP impact over 10 years			
	At 75% adoption		At 50% adoption	
	Percent	$ billion [1] (p.a.)	Percent	$ billion [1] (p.a.)
Capital	0.10%	1.44	0.07%	1.01
Operational	0.13%	1.87	0.08%	1.15
Total	**0.23%**	**3.32**	**0.15%**	**2.16**

1. At 2010-11 prices.
Source: ABS, KPMG modelling

[7] A full discussion of the assumptions underpinning the modeling is provided in Section 5 of this report.

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From a qualitative perspective, firms that engaged with KPMG were largely enthusiastic about the impact of public cloud on their operations. However, they were typically unable to quantify this impact precisely. Below is a summary of the key perceptions.

- Overall, the Australian cloud market is still at the early stages of the adoption curve in comparison to markets such as the US and Europe.
- Firms are more likely to be using private than public cloud at this stage.
- Smaller organisations can experience increased growth potential as they can access better IT solutions that may have previously been out of financial reach, but which are enable by cloud services.
- Larger organisations believe that there are productivity benefits associated with cloud services that allow staff to take on additional tasks.
- Replacement of large up-front capital outlays with small on-going user subscriptions for cloud-based products is allowing smaller, capital-constrained companies, especially technology-based ones, to enter markets more easily.
- Substitution of physical services with cloud-based services, including product delivery through streaming, could deliver significant cost savings.
- Cloud based solutions do not always deliver identifiable, immediate or on-going cost savings. There may however be intangible benefits such as access to new products that allow business expansion and improved flexibility and timeliness of delivery to market.

Conclusion

Both KPMG's consultations and current surveys of the industry suggest that the Australian cloud market is still at the early stages of adoption, particularly in comparison to the US and Europe. Many businesses which chose not to participate in KPMG's research study indicated that they believed that the Australian ICT market does not yet have mature offerings in cloud deployed solutions. Additionally, many of those who were more optimistic had either not begun to employ cloud solutions or believed their deployment was, thus far, too embryonic to allow measurement of success. However, a recent survey by Frost and Sullivan suggests that, in 2011, 43 percent of businesses in Australia were using some form of cloud computing services, up from 35 percent in 2010.

It is clear, however, that should Australian companies adopt cloud at an accelerating pace, as has been seen in more mature markets, the benefits at both the organisation and aggregate economy level in dollar terms could be significant.

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Introduction

KPMG has been engaged by the Australian Information Industry Association (AIIA) to assess the potential productivity impacts of cloud computing on the Australian economy. The results of this analysis are intended to facilitate a more informed understanding of the potential impact of cloud services on the Australian economy.

The overall objective of the project is to assess the potential economic impact of cloud computing on the Australian economy as a whole, highlighting impacts in key industry sectors.

Associated objectives of this study include:

- to provide a platform for informed discussions on cloud computing across industry, government, infrastructure providers and investors
- to elevate public debate on investment in Australian cloud infrastructure (including network infrastructure and the National Broadband Network (NBN)) by objectively analysing financial/economic outcomes.

This study looks at the current state of cloud computing and the potential path that it will follow over the next decade. The impact of this assumed path on the overall economy is then quantified through the use of Computable General Equilibrium (CGE) modelling.

1.1 Scope of this report

The project has two phases:

Phase one — A pilot study that focuses narrowly on sectors of the economy where cloud activity can be identified and quantified.

Phase two — A full study that incorporates the potential impact of cloud computing services across all 18 major sectors[8] of the economy.

This report summarises the findings from phase two and incorporates:

- a definition of cloud computing and a high-level discussion of the potential benefits (Chapter 2).
- the final quantitative findings resulting from surveys of businesses using cloud computing conducted by KPMG together with findings from a national and international literature review (Chapter 3).
- a proposed methodology for measuring the economic impact of cloud using KPMG's Computable General Equilibrium (CGE) models (Chapter 4).
- a list of assumptions (and the basis for these assumptions) that are incorporated into the model framework (Chapter 5).

[8] As defined by the Australian Bureau of Statistics (ABS) using ANZSIC codes, excluding agriculture and ownership of dwellings.

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1.2 Limitations of this report and its use

The information contained in this report is based on interviews and information received in good faith from the AIIA, its members and relevant third party persons, including a sample of early adopters of cloud computing services. In the course of our work, projections have been prepared on the basis of assumptions and methodologies deemed appropriate by the AIIA. It is possible that some of the assumptions underlying projections may not materialise. Where KPMG has made assumptions, we have applied our professional judgement in making these assumptions such that they constitute an understandable basis for estimates and projections. Beyond this, to the extent that certain assumptions do not materialise, readers will appreciate that our estimate and projections of achievable results will vary.

This subject matter and approach enable reasonable conclusions to be drawn about the overall benefit that may be generated for the Australian economy as a whole, should the assumptions hold true. However, this approach is not designed to inform any party about the appropriateness or otherwise of any particular investment decision.

The report should not therefore be regarded as suitable for use by any person or persons other than the addressees of the report or for any purpose other than that set out in Chapter 2. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

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2 What is cloud computing?

2.1 Background to cloud computing

The increasing use of Information Technology (IT) has brought with it overheads in the implementation and maintenance of in-house computing systems. The amount of time and finances invested in managing IT has increased exponentially; each decade since the 1970s has seen the evolution of IT into a new phenomenon, starting with mainframes in the 1970s, the rise of the personal computer in the 1980s and client server architecture from the 1990s. The next phase emerging in IT evolution is cloud computing. The concept of cloud computing has been around for some time; however it has only recently become feasible from both a supplier and consumer perspective.

The term 'cloud computing' has become widespread amongst the business community, government and the media, but there is still some level of confusion outside of the technology industry about what cloud computing actually is, not the least because the language around cloud is constantly evolving. Indeed, cloud computing is a catchall term describing a range of related activities, but which is identified by each of the following core criteria[9]:

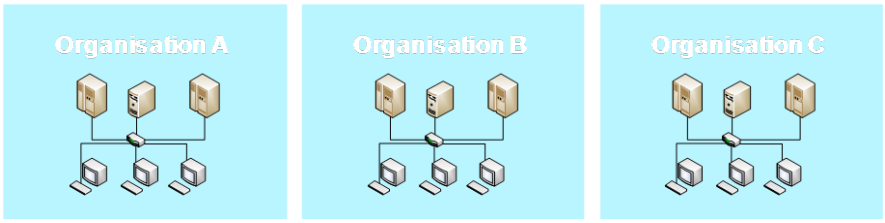
Accessing computing resources as external services, instead of as products that are purchased, installed and managed within an organisation.

The ability to rapidly scale the allocation of computing resources to match fluctuations in business demand.

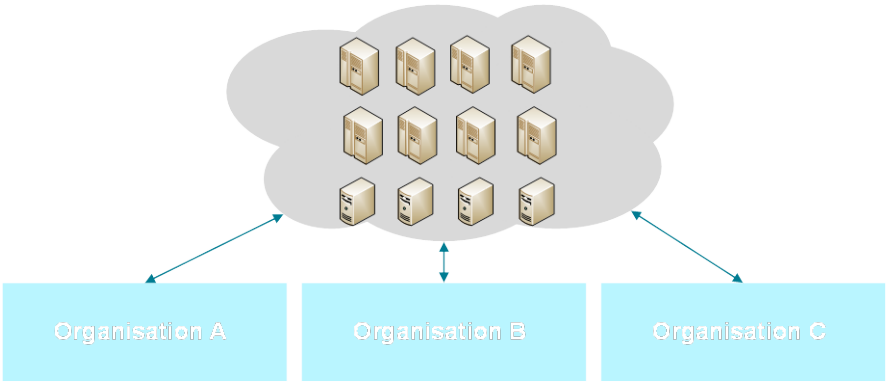
Utility-based pricing, so that users only pay for computing resources actually used (rather than for full load capacity) as they do, for example, with electricity.

Figure 4 below represents the transition from traditional, on-the-premises computing to cloud computing.

Figure 4: A visual representation of the shift to cloud computing



(a) Traditional computing, owned, installed and operated on the premises by individual organisations



(b) Cloud computing, rented and accessed as external, shared services over networks.
Source: KPMG

[9] KPMG, Cloud Computing: Australian Lessons and Experiences, 2009

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At the heart of cloud computing lies the ability of computing resources to be reliably and efficiently accessed by mainstream businesses as a pooled resource over networks.

2.2 Cloud deployment models

Cloud computing generally has four deployment models[10]: private, public, community and hybrid. These are explained in further detail below:

Private cloud — For exclusive use by a single organisation and typically controlled, managed and hosted in private data centres. The hosting and operation of private clouds may also be outsourced to a third party service provider, but a private cloud remains for the exclusive use of one organisation. Currently, this is the most common form of cloud in Australia, and typically the first step in a company's cloud journey.

Public cloud — For use by multiple organisations (tenants) on a shared basis and hosted and managed by a third party service provider (examples include Amazon EC2 and Google Apps).

Community cloud — For use by a group of related organisations that wish to make use of a common cloud computing environment.

Hybrid cloud — When a single organisation adopts both private and public cloud for a single application in order to take advantage of the benefits of both.

This analysis is centred on the potential benefits of **public** cloud, where multiple organisations access a shared resource pool for one or more of three distinct services (see below). Although at present public cloud appears to be less prevalent in Australia than private cloud, based on overseas experience and evidence from local service providers, public cloud has the greatest growth potential over the coming decade and is where economies of scale and the ensuing cost/productivity benefits to users are likely to be maximised.

Cloud computing can be categorised into three service models:

Software as a service (SaaS) — Renting access to software as Web-accessed services instead of installing it on the premises (example services include Salesforce.com, SAP Business By Design, RightNow, Google Apps and Inact).

Platform as a service (PaaS) — Developing and hosting bespoke software in cloud environments (platforms) that provide all required tools, languages, databases and resources (example services include Force.com, NetSuite Business Operating System, Microsoft Azure and Office 365 and Google App Engine).

Infrastructure as a service (IaaS) — Renting access to computer processing power and storage over networks (example services include Amazon EC2 and Amazon S3).

Figure 5 illustrates a typical cloud adoption journey – beginning with private cloud and moving through to full public cloud services – across each of these three service layers.

