

# IRELAND'S COMPETITIVENESS & JOBS OPPORTUNITY: CLOUD COMPUTING



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# Foreword

2010 marked *Microsoft's* 25th year of investing in Ireland. This milestone gave us the opportunity to celebrate the evolution of our operations here, the continued flow of investment into these operations and the significant contribution that our employees make to *Microsoft's* continued success. 2010 was also a significant year for Ireland's economy with unprecedented economic challenges. This situation has led to widespread analysis of the future outlook for the country, its people, society as a whole and the broader economic and business community.

As a committed corporate citizen in Ireland we have always taken our responsibilities as a company very seriously. As part of this we seek to identify and drive solutions to the economic challenges that we face rather than focusing on the negatives. This was demonstrated in commissioning the Tansey Report - Productivity: Ireland's Economic Imperative published in 2005 which provoked extensive debate by policy and business leaders. More recently we have focused on bringing a spotlight to the importance of innovation in a growing economy and hosted a national conference to look at what the Smart Economy means for Irish businesses, entrepreneurs, the public sector and the arts and non-profit communities.

All of the areas share a common underlying theme: each of them has a critical role to play in helping Ireland to regain its competitiveness. Never before has the issue of improving Ireland's competitiveness been so critical. The most recent World Economic Forum Competitiveness Index ranks Ireland 29th in the world - a drop of 4 places since 2009. This level of competitiveness affects our ability to attract new investments, grow existing organisations and to compete in the global export market.

We now have an opportunity, similar to the 1970s and 1980s, where Ireland built a strategy ahead of the global trend curve, correctly identifying where future investment opportunities would be. We positioned ourselves to attract technology and financial services companies and we have become world leaders in these areas. In recent months it has become very clear to me that the rapidly developing area of Cloud Computing can play a significant part in Ireland's strategy to improve competitiveness and to drive economic growth fuelled by both FDI and a healthy indigenous community.

While Cloud is considered by some as a technology evolution, the reality is that it is much more than that. The fundamental shift that it represents means that business, public sector and Government now have the opportunity to change how they run their organisations, how services are delivered, how they scale an operation - while increasing efficiencies and reducing costs. As an enabler and a facilitator of growth the Cloud is an unrivalled opportunity.

Globally, Cloud Computing is in its infancy. Therefore, Ireland has a wonderful opportunity to be a leader in the Cloud - creating the right environment to attract cloud based IP; leveraging Cloud to address the challenges in the public sector; creating a cluster of skills and talent that can help to support the growth of the next wave of Cloud based companies from Ireland - spawning a future Facebook; Salesforce.com or Amazon.

If we are to achieve these goals, it is imperative that we are first in this race to be the leader in Cloud. We have the right building blocks in place but if we don't capitalise on them our window of opportunity will be lost. NOW is the time to act. Cloud Computing can be the silver lining in Ireland's competitiveness challenge.

To quantify the economic impact that the Cloud can have on the Irish economy and competitiveness we commissioned an economic research study by Goodbody Economic Consultants. The resulting report highlights the significant opportunity that Cloud Computing presents to Ireland - both in terms of helping to improve the competitiveness of organisations in the Public and Private Sectors and also in terms of supporting the country's FDI, entrepreneurial and public policy strategies and goals. Cloud Computing will change how the world consumes technology. This report sets out a series of recommendations for immediate action to ensure that Ireland maximises its potential impact. It is the timing and pace of implementation of these actions that is critical.

History teaches us that by reviewing our previous successes and building on them we can return to competitiveness. I believe that if we embrace the Cloud from an enterprise and policy perspective we can help to strengthen Ireland's economic foundations for the future - leading to job creation, skills enhancement; increase in FDI as well as helping to improve our competitiveness.



**Paul Rellis**  
MD, Microsoft Ireland

## 4 Key Findings

### Key Findings

- Cloud Computing is a major evolving industry that will revolutionise how businesses and public sector organisations run their operations and deliver products and services. It will be a catalyst for significant changes in the national and global economy. If Ireland acts now, Cloud Computing will deliver much needed competitiveness and jobs for the Irish economy.
- Cloud Computing sales by Irish firms could reach €9.5bn per annum by 2014 and provide jobs for 8,600 people as current Information Technology activities migrate to the Cloud. New services and markets will also emerge as a result of the Cloud, creating additional opportunities for Irish firms.
- Early adoption of Cloud Computing by Irish users will take €0.5bn per annum of costs out of Irish organisations.
- Cloud Computing makes Information Technology a low operating cost rather than an expensive capital investment. This will help small firms in all parts of the economy to grow, and could lead to the formation of 2,000 new small and medium enterprises outside the Information Technology sector.
- Cloud Computing will lower the costs of delivery while also improving the quality of public services in Ireland.
- Cloud Computing has the potential to transform how children and students are educated in Ireland.

### Key Recommendations

- Ireland is an ideal base for the location of firms engaged in Cloud Computing activities. In order to capture a large share of the emerging world market (Analysts' estimates of the size of this market by 2014 range from €40bn to €110bn) in this area and to capitalise on our assets, it is critical that we move fast to create a global reputation in the area of Cloud. Key actions to ensure that this potential is realised are:
  - Organising existing publicly funded and Government Agency supports into a Cloud Cluster Programme;
  - Closing the gaps in awareness of Cloud Computing within the public and private sector;
  - Labour force development to close the skill gaps required in support the growth of a Cloud based industry;
  - Implementing a high profile public sector Cloud based project to demonstrate leadership both in Ireland and internationally;
  - Rolling out a series of initiatives to promote the use of Cloud Computing by small businesses and start ups in Ireland;
  - Ensuring the continued investment in broadband and international internet connectivity to ensure sufficient capacity exists to support the growth of the Cloud industry.

## Introduction

Cloud Computing is a major new industry that is revolutionising the way that Information Technology is developed and used. The potential impact of Cloud Computing and the changes that it can bring to the operation and organisation of businesses and public sector bodies is equivalent in scope and scale to the kinds of changes that were experienced during the initial introduction of computer technology for data processing. These changes are set to transform workplace and user practices in the same way that the proliferation of the Internet did. We are all aware of the changes that widespread deployment of the Internet brought to how we communicate, socialise and work - embracing Cloud Computing can bring changes of a similar scale. By leading the way, Ireland can harness the opportunities presented to drive economic growth and recovery.

The Cloud will deliver enormous benefits to business, government and private users and create exciting opportunities for new and existing firms to provide new services in new markets.

New Cloud Computing based products and services represent a huge opportunity for new product development and exports by Irish firms. Large new markets for exports, which Irish based firms are ideally placed to enter, are opening up at exactly the time that Ireland needs to seek export led growth.

This is all about timing. If Irish users are early adopters of Cloud Computing they will benefit from cost savings, productivity benefits and new ways of carrying out their activities. Widespread adoption of Cloud Computing by Irish businesses will produce competitiveness gains for the economy as a whole. Similarly, early adoption of Cloud Computing by government and public sector users in Ireland will lead to cost savings and improved services for the public. Ultimately these lower cost and higher quality public services will produce further competitiveness benefits for Irish businesses and the economy.

As a nation we need to act now to seize the opportunities presented by Cloud Computing to the economy as a whole. We have certain assets and characteristics as a nation and an economy that make us an ideal location to become a Centre of Excellence for Cloud Computing. However, if we delay we will lose the competitive advantage that this gives us as other countries will be able to replicate our current strengths given time. It is imperative that we act now to attract the right kind of businesses to Ireland, secure the right investment and build a global reputation as a Cloud Centre of Excellence.

Ireland is well placed to become a world centre of this important new industry. Cloud Computing sales by Irish firms could reach €9.5bn per annum by 2014 and provide jobs for approximately 8,600 people.

In addition, early adoption of Cloud Computing by computer users will lead to:

- Cost savings to users in general of at least €0.5bn per annum;
- The formation of some 2,000 new small and medium enterprises outside the IT sector;
- Significant cost savings and improvements in the services delivered to citizens for government and the public sector.
- Decisions by Cloud Companies to come and base themselves in Ireland, helping to build our global reputation as leaders in the Cloud.