[10] Oracle, Oracle Cloud Computing – An Oracle White Paper, 2010

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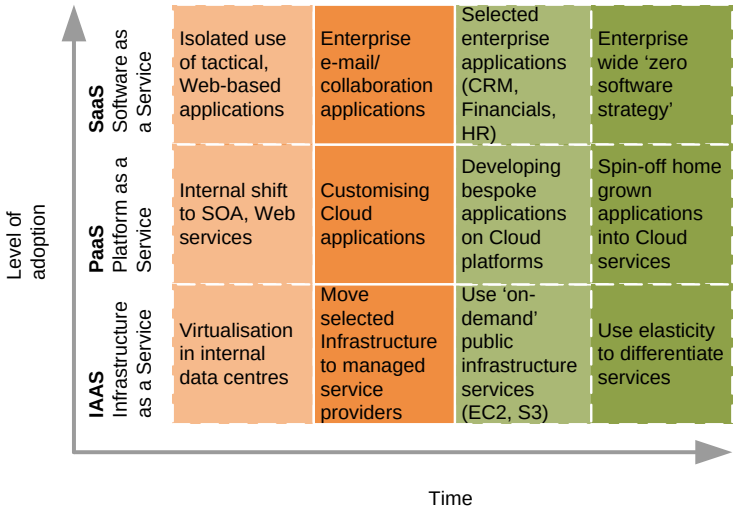
Figure 5: Potential cloud computing journeys



Source: KPMG

2.3 Potential cloud computing benefits

A number of recent international surveys[11] show that businesses are increasingly becoming aware of the potential benefits of cloud computing and moving along the 'cloud journey'. The business benefits[12] common to both public and private cloud include:

Improved efficiency — Because both public and private cloud are based on grid computing[13] and virtualisation, both offer high efficiency and high utilisation due to sharing pooled resources, enabling better workload balance across multiple applications.

Increased availability — Another benefit of being based on grid computing is that applications can take advantage of a high availability of architecture that minimises or eliminates planned and unplanned downtime, improving user service levels and business continuity.

Elastic scalability — Grid computing also provides public and private cloud with elastic scalability; that is, the ability to add and remove computing capacity on demand. This is a significant advantage for applications with a highly variable workload or unpredictable growth, or for temporary applications.

Fast deployment — Because both public and private cloud can provide self-service access to a shared pool of computing resources, and because the software and hardware components are standard, re-usable and shared, application deployment is greatly accelerated.

Additional benefits[14] that are unique to public cloud computing include:

Low upfront costs — Public clouds are faster and cheaper to get started, providing users with a low barrier to entry because there is no need to procure, install and configure hardware.

[11] CDW, From Tactic to Strategy – The CDW 2011 Cloud Computing Tracking Poll, 2011; KPMG, From Hype to Future - KPMG's 2010 Cloud Computing Survey, 2010; Red Shift Research, Adoption, Approaches & Attitudes – The Future of Cloud Computing in the Public and Private Sector, 2011

[12] Oracle, Oracle Cloud Computing – An Oracle White Paper, 2010

[13] Refers to applying the resources of many computers in a network to a single problem at the same time.

[14] Oracle, Oracle Cloud Computing – An Oracle White Paper, 2010

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Economies of scale — Large public clouds enjoy economies of scale in equipment purchasing power and management efficiencies. Savings may be passed on to consumers, and will increase as competition in the sector increases over time.

Simpler to manage — Public clouds may require fewer IT personnel to manage and administer, update, patch, etc. Users rely on the public cloud service provider instead of an internal IT department.

Operating expense — Public clouds are paid out of the operating expense budget, often by the users' line of business, not the IT department. Capital expense is avoided, which can be an advantage in some organisations.

2.4 The economics of cloud computing

The emergence of cloud computing brings many benefits which are shifting the economics of IT. Cloud technology standardises and pools IT resources and automates many of the maintenance tasks performed manually today. Cloud architectures facilitate elastic consumption, self-service, and pay-as-you-go pricing. Cloud also allows core IT infrastructure to be brought into large data centres that take advantage of significant economies of scale. The economics of cloud computing can be grouped into three broad categories:

- direct cost savings
- productivity improvements
- innovation.

Each of these features is discussed in further detail below.

Case study – Surf Lifesaving Australia

Surf Lifesaving Australia (SLSA) relies on more than 44,000 patrolling volunteer lifesavers. One of the greatest challenges for the organisation is reducing the amount of time required for the administration of clubs and services.

In 2008, SLSA committed to improve service levels, save time and facilitate commercial expansion 'by providing sophisticated business and communications tools and applications' through the provision of a cost-effective infrastructure.

SLSA's service applications and delivery, provided by Fujitsu, include a centralised operational data store and reporting application that allows:

- the SLSA access to a single national enterprise view of its information
- applications that service the SLSA community across the country
- a members' portal which is linked to web-based content and workflow management
- voice recognition and telephony services to enable on-beach access to services.

This has led to benefits including:

- cost efficiencies
- a reduced administrative burden for volunteers through on-beach patrol logs, captured on mobile phones, fed directly to the central data store
- improved data collection and analysis for education programs.

For the full case study, please refer to Appendix D.

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Direct cost savings

The largest and most identifiable economic benefit of cloud computing is the direct cost savings. Direct cost savings for organisations occur from changes both within the organisation, and also the large data centres housing the IT infrastructure. Direct cost savings[15] occur at the data centres through significant economies of scale in three areas.

Supply-side savings — Large-scale data centres potentially lower costs per server due to superior buying power and expertise.

Demand-side aggregation — Aggregating demand for computing can smooth overall variability, allowing multiple users across varying industries, regions and time zones allowing average server utilisation rates to increase.

Multi-user efficiency — Increasing the number of users often lowers the application management and server cost per tenant.

With large data centres housing the IT infrastructure, cloud computing activities remove many IT operational considerations from an organisation altogether. This can not only reduce overheads associated with day-to-day operations of computer hardware and software, but can also simplify procurement, the need to plan for upgrades and patches to software, management of software licensing and facilities management. Removing this complexity from an organisation frees personnel who are otherwise occupied with daily technology operations. This may not translate into a reduction in overall headcount, but rather a reallocation of people (and tasks) within an organisation.

With these changes, an individual organisation's costs can change from mainly capital expenditure to predominantly operating expenditure. This can be achieved through lower upfront IT costs, as discussed earlier, and because cloud computing follows a utility based pricing model in which service costs are based on consumption. That is, a company only pays for those services that it uses rather than a fixed price for a potential level of services that may not suit actual demand. Another direct cost saving may come with lower electricity consumption (including for cooling apparatus) and accommodation costs for IT infrastructure, which are often among the largest components of overall IT costs. Specifically, several key factors[16] enable cloud computing to lower energy use and carbon emissions, including:

Dynamic provisioning — Reducing wasted computing resources through better matching of server capacity with actual demand.

Multi-tenancy — Flattening relative peak loads by serving large numbers of organisations and users on shared infrastructure and reducing costs through sharing of applications.

Server utilisation — Operating servers at higher utilisation rates.

Data centre efficiency — Utilising advanced data centre infrastructure designs that reduce power loss through improved cooling, power conditioning, etc.

Additionally, large data centres may be able to take advantage of geographical variability in electricity rates and choose to be situated in locations with either less expensive electricity supply or to negotiate bulk purchase agreements to lower the cost of electricity.

[15] Microsoft, The Economics of the Cloud, 2010.

[16] Accenture, Cloud Computing and Sustainability: The Environmental Benefits of Moving to the Cloud, 2010

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Case study — Arclight Investments

Arclight Investments is a sister company of the Ray White real estate group that provides ICT related services. Arclight is an avid implementer of cloud-based solutions with well advanced implementations. Arclight has utilised a cloud solution that has converted over 7,000 users across their network of over 1,000 offices for email, calendar and document management.

Arclight has seen the benefits of cloud computing, with significantly reduced infrastructure investment in both head office and within each of Ray White franchises, as a result of cloud based solutions. In the head office, Arclight has reduced their infrastructure investment from approximately 80 servers to 25 servers. In the franchise offices that have an average of six to seven staff, Arclight has been able to remove a mail server and firewall, and to rationalise business software licenses. In some offices, there was a server for mobile phone email, and this has also been removed. The capital investment savings required every three years for each office has been reduced on average by $25,000. Furthermore, an average of $10,000 ICT spend for each office for support and maintenance has been removed.

For the full case study, please refer to Appendix D.

Productivity improvements

With the implementation of cloud computing, changes to business can be achieved without the need for detailed capacity planning, changes to installed technology or new technology purchases. Translated into business outcomes, this allows for the ability to open offices, geographically move staff and operations without compromising access to business systems, put new ideas into practice, and to meet new business requirements faster than before.

Cloud also enables organisations to scale up or down to the level of service required, allowing optimisation of required capacity and reduced costs. The on-demand up/down elasticity of cloud-based computing services allows the ability to quickly scale computing resources to match business growth while minimising downside risk, that is, preserving the ability to release resources if a new project fails to get traction.

Additionally, cloud computing allows staff to access files and data when they are working remotely or outside of office hours. E-commuting has widespread potential benefits to both business — via a reduction in overheads (i.e. smaller office space may be required through hot desking) — and to consumers (e.g. through a reduction in commuting time).

Case study — Monash University

Monash University made its first major move in its cloud implementation journey in 2009 with the implementation of Google Apps for students and staff. It has since expanded its delivery of cloud services across other technologies. Monash announced a dedicated cloud Solutions Manager in October 2011. It is expected that Monash will continue to implement cloud technologies where there is recognised value to staff and students.

Google Apps has increased collaboration for students and staff by removing the barrier often created by IT. With open shared documents, there are pockets of innovation within the staff and student communities which are becoming apparent. The productivity benefits of this are estimated by Monash to be in the tens of millions of dollars.

A key example of the reduction in time for document collaboration made possible by cloud is the development of HR position descriptions. To complete five documents, have them reviewed and agreed upon by multiple staff in different geographic locations took one day as opposed to five plus days prior to cloud. Similarly, significant productivity gains are seen when using Google Docs for sharing and reviewing key documents with Malaysian and South African campuses.

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Documents can be worked on simultaneously across geographic distances whilst providing the sense of working face to face. Staff are reporting better relationship development with staff both overseas and locally where this is occurring.

For the full case study, please refer to Appendix D.

Innovation

The cost and efficiency benefits that initially drive interest in cloud computing may be augmented by other benefits. For example, organisations may gain further increased business flexibility and agility, collaboration, and an ability to take new products and services to market. An example of this is an online DVD hiring company that is transferring to cloud services to enable streamed delivery; the customer is able to receive, and the company to distribute, the product with significant time and cost savings.