Goodbody Economic Consultants (“*Goodbody*”) have carried out a study of the economic opportunity that Cloud Computing presents for Ireland. Goodbody consulted widely with government and industry stakeholders, prepared case studies of pioneering firms in the sector and carried out an extensive survey of the Irish IT industry. This report describes and quantifies the benefits referred to above and identifies the key steps that should be taken now to allow these benefits to be realised.

## What is Cloud Computing?

Cloud Computing is a new approach to information technology that promises huge benefits to all users of information technology from individuals to the largest corporate users. One useful definition of the concept comes from the US National Institute of Standards and Technology:

“Cloud computing is a model for enabling 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 with minimal management effort or service provider interaction.”<sup>1</sup>

Many private individuals are already using Cloud Computing. For example, users of *Hotmail* from *Microsoft*, *Facebook*, *Gmail* or *YouTube* are using an application that runs on a remote server and which they access as and when they need it. This is the “*Cloud Computing*” approach.

Businesses are also starting to use Cloud Computing. Companies that need computing power can now use the facilities of remote data centres rather than acquiring and operating in-house computer equipment. Similarly, businesses can access development platforms or use software applications that are hosted at remote data centres. These services - often referred to as “*Infrastructure as a Service*” (IaaS), “*Platform as a Service*” (PaaS) and “*Software as a Service*” (SaaS) - are all aspects of Cloud Computing.

## Cloud Computing as a Source of Exports, Growth and Jobs

By far the greatest benefit of Cloud Computing is as a source of exports, growth and jobs for the Irish economy. Ireland’s current economic difficulties are well known. There is a clear consensus that Ireland’s economic recovery can only be driven by the export of high value added, high technology goods and services.

Cloud Computing will be an extremely large, new part of the Global IT industry. Significant portions of existing IT activity will migrate to the Cloud because of its cost and quality advantages. In addition the Cloud will give rise to innovative new services.

Ireland is well placed to capture a significant share of these important new markets. Ireland is already a significant base for most of the worlds leading IT firms, and most of these have made Ireland a centre for their Cloud Computing activity. In addition, Ireland has a vigorous emerging Cloud Computing industry.

This emerging cluster of Irish Cloud Computing firms could have total sales of €9.5bn per annum by 2014 and employ approximately 8,600 people, provided that the right steps are taken now to allow it to reach its potential.

## Benefits of Cloud Computing for Irish Users

Cloud Computing is considerably cheaper than conventional approaches to computing. Providers of Cloud Computing services benefit from significant economies of scale in providing IT resources to their clients. In addition, the Cloud Computing approach leads to very efficient use of these computing resources.

These savings for individual users of Cloud Computing will be a significant benefit for the economy as a whole. The total cost of information technology (“IT”) for Irish businesses and public sector users was €4.2bn in 2009. Goodbody has estimated Irish businesses and public sector bodies would benefit from cost savings of approximately €0.5bn per annum if Cloud Computing is adopted quickly by Irish IT users.

The advantages of Cloud Computing for users will go far beyond simple cost savings. With this new approach, computing becomes an operating cost rather than a capital cost. This is particularly useful for businesses in the current climate when finance is hard to obtain.

1. <http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-def-v15.doc>

Businesses will no longer have to raise money to invest in capital equipment for IT.

This flexibility will also have benefits for the economy as a whole. The availability of Cloud Computing will boost the formation of new businesses and the creation of new jobs across the Irish economy. This could result in the formation of up to 2,000 additional non-IT small and medium sized businesses in Ireland over the short to medium term. These businesses could increase employment in the economy by 11,000.

Cloud Computing will mean that even the smallest user of IT will have access to IT services of the highest quality. A small Cloud Computing user buying IT services from a large specialised provider will be able to receive services of the same quality as a large corporate or government user with a state of the art in-house IT system.

### **Specific benefits of Cloud Computing for Government and Public Sector Users**

Cloud Computing is particularly suitable for meeting some of the challenges in providing government and public services, including in particular education. All governments want to give citizens access to government services at a time and place that suits them. This requires enormous computing power at times of peak demand. At other times the need for computing power will be extremely low. Cloud Computing is particularly well suited to this situation.

The public sector is such a large user of IT services that many of the benefits of Cloud Computing could be secured by using “*Private Clouds*” i.e. centralising public sector IT resources and using Cloud Computing approaches to manage access to these centralised resources. A number of jurisdictions around the world, including the UK, the USA and Japan, are already making significant investments in Cloud Computing.

### **Next Steps**

Cloud Computing represents a huge opportunity for Irish firms, public bodies and the economy as a whole. Realising this opportunity depends on moving at a rapid pace so that Ireland can establish itself as a Centre of Excellence for Cloud Computing before any other nation seeks to position itself in this way. The opportunity to create new economic activity and jobs by becoming a world centre for the development and export of Cloud Computing services will only be realised if Irish firms are early to these new world markets. Similarly, Cloud Computing will only improve the competitiveness of the Irish economy if it is adopted early by businesses and public bodies and so lowers our costs and improves our performance relative to international competitors.

Irish businesses and the public bodies are already taking many of the right steps to develop the Irish Cloud Cluster and promote adoption of Cloud Computing by Irish users. The key recommendations from this study are:

- **Organise existing supports and promotion into a Cloud Cluster Programme.** Ireland is an excellent environment for Cloud Computing firms and good incentives exist to promote this activity. Enterprise Ireland and the IDA are already doing a great deal to promote Cloud Computing based on these incentives and environmental factors. At the same time Science Foundation Ireland is funding essential research in the field. This work should be organised into a formal programme to promote the Irish Cloud Computing Cluster. An express commitment by these agencies to promoting Cloud Computing would also send a valuable signal to Irish businesses on the importance of this emerging sector and would help achieve wider recognition and understanding of this potential growth industry. The list of assets and attributes that Ireland has should also be compiled and used to market the country as a location of choice for companies in Cloud. These include the existence of large amounts of infrastructure relevant to the Cloud such as Data Centres, a cluster of high performance technology companies - both multinational and indigenous, a positive business and political community, the right skills in the workforce, - as well as the Cluster of supports as referenced above.

- **Fill the gaps in awareness of Cloud Computing.** Goodbody's survey of the Irish ICT sector found an encouragingly high level of awareness of Cloud Computing and a widespread commitment among firms to develop Cloud Computing activities. However, a small but significant minority of firms indicated little or no awareness of Cloud Computing. This knowledge gap needs to be addressed to maximise the impact of Cloud Computing for Ireland. A specific focus by Enterprise Ireland and the IDA on the Cloud Sector could be an effective way of doing this.
- **Labour force development.** Irish ICT firms developing Cloud Computing products identified a need for additional marketing, sales and technical staff with the relevant skills for Cloud Computing, and a need for training for their current employees. This needs to become a focus for existing public and private training and education providers.
- **A high profile implementation of Cloud Computing by the Irish Public Sector.** A new system, based on Cloud Computing, to carry out a relatively small administrative task such as issuing driving licences or processing CAO results would:
  - Promote Ireland as a world centre for this important new technology by showcasing a high profile public facing activity in the Cloud;
  - Act as a valuable reference site for Irish firms selling Cloud Computing around the world;
  - Demonstrate the benefits of adopting Cloud Computing to all Irish users; and,
  - Improve service and lower costs for the Irish government.
- **Infrastructure.** In the longer term the Irish Cloud Computing industry will need additional infrastructure. Connections between Irish internet users and tier-1 backbone connections are currently made via hubs outside the country. As the Irish Cloud Cluster grows, firms providing services to customers around the world will need at least one tier-1 internet backbone provider with a point of presence in Ireland. This infrastructure should be self financing, and not require the investment of public funds.
- **Ensure that small firms adopt Cloud Computing.** Cloud Computing provides significant cost savings and higher quality IT services to users. Even the smallest user benefits from cost efficiencies and service quality that are currently only available to the very largest IT facilities. This represents a particularly important opportunity for small businesses. Agencies supporting small business in Ireland such as Enterprise Ireland and the County Development Boards should proactively advocate the benefits of adopting Cloud Computing. Where facilities are provided to small businesses, for example at the Digital Hub or other incubators these should include Cloud Computing facilities. Given that there are almost 200,000 SMEs in Ireland – 90 per cent of the total number of companies in Ireland's business population - it is essential that SMEs are aware of the efficiency and productivity opportunities that the Cloud presents and are encouraged to tap into this. Success in this area would have a significant impact on the economy by releasing funds used in other areas to help support business growth and potential recruitment. In addition, efforts should be made to encourage those looking at setting up a start up operation to consider doing so on a Cloud platform. This would significantly reduce the start up capital needed to get established helping to increase the pace of growth and opportunities for employment.