Cloud services may be particularly beneficial to small businesses that might lack the capital to acquire the in-house ICT solutions required in the absence of cloud services.

The benefits of cloud computing may also translate into a faster 'time to market' for customer-facing activity. New services can potentially be built, and existing services adapted, more rapidly in response to feedback or changing customer requirements. In some cases, this could mean that improvements are significant, coming down from months to weeks or from weeks to days. Organisations may also progress to building entirely new services and products on cloud platforms taking full advantage of centralised data, easy scalability and web accessibility.

Furthermore, many companies spend a significant portion of their IT budget on maintaining existing services and infrastructure (refer to Ovum data in Appendix B), leaving few resources available for innovation. Cloud computing has the potential to free up significant resources that can be redirected to innovation.

Case study — channel partner

Company A is a Microsoft channel partner which has been in operation for 13 years. They build Platform as a Service (PaaS) products and go to market utilising Microsoft's Azure cloud service. Their main offering is a conversion utility, and utilising the cloud. They anticipate they will be able to rapidly scale emerging markets in Europe and Asia. The company have had to change their operating model and the basis of their technology to ensure they are not left behind.

As a result of their cloud based products and services, Company A have grown in the last four years from eight FTEs to 52 FTEs as they have shifted from selling services to selling a product. Additionally, the company expects revenue to increase by 50 percent in 2012 and by 166 percent in 2013 with their cost base only rising by five percent. Historically, they have been using profits to reinvest in research and development which has tripled in size.

The company name has been withheld for privacy reasons. For the full case study, please refer to Appendix D.

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Barriers to uptake

While there is often a strong case for the adoption of cloud services, there are several constraints that need to be overcome. The natural barriers to full adoption include, but are not limited to:

- speed/latency issues and reliance on telecommunications services providers
- consistency of current processes and applications with cloud offerings (for example, 'off the shelf' cloud services may not integrate well with a business' existing operations)
- location of data and related security and data sovereignty issues (including implications of the US Patriot Act[17])
- business continuity/disaster recovery and integrations
- (in Australia at present) limited knowledge of product offerings and lack of familiarity of businesses with opportunities.

A 2009 survey by KPMG[18] of managers in Australian organisations identified as 'pushing the boundaries' of cloud computing came up with several findings.

Location is important — Although cloud computing makes it possible to access services located anywhere in the world, there is a strong desire for services located within Australia's borders.

A significant barrier to take-up is the wide variation in maturity and quality of cloud services and service providers — A particular problem is the inability to get enterprise-grade service level agreements.

Common challenges — Common challenges include uncontrolled adoption of cloud applications in large organisations, non-compliance with local regulations (especially those that relate to the handling of customer information), concerns about regulations applying to services in other jurisdictions, preparing 'apples to oranges' business cases for cloud computing, and measuring the performance of cloud service providers.

For the purpose of this project, KPMG has assumed that over time the above challenges to adoption are substantially overcome, as is being seen in early adopter countries such as the US and Europe.

Case study — Ricoh

To date, Ricoh has implemented Salesforce.com and has also migrated their public website to a public cloud environment. The benefits identified by Ricoh from their cloud based initiatives include:

Better quality and more accessible information with the sales team keeping accounts, contracts, opportunities and leads data up to date for the benefit of all users across the organisation.

Information can be accessed from anywhere at any time. There has been a 40 percent reduction in time spent in the office from the team updating the old CRM system.

Better management due to visibility of opportunities in real time and better analysis of the reasons why opportunities are won and lost.

The Salesforce.com product includes a module to track ideas. This has led to an increase of 100 percent in idea nominations across the organisation.

More accurate sales forecasting has led to reduction in stock counts.

For the full case study, please refer to Appendix D.

[17] Enacted 2001, extended 2011

[18] KPMG, 2009, Cloud Computing – Australian lessons and experiences

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3 Preliminary findings

3.1 Participation

Between August and October 2011, KPMG approached 162 companies that were identified by KPMG and AIIA members as early adopters of cloud technologies; interviews were conducted with 29 of these organisations. The firms interviewed also covered a range of sizes; from 20 employees up to many thousands. The representation of industries covered in interview to date is shown in Table 4.

Table 4: Participation by sector

Sector	% of GDP	Interviews
Public sector	23.5	2
Financial and insurance services	10.2	6
Property and business services	9.0	3
Manufacturing	8.6	3
Construction	7.3	1
Health and community services	5.7	2
Transport and storage	5.0	1
Education and training	4.1	3
Information media and telecommunications (IMT)	3.1	5
Personal and other services	1.5	2
Cultural and recreation services	0.8	1
TOTAL	78.8	29

Source: ABS, KPMG

From the detailed interviews conducted, KPMG found that the financial services, property and business services, education services and IMT sectors had the most robust results.

Many executives KPMG contacted believed that the Australian ICT market does not yet have mature offerings in cloud deployed solutions. This view is supported by:

- a lack of knowledge of locally domiciled data centres
- the infancy in the deployment of the National Broadband Network (NBN)
- perceived barriers due to governance, security, disaster recovery and location of data.

Many of those who were more optimistic had nevertheless either not begun to employ cloud solutions, or believed their deployment was, thus far, too embryonic to allow measurement of success.

The Australian Government has actively sought to become better informed about cloud computing and the associated opportunities and risks through initiatives such as the Global Access Partners (GAP) Task Force on cloud computing, and through research such as the *Department of Finance and Deregulation Cloud Computing Strategic Direction Paper*.

However, based on discussions with both state and federal governments, widespread implementation is still some way off.

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3.2 Data

The firms that did engage with KPMG were largely enthusiastic about the impact of public cloud on their operations. However, they were typically unable to quantify this impact precisely. Additionally, many firms are using private cloud rather than a public cloud at this early stage, particularly where privacy and security considerations are significant.

Infrastructure as a service (IaaS) — Many firms appeared not to have the appetite for public cloud services due to the lack of locally domiciled data centres and the difficulties in transition such as compatibility in program language.

Platform as a service (PaaS) — Some enterprise level organisations are pooling licences for platforms and leasing them out to businesses on a subscription basis. Smaller ICT organisations are using PaaS offerings to develop applications that they are then taking to market in Australia and overseas. Speed, availability and price have made it possible for these smaller players to accelerate their development.

Software as a service (SaaS) — Some enterprise level organisations and a few in the small to medium space have deployed applications using public clouds. Examples include email and Customer Relationship Management (CRM), e-store hosting and services such as payroll hosting. There is a high level of interest in this space, but many organisations are still developing their cloud based strategies and the business cases that underpin them.

Case study — Investment Bank

Company B is at the very early stages of investigating what cloud computing can mean for the organisation. The first considerations are governance, regulation and security. Company B has started with Infrastructure as a Service (IaaS) with the implementation of a private cloud environment. They bill businesses a subscription fee on a month by month basis. They anticipate they will be able to bill on an hour by hour basis very soon.

Company B is offering Oracle databases as a service and bill businesses on a month by month subscription from their paid licence pool. This has saved the organisation substantial savings from reduced licences. The figure is estimated in the millions (50 percent of what it was previously).

The company name has been withheld for privacy reasons. For the full case study, please refer to Appendix D.

Even for companies that were well-progressed along their cloud journey, it was generally difficult to quantify the relative costs and benefits of cloud services implementation precisely. There are a number of reasons why this might be so, even though it is reasonable to expect that firms would have undertaken some cost-benefit analysis of cloud options before switching to these services:

- accounting standards do not dictate line by line financial reporting on ICT spend, so interviewees may genuinely not know precise changes in cost structure
- in some instances, firms might prefer that the information remain confidential (although none of the participants indicated that this was the case)
- in many cases, a reduction in ICT spend has been experienced for a particular service but overall the total ICT spend has increased as the business has grown, meaning the business could not isolate the impact of cloud-based spending from other ICT spending.

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Case study — internet service provider

Company C is an internet service provider with approximately 2,100 FTEs of which 900 are located outside of Australia. They are approximately 60 percent through their internal cloud journey, five percent through their external cloud journey, and they believe their journey will be completed in the next 2.5 years.

Company C has migrated applications such as HR, Payroll and Asset Management to the public cloud. Over the next 2.5 years, the company has a strategy to replace their infrastructure for a cloud architecture model.

Company C has not experienced any reduction in ICT costs as a result of implementing the cloud solution. There has been a move from a capex to an opex model, however, the total ICT spend has remained the same.

The company name has been withheld for privacy reasons. For the full case study, please refer to Appendix D.

3.3 Summary

- Discussions with Australian businesses to date indicate that, overall, the Australian cloud market is still at the early stages of the adoption curve in comparison to markets such as the US and Europe.
- Firms are more likely to be using private than public cloud at this stage.
- Smaller organisations are experiencing increased growth potential as they can access better IT solutions that used to be out of reach.
- Larger organisations believe that there are productivity benefits associated with cloud services that allow staff to take on additional tasks.
- Replacement of large up-front capital outlays with small on-going user subscriptions for cloud-based products is allowing smaller, capital-constrained companies, especially technology-based ones, to enter the market more easily.
- Substitution of physical services with cloud-based services, including product delivery through streaming, could deliver significant cost savings.
- Cloud-based solutions do not always deliver identifiable, immediate or on-going cost savings. There may be intangible benefits such as access to new products that allow business expansion and improved flexibility and timeliness of delivery to market.

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4 Modelling the cloud

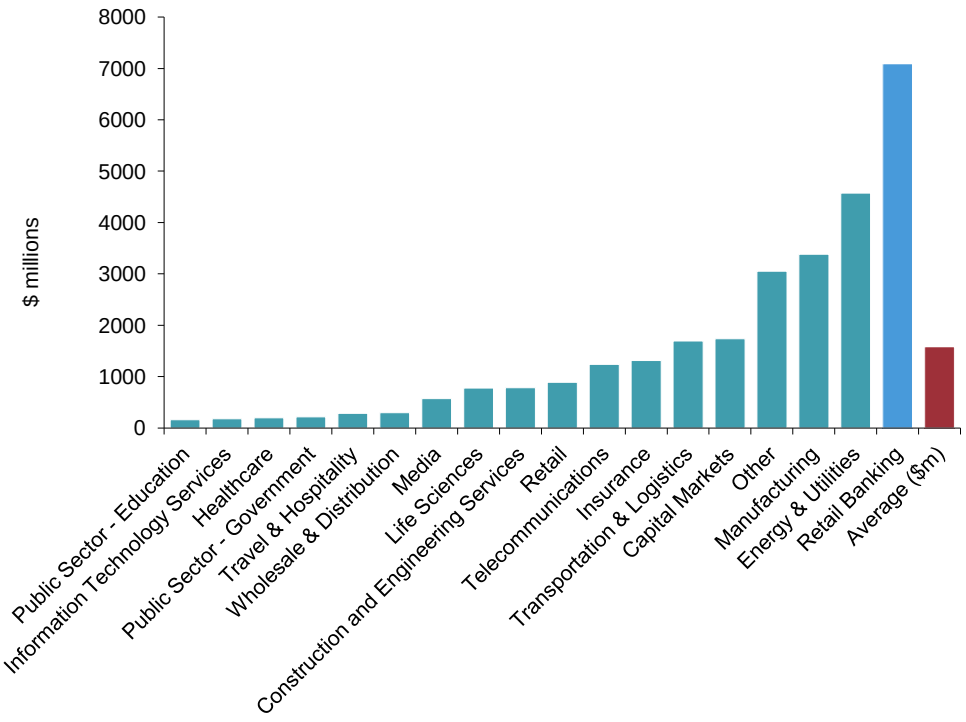
In addition to the findings from KPMG's consultations with organisations, the modelling assumptions and results in this report are supported by published research which is presented in some detail in this chapter.

4.1 Supporting data

A key source of data used by KPMG is the IT Spending Predictor produced by Ovum. The IT Spending Predictor offers data estimates for IT expenditure for 666 organisations in Australia. The Predictor is based on a 'statistical model that processes data from large sets of Ovum surveys and in-depth interviews with senior IT decision makers'. The Predictor provides IT budget estimates in the current calendar year, broken down by segment (hardware, software, services, communication and consulting), and spending by channel (internal IT, product vendor, local reseller, telco, systems integrator and specialist outsourcer).

Figure 6 highlights the total expected ICT spending by industry for 2012.

Figure 6: Overall ICT spending by industry



Source: Ovum's IT Spending Predictor

To understand how businesses are spending their ICT budgets, total ICT spending in 2011 can be broken down by either segment or channel. Figure 7 illustrates the breakdown of ICT expenditure over five segments: hardware, software, services, communications, consulting and other, and shows that nearly 70 percent of expenditure is spent on hardware, software and services; these components of spend are typically transferable to the cloud, and therefore KPMG has modelled the impacts using adjusted ICT-expenditure that reflects this proportion.

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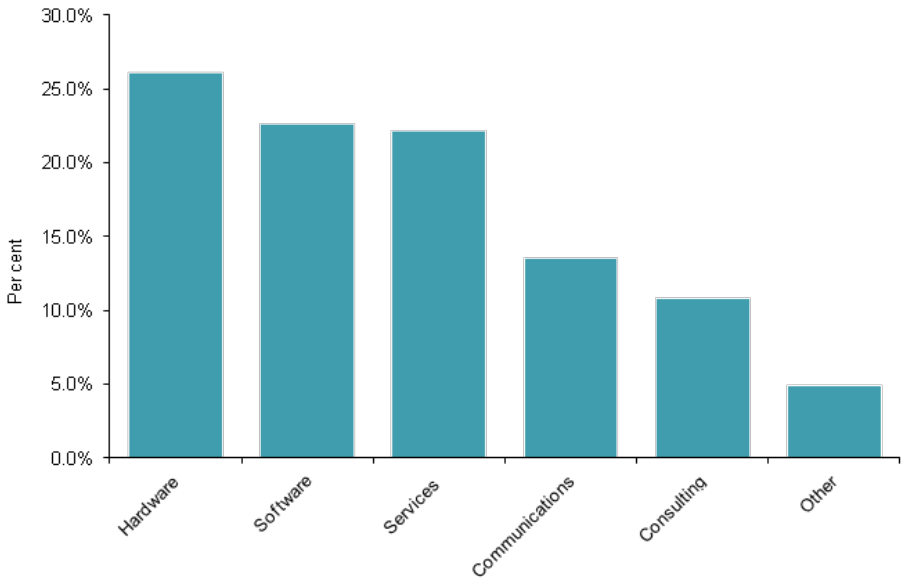
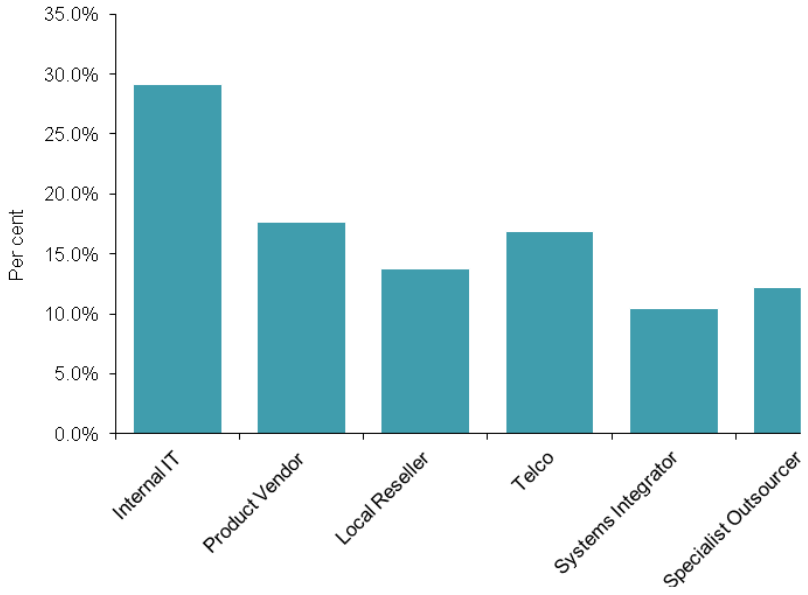
Figure 7: ICT spending by segment 2011



Source: Ovum

The breakdown of ICT expenditure over six channels – internal IT, product vendor, local reseller, telco, systems integrator and specialist outsourcer – can be seen in Figure 8. It highlights that internal IT is the biggest component of all the channels with just under 30 percent of the total ICT spending.

Figure 8: ICT spending by channel 2011



Source: Ovum

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4.2 Global research findings

Research on the benefits of cloud computing is a relatively new field, and hence most of the studies cited in this section have been published in the last few years. Many of the studies into the benefits of cloud computing fail to quantify the benefits, rather they just state the general business benefits expected from implementation of cloud computing. The limited number of studies which do quantify benefits are restricted to Europe and the US.

Nevertheless, a few key studies provide an indication of the quantifiable benefit cloud computing is expected to have. The benefits highlighted from these studies are outlined in Table 5 below. A more detailed summary of the studies on the benefits of cloud computing can be found in Appendix A.

Table 5: Economic impacts of cloud computing: literature review

Quantifiable economic benefits	
Study	**Quantifiable impact of cloud computing**
The Economic Impact of Cloud Creation on Business Creation, Employment and Output in Europe, Federico Etro, 2009	• Contribute to the annual growth rate of Europe by between 0.05 percent and 0.3 percent
The Cloud Dividend – The economic benefit of cloud computing to business and the wider EMEA economy, Centre for Economics and Business Research, December 2010	• Generate over €763 billion or 1.57 percent of the total cumulative GDP of United Kingdom, Germany, France, Italy and Spain over the period 2010 to 2015 (average of 0.3 percent per annum) • Improve the efficiency of an average employee by an average of 2.1 percent
Economic Impact of Cloud Computing White Paper, Professor Marco Iansiti (Harvard Business School) and Gregory Richards (Keystone Strategy)	• Increase US GDP by 0.83 percent to 0.99 percent per year (8.64 percent to 10.37 percent over the next 10 years)
Saving Money through Cloud Computing, Darrell West (Brookings Institution), 2010	• Cost savings in IT related expenditure in US government agencies of between 25 and 50 percent
Other quantifiable benefits	
Study	**Quantifiable impact of cloud computing**
Cloud Computing and Sustainability: The Environmental Benefit of Moving to the cloud, Accenture, WSP and Microsoft, November 2010	• Reduce carbon emissions by 30 percent for large, already-efficient companies and as much as 90 percent for the smallest and least efficient businesses
Cloud Computing Energy Efficiency, Pike Research, December 2010	• Reduce total data centre energy expenditures from US$23.3 billion in 2010 to US$16.0 billion in 2020, as well as causing a 28 percent reduction in GHG emissions from 2010 levels
Cloud Computing – the IT Solution for the 21st Century, Carbon Disclosure Project Study 2011, Verdantix, 2011	• Enable companies to save US$12.3 billion off their energy bills, which translates into carbon emission savings of 85.7 million metric tons per year by 2020

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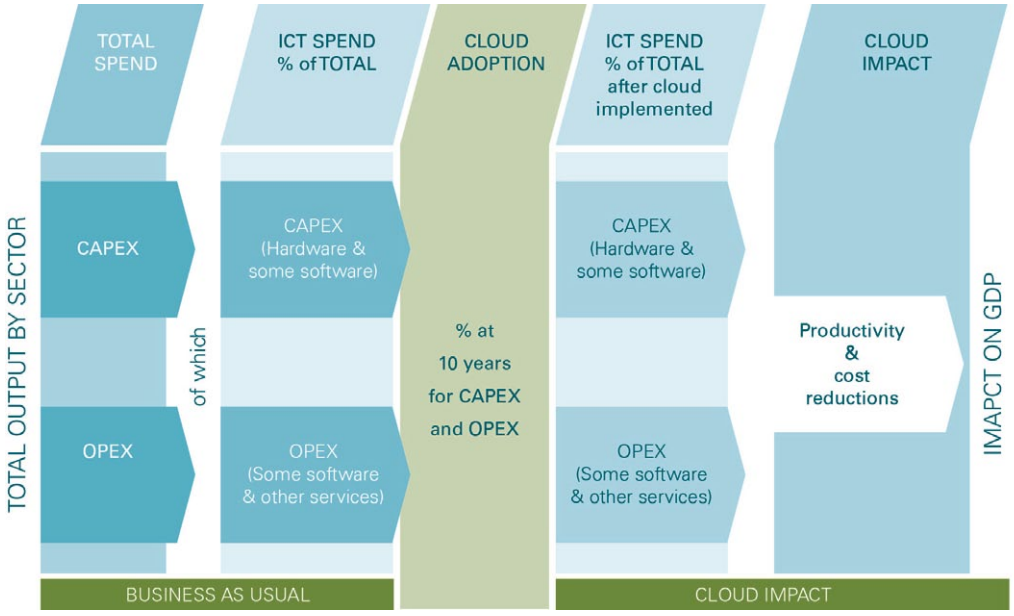
4.3 Modelling approach

KPMG has modelled outcomes for the Australian economy, excluding agricultural services, which is a relatively small sector with low ICT intensity. Modelling inputs were heavily influenced by findings in the financial services, property and business services, and education services sectors. These were the sectors where data from consultations were most robust. Other sectors either had a limited number of interviews conducted, or the information that was collected contained limited quantifiable data due to cloud implementation being in its early stages. To support economy-wide modelling, KPMG supplemented primary research findings with an extensive national and international literature review.