If these steps are taken quickly, Ireland can become a world centre for an exciting new industry. If we delay we will lose our current competitive advantages and these new activities will develop elsewhere in the world.

*Microsoft* engaged Goodbody Economic Consultants to investigate the potential economic benefits for Ireland from the emergence of Cloud Computing and to identify any key actions needed to secure these benefits. This report is the result of that investigation.

**This report:**

- Summarises the urgent current needs of the Irish economy for improvements in competitiveness and export driven growth;
- Describes and, as far as possible, quantifies the competitiveness benefits that will flow from the early adoption of Cloud Computing by Irish businesses and public sector bodies;
- Highlights the potential for Ireland to become the base for a significant cluster for firms providing Cloud Computing services on world markets, and the economic benefits that would flow from this and highlights the need to move at pace in order to ensure that another country doesn't take this position first; and,
- Identifies the key barriers and issues that will have to be overcome to realise the potential of Cloud Computing for the Irish economy and proposes the actions that need to be taken to address these obstacles.

**To put these findings in context a set of Appendices to the report set out:**

- An outline of the successful development to date of the Irish Information and Communication Technology ("ICT") sector;
- A summary description of the development of Cloud Computing to date;
- Case studies of Irish adopters and developers of Cloud Computing; and,
- An overview of the supports available to indigenous firms entering Cloud Computing markets.

## 10 National Economic Priorities and Needs

This Section summarises the current economic situation and the main strands of national policy to address our current problems. It goes on to identify the key current needs of the Irish economy and the role Cloud Computing can play in addressing these.

### 2.1 Current Economic Crisis

The current recession has been extensively discussed and debated elsewhere. However, it is worth recalling the events of recent years and the scale and the extent of the economic challenges that Ireland currently faces.

Ireland enjoyed several years of impressive export led growth up to the end of the 1990s. The ICT sector played a leading role in these exports and much of this export activity was driven by inward investment with foreign-owned firms bringing additional capital and know-how to the Irish economy.

In contrast, Ireland's economic expansion from approximately 2001 onwards was largely driven by domestic consumption and construction. Domestic consumption and construction activity must ultimately be related to the size of the national population and its current level of wealth. Therefore there is a limit to the amount of economic growth that can be based solely on increased domestic consumption and the construction of houses and other property assets in Ireland. This limit was reached, abruptly, in late 2008.

Since late 2008 Ireland's economy has been suffering from the combined effects of a world wide economic slowdown and a huge adjustment in the national property and financial markets. The economy shrank by 3.5 per cent in 2008 and by a further 10.7 per cent in 2009<sup>1</sup>. The forecast for 2010 is for a decline of approximately 2 per cent<sup>2</sup>. This suggests that the economy will decline by a total of 15.5 per cent from its peak level.



Source: CSO

This change in fortunes has had serious negative effects on economic welfare and public finances. Unemployment was consistently low during the years of economic growth. It has recently grown sharply and reached 13.4 per cent by the end of 2010<sup>3</sup>.

The sudden reduction in taxation revenues and increase in social welfare spending as a result of this recession put severe pressure on the public finances. Government finances have transformed from an extremely healthy stage where an excess of receipts over current spending was being invested in capital spending, to a situation where Government spending was well in excess of receipts.

Despite the actions taken to date to curtail spending and raise taxes, government spending is expected to exceed revenue by an amount equal to 40 per cent of GDP for 2010<sup>4</sup>. (This deficit

1. CSO Annual % change in GNP at constant market prices
2. Department of Finance Forecast -2.0% (November 2010), Central Bank Forecast -1.7% (October 2010), IMF Forecast -1.7% (October 2010) All forecasts as reported in Department of Finance Monthly Economic Bulletin for December 2010.
3. "Live Register December 2010" released on 6<sup>th</sup> January 2011
4. CSO Quarterly National Household Survey, released September 2010

includes one-off costs of bank rescues). The 2011 Budget has started the process of restoring balance to the public finances by reducing the gap between public incomes and spending by €6bn. This is the first step in a four year plan to restore the public finances by 2014<sup>5</sup>. Restoring control over public finances in this way is a condition of the financial support granted to Ireland by the EU and the IMF<sup>6</sup>.