Figure 9 below provides a graphical representation of KPMG's approach to modelling the impact of the cloud on the Australian economy.

In essence, firms' expenditures on ICT (split into capital (capex) and operating expenditures (opex)) are measured before and after implementation of the cloud. Any reduction in costs per unit of production is then incorporated into KPMG's Computable General Equilibrium Model (MM900).

Figure 9: Impact of cloud computing



Source: KPMG

MM900 incorporates cost curves based on some 900 different products across each industry sector. KPMG will extrapolate the expected change in cost curve structures within MM900, for example replacing some spending on a unit of ICT with spending on a new input that is cloud computing services. The impact of these changes is then measured over a 10-year period, allowing the economy to adjust in an iterative process.

A more detailed description of MM900 is provided in Appendix C.

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4.4 Assumptions

This section reviews the key assumptions underpinning the modelling. These assumptions are based on KPMG's preliminary findings from interviews as well as the findings of desktop research presented earlier in this chapter.

Modelling assumptions are split into two categories:

The current state — the cloud computing market in Australia at present.

The future state — what the cloud computing market in Australia will be in 10 years' time.

The key assumptions of the current state include:

- current ICT spend per industry, based on KPMG CGE model databases, ABS ICT Satellite Account 5259.0 and 2004-05 input-output tables as well as Ovum survey data
- based on discussions with Australian businesses to date, as well as information from Forrester[19], cloud adoption in Australia appears to be in its infancy and is estimated as approximately two years behind other more mature markets, such as the US and Europe
- in some instances, cloud-based solutions may lead to either short-term or even permanent increases in overall ICT costs as investment in cloud is undertaken.

The key assumptions used in KPMG's future state (i.e. after 10 years) modelling.

- ICT opex and capex will significantly reduce for each unit of output from business-as-usual (BAU) outcomes as a result of cloud adoption:
  - based on literature reviews, as well as consultations with Australian businesses, the reduction is assumed to be 25 percent for opex and 50 percent for capex (the smaller percentage reduction for opex takes into account the offsetting impacts derived from additional costs due to new activities associated with cloud computing (including software integration requirements)
  - while cloud implementation may be undertaken at different rates across different sectors of the economy, over a long period of time all sectors of the economy can be expected to converge in adoption rates – because Australian cloud offerings are still in the early stages of development, KPMG has modelled two potential scenarios with uniform rates of adoption at 75 percent and 50 percent.
- Forrester estimates that total spend in the global cloud market will increase to $159.3 billion by 2020 — as this market increases, traditional ICT markets will proportionally reduce.
- The rate of change in ICT opex and capex is expected to reduce as market offerings become more mature. Forrester suggests that this will happen more quickly for infrastructure (IaaS) than software (SaaS).

Table 6 summarises the current level of ICT expenditure, broken down into operating and capital expenses, as a per cent of total costs by sector, as well as the expected level of expenditure under the two adoption scenarios modelled.

The reduction in the cost of traditional ICT expenditure that is replaced with cloud allows an increase in output (as measured by GDP) either through maintaining expenditure on ICT inputs to increase production, or by freeing up ICT resources to alternate (additional) forms of production.

[19] Forrester, Sizing the Cloud, April 2011

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Table 6: Expenditure (operating and capital) assumptions

Sector	Cost shares of ICT					
	Opex	Capex	Opex	Capex	Opex	Capex
	Base Case		75% take up		50% take up	
Agriculture, forestry and fishing	0.2%	1.3%	n/c	n/c	n/c	n/c
Mining	0.4%	3.2%	0.4%	2.3%	0.4%	2.6%
Manufacturing	1.3%	9.1%	1.2%	6.7%	1.2%	7.5%
Electricity, gas and water	0.3%	8.2%	0.3%	6.0%	0.3%	6.8%
Construction	1.2%	9.8%	1.0%	7.2%	1.1%	8.1%
Wholesale trade	1.7%	17.8%	1.5%	13.1%	1.5%	14.7%
Retail trade	0.6%	16.4%	0.5%	12.1%	0.6%	13.5%
Accomm., cafes and restaurants	1.5%	2.5%	1.3%	1.9%	1.3%	2.1%
Transport	4.0%	4.9%	3.5%	3.6%	3.6%	4.0%
Communication services	6.0%	31.4%	5.2%	23.1%	5.4%	25.9%
Finance and insurance	1.6%	31.1%	1.4%	22.9%	1.5%	25.6%
Property and business services	2.3%	22.4%	2.0%	16.5%	2.1%	18.5%
Government admin. and defence	4.6%	37.2%	4.0%	27.5%	4.2%	30.7%
Education	2.3%	11.4%	2.0%	8.4%	2.1%	9.4%
Health and community services	0.5%	15.7%	0.4%	11.6%	0.4%	13.0%
Cultural and recreational services	1.8%	7.9%	1.6%	5.8%	1.6%	6.5%
Personal and other services	2.1%	7.7%	1.8%	5.7%	1.9%	6.3%
Ownership of dwellings	0.0%	0.0%	n/c	n/c	n/c	n/c
Total	**1.7%**	**9.9%**	**1.5%**	**7.4%**	**1.6%**	**8.2%**

Source: KPMG Analysis using ABS data

4.5 Modelling results

The following long-run GDP impacts from cloud adoption across all sectors were derived by employing the data and assumptions outlined previously in this report in KPMG's in-house CGE model of the Australian economy.

The CGE model allows the economy to adapt to significant changes, such as the potential shift in the cost structures of ICT goods and services as a result of cloud implementation, over a prolonged period of time and across all areas of the economy such as labour and prices.

Table 7: Potential GDP impact of cloud computing adoption

Expenditure	Annual GDP impact over 10 years			
	At 75% adoption		At 50% adoption	
	Percent	$ billion[1]	Percent	$ billion[1]
Capital	0.10%	1.44	0.07%	1.01
Operational	0.13%	1.87	0.08%	1.15
Total	**0.23%**	**3.32**	**0.15%**	**2.16**

1. At 2010-11 prices.
Source: ABS, KPMG modelling

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A Literature review

The Economic Impact of Cloud Creation on Business Creation, Employment and Output in Europe, Federico Etro, 2009

This report focuses on the economic impact of the innovation of cloud computing. It adopts a macroeconomic approach emphasising the effects that this innovation has on the cost structure of the firms investing in IT and, as a result of cost, the impact on: the incentives to create and expand new businesses; market structure; the level of competition in the sectors; and ultimately the effects for aggregate production, employment and other macroeconomic variables.

It estimates that the diffusion of cloud computing could provide a positive and substantial contribution to the annual growth rate (between 0.05 percent and 0.3 percent), helping to create about one million new jobs through the development of a few hundred thousand new small and medium sized enterprises across Europe. Under different scenarios, results continue to show a strong impact on the creation of new businesses, in the magnitude of a few hundred of thousand within Europe.

The Cloud Dividend – The economic benefit of cloud computing to business and the wider EMEA economy, Centre for Economics and Business Research, December 2010

This paper is a study of the economic impacts of cloud computing in the large European economies. The study shows that cloud computing could improve the efficiency of an average employee by an average of 2.1 percent, while also reducing the amount of investment tied up in underutilised IT capacity.

The CEBR study estimates that across the economies of the UK, Germany, France, Italy and Spain, 'widespread adoption of cloud computing has the potential to generate over €763 billion of cumulative economic benefits over the period 2010 to 2015'. This is 1.57 percent of CEBR's estimates of the total cumulative GDP of the five economies over the same period.

CEBR concludes that widespread cloud computing adoption 'has the potential to support significant direct and indirect job creation which, across the five economies, we predict to be in excess of 2.3 million net new jobs on a cumulative basis over the period 2010 to 2015. Cloud computing adoption is expected to yield annual net new jobs of 446,000 across the five economies by 2015'.

The breakdowns between the individual economies and between the different components of the aggregated benefits are shown in the table below.

Table 8: EMEA: Cumulative Economic Benefits 2010-2015 (€ mil)

	France	Germany	Italy	Spain	UK	EMEA
Business development opportunities	24,599	32,642	23,995	16,866	29,555	**127,657**
Business creations	51,377	69,507	43,305	30,939	20,026	**215,153**
Net total cost savings	26,323	37,740	28,463	22,008	26,206	**140,740**
IT Capex savings	28,653	36,378	30,461	23,013	36,176	154,682
IT Opex savings (FTEs/productivity)	13,818	18,139	14,533	10,396	16,943	73,829
IT Opex savings (power and cooling)	11,107	14,345	11,821	8,510	10,566	58,349
Additional cloud services expenditure	-27,255	-31,122	-28,353	-19,910	-37,481	-144,120
Indirect GVA	60,450	81,351	55,007	40,737	42,202	**279,747**
Total economic benefit	**162,749**	**221,239**	**150,770**	**110,550**	**117,989**	**763,297**
Direct and indirect ('000s)	**469.4**	**789.4**	**455.8**	**392.5**	**289.0**	**2,396.2**

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Economic Impact of Cloud Computing White Paper, Professor Marco Iansiti (Harvard Business School) and Gregory Richards (Keystone Strategy) 2011

This paper explores the likely economic impact of cloud computing in developed economies and economies where IT penetration has not yet fully matured. The paper identified the sources of productivity growth from IT investment through three broad categories:

- Increase in capital deepening in IT using industries:
  - increase in IT spending
  - decrease in IT costs (economies of scale and converting fixed costs to variable costs).
- Increase in Total Factor Productivity (TFP) in IT producing industries:
  - reduction of development costs
  - reducing complexities of software development
  - increase available markets for small and medium vendors of packaged software.
- Increasing efficiencies from the amplifying complementary effects of IT as a General Purpose Technology (GPT) in IT using industries:
  - increases productivity by outsourcing non-core services
  - promoting business growth by fostering innovation
  - increase the flexibility and competitiveness of current businesses
  - improved Business Intelligence capability increases responsiveness to market changes and better decision-making
  - promote new businesses and foster growth in existing SMBs.

The paper projects the effect of cloud investments on US GDP in the next 10 years using two different scenarios: a conservative scenario (where the elasticity of GDP with respect to IT capital is assumed to remain constant) and a more 'realistic' scenario (where the elasticity of GDP with respect to IT capital is assumed to be 20 percent higher on average during the next 10 years, so the elasticity estimated for the conservative scenario is multiplied by 1.2 and then used for the projections). The results forecast that investments in the cloud will increase US GDP by 8.64 percent to 10.37 percent over the next ten years, or by 0.83 percent to 0.99 percent per year.

Saving Money through Cloud Computing, Darrell West (The Brookings Institution), 2010

This paper outlines results of possible cost savings from migrating to cloud computing from a series of case studies of government agencies. It found cost savings between 25 and 50 percent in moving to the cloud depending on the actual migration.

Cloud Computing and Sustainability: The Environmental Benefit of Moving to the cloud, Accenture, WSP and Microsoft, November 2010

This report from Microsoft found that moving business applications to the cloud could cut the associated per-user carbon footprint by 30 percent for large, already-efficient companies and as much as 90 percent for the smallest and least efficient businesses.

Cloud Computing Energy Efficiency, Pike Research, December 2010

This report provides an in-depth analysis of the energy efficiency benefits of cloud computing. Pike Research expects the growth in cloud computing revenue to continue worldwide between now and 2015 at a compound annual growth rate of 28.8 percent, with the market increasing from $46.0 billion in 2009 to $210.3 billion by 2015.

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The report also forecasts that data centres will consume 139.8 terawatt hours (TWh) of electricity in 2020, a reduction of 31 percent from 201.8 TWh in 2010. This also represents a significant decrease from the 226.4 TWh that would be consumed by data centres in the firm's business as usual scenario. The reduction will drive total data centre energy expenditures down from $23.3 billion in 2010 to $16.0 billion in 2020, as well as generating a 28 percent reduction in GHG emissions from 2010 levels.

Cloud Computing – the IT Solution for the 21st Century, Carbon Disclosure Project Study 2011, Verdantix, 2011

This report, prepared by research firm Verdantix, and sponsored by AT&T, details the role cloud computing can play in increasing business efficiency and reducing greenhouse gas emissions.

This study used detailed case study evidence from 11 global firms that have been using cloud computing for at least two years. The information was used to build a forecast model which assesses the financial benefits and carbon reductions for a firm opting for a particular cloud computing service.

The study estimates that cloud computing could enable companies to reduce their energy bills by $12.3 billion, and lower carbon emissions by 85.7 million metric tons per year by 2020.

Summary

In summary, the quantifiable economic benefits highlighted from the literature review include:

- contribution to the annual growth rate of Europe of between 0.05 percent and 0.3 percent
- generate over €763 billion or 1.57 percent of the total cumulative GDP of UK, Germany, France, Italy and Spain over the period 2010 to 2015 (average of 0.3 percent per annum)
- increase US GDP by 8.64 percent to 10.37 percent over the next ten years, or 0.83 percent to 0.99 percent per year
- create about one million new jobs through the development of a few hundred thousand new small and medium sized enterprises across Europe
- yield annual net new jobs of 446,000 across five economies (UK, Germany, France, Italy and Spain) by 2015
- cost savings in IT related expenditure of between 25 and 50 percent
- improve the efficiency of an average employee by an average of 2.1 percent
- reduce carbon emissions by 30 percent for large, already-efficient companies and as much as 90 percent for the smallest and least efficient businesses
- Total data centre energy expenditures down from $23.3 billion in 2010 to $16.0 billion in 2020, as well as causing a 28 percent reduction in GHG emissions from 2010 levels
- enable companies to save $12.3 billion off their energy bills, which translates into carbon emission savings of 85.7 million metric tons per year by 2020.

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B ABS and OVUM Data

Table 9: Investment in computer hardware and software 2004-05

ANZSIC industry	Investment in computer hardware ($m)	Investment in computer software ($m)
Agriculture, forestry and fishing	91	78
Mining	303	406
Manufacturing	1,202	992
Electricity, gas and water supply	337	465
Construction	274	205
Wholesale trade	776	637
Retail trade	928	637
Accommodation, cafes and restaurants	97	54
Transport and storage	483	590
Communication services	479	732
Finance and insurance	1,723	1,862
Property and business services	2,113	2,016
Government administration and defence	1,068	1,604
Education	584	455
Health and community services	445	358
Cultural and recreational services	208	216
Personal and other services	202	231
Total	**11,313**	**11,538**

Source: ABS, 5259.0 - Australian National Accounts: Information and Communication Technology Satellite Account, 2002-03

Table 10: ICT Share of GDP 2002-03

Industry	ICT related output ($m)	ICT gross value added ($m)	Share of GDP (%)
Manufacturing	1,813	709	0.1
Wholesale trade	8,861	5,165	0.7
Telecommunication services	32,650	15,397	2.1
Computer services	15,528	9,740	1.2
Other industries	6,227	3,781	0.5
Total	**65,079**	**34,792**	**4.6**

Source: ABS, 5259.0 - Australian National Accounts: Information and Communication Technology Satellite Account, 2002-03

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Table 11: Overall ICT spending by industry

Industry	Overall ICT spend 2011 ($m)	Overall ICT Spend 2012 ($m)	Proportion of total ICT spend 2011 (%)
Capital markets	1,739.15	1,756.61	6.11
Construction and engineering Services	782.12	789.95	2.75
Energy and utilities	4,571.36	4,617.25	16.07
Healthcare	199.45	201.44	0.70
Information technology services	179.26	181.05	0.63
Insurance	1,316.20	1,329.40	4.63
Life sciences	774.98	782.76	2.72
Manufacturing	3,385.27	3,419.23	11.90
Media	572.45	578.19	2.01
Other	3,049.37	3,079.96	10.72
Public sector – education	162.05	163.68	0.57
Public sector – government	216.13	218.30	0.76
Retail	888.77	897.70	3.12
Retail banking	7,088.86	7,160.05	24.92
Telecommunications	1,239.07	1,251.51	4.36
Transportation and logistics	1,690.66	1,707.62	5.94
Travel and hospitality	284.98	287.84	1.00
Wholesale and distribution	300.72	303.73	1.06
Total ($m)	**28,440.86**	**28,726.27**	**100**

Source: Ovum's IT Spending Predictor and KPMG analysis

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Table 12: ICT spending by segment 2011

Industry	Hardware ($m)	Software ($m)	Services ($m)	Comms ($m)	Consulting ($m)	Other ($m)	Total ($m)
Capital markets	303	265	277	172	158	113	**1,288**
Construction and engineering services	169	125	124	76	47	19	**560**
Energy and utilities	888	768	667	557	398	158	**3,436**
Healthcare	43	43	27	16	10	10	**149**
Information technology services	43	30	22	14	8	2	**119**
Insurance	266	199	169	122	135	48	**939**
Life sciences	161	112	104	78	61	24	**540**
Manufacturing	631	564	396	208	217	132	**2,148**
Media	134	105	72	57	41	5	**414**
Other	594	447	523	287	214	74	**2,138**
Public sector - education	38	22	14	14	9	10	**108**
Public sector - government	42	39	36	20	17	10	**164**
Retail	160	125	134	97	80	26	**621**
Retail banking	1,193	1,195	1,327	691	521	263	**5,189**
Telecommunications	225	177	193	72	92	15	**774**
Transportation and logistics	248	247	295	187	130	64	**1,170**
Travel and hospitality	48	41	43	28	18	9	**187**
Wholesale and distribution	61	45	43	24	17	8	**198**
Total ($m)	**5,248**	**4,550**	**4,465**	**2,718**	**2,171**	**991**	**20,143**
Total (%)	**26**	**23**	**22**	**14**	**11**	**5**	**100**

Source: Ovum's IT Spending Predictor and KPMG analysis

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Table 13: ICT spending by channel 2011

Industry	Internal IT ($m)	Product vendor ($m)	Local reseller ($m)	Telco ($m)	Systems integrator ($m)	Specialist outsourcer ($m)	Total ($m)
Capital markets	451	295	217	309	204	263	**1,739**
Construction and engineering services	222	153	143	131	71	62	**782**
Energy and utilities	1,136	800	583	889	476	688	**4,571**
Healthcare	50	45	37	26	23	20	**199**
Information technology services	61	39	34	21	14	11	**179**
Insurance	377	196	207	223	154	159	**1,316**
Life sciences	235	127	71	152	98	92	**775**
Manufacturing	1,238	679	490	378	299	301	**3,385**
Media	158	105	90	97	58	63	**572**
Other	911	569	494	526	320	229	**3,049**
Public sector – education	54	38	23	17	17	12	**162**
Public sector – government	52	43	25	30	24	42	**216**
Retail	268	157	92	131	103	137	**889**
Retail banking	1,900	1,172	890	1,230	720	1,178	**7,089**
Telecommunications	465	200	177	175	151	72	**1,239**
Transportation and logistics	521	290	243	360	170	107	**1,691**
Travel and hospitality	98	53	40	51	30	14	**285**
Wholesale and distribution	103	51	55	43	32	18	**301**
Total ($m)	**8,298**	**5,013**	**3,912**	**4,788**	**2,963**	**3,467**	**28,441**
Total (%)	**29**	**18**	**14**	**17**	**10**	**12**	**100**

Source: Ovum's IT Spending Predictor and KPMG analysis

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C KPMG Computable General Equilibrium model

Purpose

MM900 is a member of KPMG's suite of models of the Australian economy. It is designed to analyse the lasting effects of changes in the national economic environment, and is a useful tool to analyse the impacts of permanent policy changes and other economic shocks on the economy.

MM900 is a *static model*, giving a snapshot picture of the economy before and after policy changes or other shocks. MM900 gives estimates of the long-run economic impact of shocks compared to the current state of the economy, rather than giving a dynamic analysis which might show short and medium-term adjustment paths. MM900 is a comparative static analytical tool that can provide answers to 'what if?' questions such as what if microeconomic reforms enhance the productivity of the Australian labour force, or what if a carbon tax is introduced?