## 2.2 Government Response and the Smart Economy

The Government's strategy to respond to the current economic crisis includes a focus on Research and Development and technology. "*Building Ireland's Smart Economy – A Framework for Sustainable Economic Renewal*" was announced in December 2008. The four main pillars of this strategy are:

- Addressing urgent needs by stabilising the public finances, improving competitiveness, assisting people who had lost their jobs and supporting indigenous and foreign owned firms through the crisis;
- Developing economic activity and exports based on new technology by:
  - Public funding for Research and Development;
  - Incentives for multi-national firms to carry out Research and Development in Ireland; and,
  - Actions to ensure that the results of this Research and Development are commercialised in Ireland;
- Investments in renewable energy and green technology to:
  - Increase the sustainability of Irish energy use; and,
  - Develop a green enterprise sector;
- Infrastructure investments to improve quality of life and increase the competitiveness of Irish business.

The "*Smart Economy*" or Knowledge Economy strategy emphasises:

- Improving the competitiveness of all Irish businesses;
- Economic growth based on the export of high technology products and services; and,
- Developing green technologies to improve the sustainability of the Irish economy and as a source of opportunities for exports and "*green collar*" jobs.

The latest update on the implementation of the Smart Economy strategy was published in late September 2010<sup>6</sup>. This document sets out tasks for the Government and state agencies in implementing the "*Smart Economy*" strategy. The need to develop Ireland as a hub for global high technology industries is reinforced. Cloud Computing services are specifically mentioned as an area to be targeted in this respect<sup>7</sup>. This latest action plan emphasises the need to increase exports by indigenously owned firms, pointing out that 85 per cent of exports are made by foreign owned firms. This study has identified significant potential for indigenous Irish firms to enter world markets for Cloud Computing services.

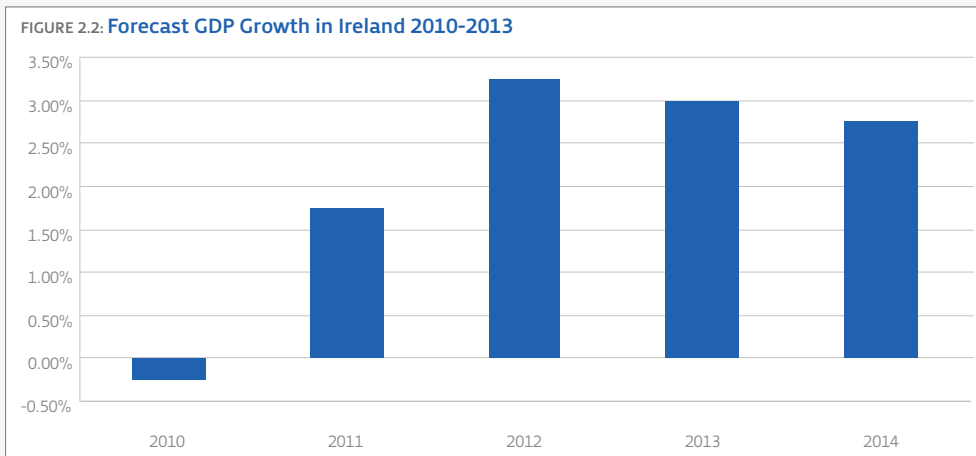
If these actions are taken, Ireland will be well positioned, as a small trading economy, to take advantage of the upturn in the world economy. The potential exists for the Irish economy to return to a sustainable growth path over time. The Government launched a four-year budgetary plan in November and has published details of the assumptions underlying this plan<sup>8</sup>. Recovery in our trading partners is expected to drive export led growth from next year. The expected growth path is set out in Figure 2.2 overleaf:

5. The National Recovery Plan 2011-2014 available at [www.finance.gov.ie](http://www.finance.gov.ie)

6. "EU/IMF Programme of Financial Support for Ireland" Programme Documents 1 December 2010. Available at [www.finance.gov.ie](http://www.finance.gov.ie)

7. Ibid p.27 "...Taking advantage of the shift towards software-as-a-service and increased demand for hosted/managed services, such as electronic records and information management services (RIMS) and supporting data centre infrastructures"

8. See note 4. This document forecasts GDP growth, rather than GNP for 2012-2014.



Source: Department of Finance

This approach, of restoring competitiveness and supporting key high technology industries to promote export led growth has been endorsed by the National Competitiveness Council. As the National Competitiveness Council put it in December 2009:

“ It is now clear that growth derived from property price inflation, fuelled by low interest rates and reckless borrowing, was not a sufficient basis for sustainable growth.