MM900 is a *long-run model*. That is, the snapshots of the economy are taken after it has fully adjusted to any shock, and all markets are in equilibrium. These long run outcomes are the most important for policy analysis, because they show the lasting impacts of any policy change.

MM900 is a *computable general equilibrium* (CGE) model. That is, it is a model which uses data to estimate how the economy responds to economic shocks, such as changes in government policy or changes in the economic environment. As a general equilibrium model, all markets are assumed to be in equilibrium before and after the economic shock. The behaviour of the agents in the model (households, firms, government and the foreign sector) are all interlinked through these markets. The model also recognises that there are important long-run constraints on the economy such as the budget constraints of households that government spending cannot be greater than tax revenues.

MM900 has a number of features which makes it well suited to analysing the economic impact of a wide range of economic shocks. For example, the model contains a fine level of detail in the goods and services produced and consumed, allowing a precise identification of the direct impacts of economic shocks. MM900 also takes into account a large number of behavioural responses to shocks, where economic agents respond to changes in prices and incomes. One of the main purposes of MM900 is analysing the economic impacts of taxes. For this reason, particular attention has been paid to the representation of the Australian tax system in the model.

This model documentation explains the features of MM900 which are important for users of the model. Understanding these features will assist in the interpretation of model results.

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Main features

MM900 belongs to a class of models known as computable general equilibrium (CGE) models. Therefore, it shares some common features with other CGE models of the Australian economy. However, it also has some special features which set it apart from these other models. This chapter gives a birds-eye view of these features, and how MM900 compares to other CGE models of the Australian economy.

Standard features

MM900 contains a number of features which are standard to long-run CGE models. Broadly, these are that all key agents optimise, all markets are in equilibrium and assets and liabilities follow long-run sustainable paths.

In response to any shock, households, firms and the foreign sector each make price sensitive choices, and the economy adjusts accordingly. The choices of each agent are briefly described below.

Households — The representative household chooses how much labour to supply, how much to save and how much to spend on each good and service. It does this by maximising utility, subject to a full income constraint.

Producers — In each industry, a representative business maximises its profit, by choosing amounts to supply and demands for inputs. It operates under perfect competition, with a production technology that exhibits constant returns to scale.

Government — The government demands a fixed bundle of products, and levies a wide range of taxes and provides subsidies. It balances its budget in the model by automatically adjusting either lump sum tax or labour income tax or GST. The model user chooses which of these three taxes serves as the swing fiscal instrument.

Foreigners — Foreigners supply net foreign assets to Australia as long as they can achieve the required after-tax world rate of return (although this assumption can be relaxed by assuming imperfect capital mobility). Likewise, they supply as many imports into Australia as demanded at the world price. Foreigners choose their demand for exports from Australia according to highly elastic demand curves.

Since MM900 is a comparative static model, results for simulations compare the situation before and after an economic shock. Each simulation of the model assumes that the economy is in a steady-state equilibrium, implying that there is no excess supply or demand. Results compare one long-run equilibrium with another, and are expressed as deviations from the baseline scenario. They show the lasting effects of the economic shock.

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Special features

MM900 goes well beyond other Australian modelling, in terms of capturing the economic effects of the tax system, and other policy variables, on the Australian economy. MM900 has a number of features that set it apart from other CGE models of the Australian economy. Examples of these include:

- detail in products (goods and services)
- detail in production methods
- very wide range of economic choices
- detail in the representation of taxes
- a rigorous measurement of economic welfare.

The nature and benefits of these special features are discussed in turn below.

Detail in products

MM900 contains a fine level of product detail by incorporating multi-product industries. Specifically, in MM900, 109 industries produce 889 different products (i.e. about 900 products), giving eight times as much product detail compared to the single-product approach of other comparable models. This high-level of detail has a number of advantages. These stem from the increased analytical power, since a larger number of products allows a more detailed analysis of policies and behaviours.

Detail in production methods

MM900 contains a fine level of detail in modelling production processes. Firms in each of the 109 (multi-product) industries choose their use of up to six different primary factors of production, or types of labour, capital and fixed factors.

Very wide range of economic choices

MM900 includes a wider range of price-sensitive economic choices than other comparable models of the Australian economy. This allows a more comprehensive modelling of the impacts of policy changes.

Consumer substitution possibilities — For consumers, MM900 includes a detailed treatment of consumers' responses to changes in the economy. This includes their labour supply decisions, saving decisions and consumption pattern decisions, which are all modelled in a consistent manner. The consumption pattern decisions in response to relative price changes are particularly rich. MM900 specifies a two-tier consumer demand system covering the 889 products in the model[20]:

- after deciding their labour supply and saving, the consumer decides between 17 different broad groups of products using a linear expenditure system
- second, and importantly, MM900 also allows for substitution within these 17 broad groups, between individual products, with the degree of substitutability able to vary from one group to the next, adding extra sophistication.

[20] Specifically, MM900 uses a S-Branch system of consumer demand. This is discussed further in chapter 6.

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Export demand — For the foreign sector, MM900 recognises that, as a relatively small part of the world economy, Australia is close to being a 'price taker' in world trade markets. That is, the elasticities of export demand are high. Due to the fine level of product detail in MM900, important distinctions can be made between elasticities of export demand. For example, in those international markets where Australia has some market power, such as the market for wool, the elasticities can be set at a lower level. This gives greater realism to the modelling results from MM900.

Export supply — In MM900, industries choose between supplying the export and domestic markets. This choice is governed by an elasticity of transformation, which takes into account that there may be some cost involved in switching between supplying the domestic market and the export market. This treatment of export supply is more sophisticated than comparable models.

Firm size — In each industry, the representative firm chooses its size to minimise the unit costs of production in that industry. This allows for a more sophisticated modelling of factors affecting the choice of business size. For example, the small business exemption for payroll tax gives firms an incentive to reduce the size of their businesses below the technically efficient level.

Detail in taxes

MM900 goes well beyond other Australian modelling in capturing the economic effects of the tax system on the Australian economy. It distinguishes 19 different major taxes at the federal, state and local levels.

Rigorous measurement of welfare

Changes in taxes, government policies and other economic shocks impact on consumer welfare, which is the most important indicator used to evaluate economic policy. Capturing changes in welfare accurately requires that the modelling of household behaviour is underpinned by a consistent treatment of consumer welfare. In MM900, this occurs by using a utility function in which a representative household derives welfare or utility from leisure, saving and consumption of products. All household behaviour is then derived from that same utility function. Other comparable models include more ad hoc elements in modelling household behaviour in terms of the choices for consumption, saving and leisure/labour supply.

MM900 also includes a facility to model consumption externalities, which feed into the welfare calculation.

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D Case studies

Case study — Arclight Investments

Current situation

Arclight Investments is a sister company of the Ray White real estate group that provides ICT related services. Arclight's future plans are to expand its operations to provide further ICT services to the market.

Arclight is an avid implementer of cloud-based solutions with implementation well advanced. They have utilised a cloud solution that has converted over 7,000 users across their network of over 1,000 offices for email, calendar and document management.

In addition to this investment, Arclight utilises PaaS (Platform as a Service) to develop specialised applications for their group.

Benefits

Monitoring user accounts under the previous regime was almost impossible, as a user account is either created or removed on average every 30 minutes. Using cloud solutions, the process of adding, changing and deleting user accounts has been streamlined significantly.

The IT infrastructure investment in both the head office and within each of Ray White franchises has been significantly reduced as a result of implementing cloud based solutions. In the head office, they have reduced their infrastructure investment from approximately 80 servers to 25 servers. In the franchise offices that have on average six to seven staff, they have been able to remove a mail server, firewall, and rationalise business software licenses. In some offices there was a server for mobile phone email and this has also been removed. The capital investment savings required every three years for each office has been reduced on average by $25,000. Furthermore, an average of $10,000 ICT spend for each office for support and maintenance has been removed.

In addition to the cost reductions, each office has experienced reduced network and general IT failures. Increased functionality in terms of mobile mail has enabled agents to spend more time in the field. An application available through one of their cloud solution providers is a voice to text application that is being utilised by their agents to add commentary to photos taken when property is inspected. This has further reduced administration activities for staff.

Arclight Investments have been able to reduce IT staff through natural attrition over time as they are no longer needed, reducing salary costs/opex. The IT help desk has been augmented to have three non-IT business experts who share a passion for their cloud solutions to liaise with the business. In addition to this, each of the Ray White offices no longer require a full time IT resource.

Cloud implementations have also added a level of automation to some business processes. An example of this is where automated emails are sent to clients after making payments and other business related activities.

Solutions implemented by their cloud vendor have enabled staff to collaborate more closely. Previously, multiple people would work on a document and there would be multiple versions sent around which could take days and weeks to complete. In one recent instance, four employees were collaborating on one document at the same time after hours, reducing the time spent to complete significantly.

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Challenges

Arclight Investments have had to overcome some unique challenges to achieve their current progress. They have some legacy applications that are difficult to migrate to a cloud vendor which may have to remain in-house for some time.

Data retention or duplication for what is deployed in the cloud for disaster recover purposes is difficult because one of their solution providers does not reside on a relational database management system (RDBMS). What this means is that all transactions and master data reside in one table and is technically difficult to separate. Further to this, one of their cloud solution providers data centre is not PCI compliant so they can't store confidential data like credit card details without using a middleman to encrypt it. Arclight is also investigating ways they can ensure their clients that their data is safe.

A cultural shift was necessary in the way people within the organisation worked as a result of their cloud solution deployments. Adapting to functional changes in layout and processing with some key applications was a real challenge for some and there has been a level of resistance within their franchise network to change.

Future state

Due to the benefits obtained to date, Arclight has mandated that all new software investments for the group must be in the Software as a Service (SaaS) format that can be deployed over their current cloud investments.

Arclight are further investigating MYOB's web-based ERP (Enterprise resource planning) solutions and assessing how they may be able to migrate their current solution into the cloud.

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Case study — Monash University

Current state

Monash University made its first major move in its cloud implementation journey in 2009 and 2010 with the implementation of Google Apps for students then staff. It has since expanded its delivery of cloud services across other technologies. Monash announced a dedicated Cloud Solutions Manager in October 2011. It is expected that Monash will continue to implement cloud technologies where there is recognised value to staff and students.

Google Apps Education Edition is free and has had a rapid take up because of ease of use. Around 175,000 user accounts have been created with 25GB of storage. Monash have utilised Google Apps for email, calendar, room bookings, documents, sites, groups and contacts.

Benefits

Whilst all staff are now on Google Apps, Monash has chosen to allow staff to use Google Apps directly via the web, or to connect to Google Apps via a traditional desktop mail client. Currently there are still some staff who have desktop clients in areas where they are slower to adopt the newer technology or have distinct uses for their existing client. Trends so far indicate a greater use of Google Apps via the web. Because of allowing staff desktop integration to Google, there was an increased overhead initially with the staff implementation of Google Apps. However ICT costs for the delivery of mail especially that of staff, were reduced immediately. There has been over $1 million of storage, licences, other costs released.

Staff who were previously responsible for calendar management and email are now responsible for document management, sites, groups and contacts with no additional cost or staff at this stage. To achieve these additional services they estimate they would have had to have spent millions more.

Additionally, mobile access to these services is an unanticipated benefit. If a project had been taken to achieve what Google provide, it could have been a five-year project with an estimated cost of about $15 million.

There was a project initiated for migration to Google Apps at low cost to the University compared to similar messaging projects. The first stage allowed students and staff to move to the cloud service at their own convenience at the click of a button from their existing my.monash portal. The second stage automatically migrated the remaining staff and student accounts. The accounts remaining to be automatically moved were relatively small.

Google Apps has increased collaboration for students and staff by removing the barrier often created by IT. With open shared documents, there are pockets of innovation within the staff and student communities which are becoming apparent. The productivity benefits of this could be in the tens of millions of dollars.

A key example of the reduction in time for document collaboration is the development of HR position descriptions. To complete five documents, have them reviewed and agreed upon by multiple staff in different geographic locations took one day as opposed to five plus days. Similarly significant productivity gains are seen when using Google Docs for sharing and reviewing key documents with the Malaysian and South African campuses. Documents can be worked on simultaneously across geographic distances whilst providing the sense of working face to face. Staff are reporting better relationship development with staff both overseas and locally where this is occurring.

Monash purchases Google Message Discovery as an additional service for their staff emails at the education pricing of US$8.33 per unit (staff).

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Google Application Programmable Interfaces (API's) have already been utilised to provide additional home grown services to Monash staff and students. An example of this is allowing students to populate their Google calendar with their student timetable at the click of a button.

Use of cloud and the rapid development of Google Apps has allowed students and staff to stay in step with world technology expectations and to explore for themselves innovative ways to improve their work and study without central IT assistance.

Future state

Monash expects to continue to expand its take up of Google Apps. There are other products available that they can turn on for free. These are being reviewed for value and impact.

As a result of staff and students growing in their understanding of the potential of other Google services, there has been a significant push by the Monash community for the University to make specific additional Google services available through their Monash Google Apps account. As each of these services hold to additional terms of services and contractual obligations, there is still a lot of work ahead to analyse the impacts and Monash's obligations before they can be considered for release. Some of these services have not been implemented in a way that makes it easy for education institutions to easily consider.

Monash also expect to increase their implementation of other cloud services where value is proven. Additionally, there are further APIs and development opportunities available through Google Apps that Monash are interested in implementing.

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Case study — channel partner

Current state

Company A is a Microsoft channel partner which has been in operation for 13 years. They build Platform as a Service (PaaS) products and go to market utilising Microsoft's Azure cloud service. Their main offering is a conversion utility and utilising the cloud, they anticipate they will be able to rapidly scale in emerging markets in Europe and Asia. The company has had to change their operating model and the basis of their technology to ensure they are not left behind

Benefits

As a result of their cloud based products and services, Company A has grown in the last four years from eight FTEs to 52 FTEs as they have shifted from selling services to selling a product.

Additionally the company expects that revenue increase by 50 percent in 2012 and by 166 percent in 2013 with their cost base only rising by five percent. Historically, they have been using profits to reinvested in research and development which has tripled in size.

Case study — Investment Bank

Current state

Company B is at the very early stages of investigating what cloud computing can mean for the organisation. The first considerations are governance, regulation and security.

Company B has started with Infrastructure as a Service (IaaS) with the implementation of a private cloud environment. They bill businesses a subscription fee on a month-by-month basis. They anticipate they will be able to bill on an hour-by-hour basis very soon.

Further to the solutions offered, they plan to offer self-service and a higher level of automation to the business.

Company B has done very little by way of public clouds. They have not invested or deployed any software or platforms as a service.

Benefits

Company B is offering Oracle databases as a service and bill businesses on a month-by-month subscription from their paid licence pool. This has saved the organisation substantial savings from reduced licences. The figure is estimated in the millions (50 percent of what it was previously).

Future state

Company B would like to investigate community clouds. In particular, they would like to look at running pricing models on grid environments. Further to this, the New York Stock Exchange has a community cloud offering to their financial services clients and should something like that be available, the company would have some interest.

Future plans include looking at cloud based email. Microsoft Office 356 is of interest as the organisation can choose the location of the data. Whether this is possible with APRA requirements is also of interest.

There are further plans for desktop virtualisation so iphones, ipads and Apple Macs can be used anywhere.

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Case study — Surf LifeSaving Australia

Current situation

Surf Lifesaving Australia (SLSA) relies on the time and commitment of more than 44,000 patrolling volunteer lifesavers. One of the greatest challenges for the organisation is reducing the amount of time required for the administration of clubs and services.

Starting in 2008, the 'Saves Time Saves Lives' project aimed to improve service levels, save time and facilitate commercial expansion by providing sophisticated business and communications tools and applications. Through the provision of a cost-effective infrastructure, the SLSA project aimed to benefit members, employees, clubs, the organisation and importantly, all Australian beachgoers.

SLSA selected cloud services as the infrastructure underpinning the 'Saves Time Saves Lives' ICT project. SLSA recognised the overwhelming cost advantages of a cloud solution and developed a three-phase strategy to roll out its redesigned processes and underlying ICT infrastructure in the cloud.

- The service applications and delivery provided cost-effective infrastructure including:
- centralised operational data store including people, organisations, awards, patrols, incidents and beaches
- members' portal, linked to web-based content and workflow management with a national enterprise view of SLSA information
- voice recognition and telephony services enabling 'on beach' access to services.

Benefits

The development of the 'Saves Time Saves Lives' project has seen the provision of a centralised operational data store and reporting application that allows:

- the SLSA access to a single national enterprise view of its information
- applications that service the SLSA community across the country
- a members' portal which is linked to web-based content and workflow management
- voice recognition and telephony services to enable on-beach access to services.

This has led to benefits including:

- cost efficiencies of cloud solution
- reduced administrative overhead for volunteers with on-beach patrol logs, captured on mobile phones, fed directly to the central data store
- improved data collection and analysis for education programs.

Future state

The final phase of the project will see a review of SLSA's legacy systems, and will provide further opportunities to move SLSA's full IT infrastructure from ageing on-premise servers to the efficiencies of cloud.

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Case study — internet service provider

Current state

Company C is an internet service provider who has approximately 2100 FTEs of which 900 are located outside of Australia. They are approximately 60 percent through their internal cloud journey and five percent through their external cloud journey, and they believe their journey will be completed in the next 2.5 years.

Company C has migrated applications such as HR, Payroll and Asset Management to the public cloud. Over the next 2.5 years, the company has a strategy to replace their infrastructure for a cloud architecture model.

Benefits

Company C has not experienced any reduction in ICT costs as a result of implementing the cloud solution. There has been a move from an opex to a capex model, however, the total ICT spend has remained the same.

The cloud solution has allowed the company to rapidly expand and integrate the technology faster (underlying PC/infrastructure layer, not applications).

Disaster Recovery (DR) capability has significantly improved as a result of their cloud solution. There has been a significant reduction in risk as the cloud model allows the company to set up contact centre within a few days if required. In addition, the cloud solution allows employees to work from home using a secure connection.

The cost of hardware acquisition has decreased as employees working from home only require a secure internet connection. This has resulted in cost benefits of $8,000 per person per year (hardware, outgoings and rent). Company C currently has approximately 150 staff working from home at any given time.

Company C has also experienced time savings in setting up contact centre. As a result of the implementation of the cloud solution, the time taken to set up a contact centre has been reduced from weeks to days.

Future state

Going forward, the company does not see utilising an external cloud as an option for most of its internal applications. The internal systems are heavily customised and they do not believe cloud providers can provide the solutions they require. Currently, the company has a pool of 100-120 developers.

Company C is looking into ERP solutions in the public cloud, e.g. SAP cloud where integration is generic. They are currently undertaking a tender process for Campaign Management systems in the cloud.

Over the next 18 months, the company believes that ICT spend will increase by 10 percent monthly as a result of the implementation of the cloud.

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Case study — Ricoh

Current situation

Ricoh commenced implementation of cloud-based solutions in December 2008. They completed their current levels of cloud solution implementation — 25 percent to 50 percent of their cloud computing journey — in 2009.

The company estimate they will have completed all cloud solution implementation in two to five years. So far they have implemented Salesforce.com and they have also migrated their public website to a public cloud environment.

Benefits

The benefits identified by Ricoh from their cloud based initiatives are several.

- Quick implementation (three months for pilot and four months for the rest of the company).
- Better quality and more accessible information with the sales team keeping accounts, contracts, opportunities and leads data up to date for the benefit of all users across the organisation.
- Information can be accessed from anywhere at any time. There has been a 40 percent reduction in time spent in the office from the team updating the old CRM system.
- Better management due to visibility of opportunities in real time and better analysis of the reasons why opportunities are won and lost.
- The Salesforce.com product includes a module to track ideas which has led to an increase of 100 percent in idea nominations across the organisation.
- More accurate sales forecasting has led to reduction in stock counts.

Future state

Ricoh plans to extend their CRM to include more sales and pre-sales processes such as quoting. They anticipate this will replace current manual paper based systems and provide a consistent interface and provide 50 percent savings in preparation time.

Another area that is under consideration for cloud based deployment is managed services for customer needs. This includes print services and complaints handling. It is a growth area for the business and for example can enable a sales person to contact a client when their printers are due to go out of warranty. More cloud based applications for project management and recycling registrations are in the planning phase for future deployment

Ricoh does not anticipate moving their ERP system to the cloud at any stage. They are currently under contract for the next five to ten years. Currently, web-services is utilised to integrate Salesforce.com to their ERP system.

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