Generating export-led growth is the only sustainable strategy to secure long term growth and prosperity.<sup>9</sup>



The Council concluded that restoring cost competitiveness and improving productivity growth across all sectors of the economy are the key requirements for export-led growth.

### 2.3 Addressing the Economic Crisis

Ireland urgently needs to return to a path of economic growth and to restore overall competitiveness. By definition Ireland's national income is the sum of:

- Consumption: total spending by individuals on goods and services for their own use;
- Investment; total spending by individuals and businesses on assets;
- Government spending; and,
- Net Exports.

Economic growth can only come from an increase in one or more of these components of the national economy. The current state of public finances and the open nature of the Irish economy limit the options that are available to seek economic growth.

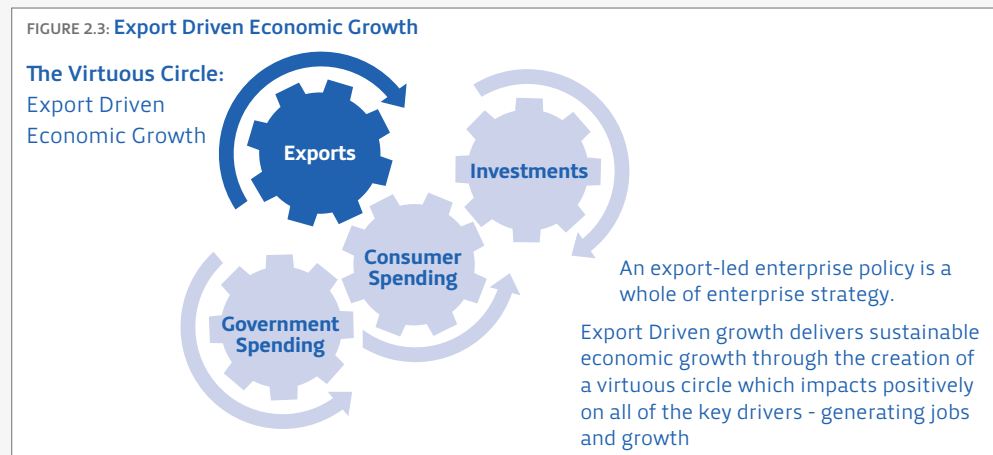
In theory, Consumption can be increased by a government increasing its spending or reducing taxes, or by an expansionary monetary policy. These options are not available to Ireland at present. It would not be possible for the Irish Government to borrow more to finance extra spending or reduced taxes. In any event, this type of fiscal expansion is not very effective in an open economy. A huge amount of the goods actually consumed by Irish people are imported. Fiscal action to boost demand tends to result in extra imports rather than extra economic activity in Ireland. In addition, Ireland cannot run an independent monetary policy while it is a member of the Single Currency.

Encouraging Investment is also difficult in an environment where credit is hard to obtain and the business and economic environment is such that very few potential investments are commercially viable.

9. National Competitiveness Council “Driving Export Growth: Statement on Sectoral Competitiveness” December 2009.

Government finances are in such a poor state that it is not possible for the Government to boost economic activity by increasing the scale of its own activities.

The only practical source of extra economic activity is demand from outside the Irish economy i.e. increased net exports. Additional exports will create extra activity and employment directly. They will also set up a virtuous circle of growth in the other parts of the economy. Increased exports and extra employment in exporting firms will increase domestic consumption, make investing more attractive and provide extra tax revenue allowing the Government to expand its activities. A recent analysis by Forfás expresses this point in the diagram below<sup>10</sup>:



Source: Forfás

#### Ireland can increase its exports by:

- Restoring the competitiveness of Irish businesses; and,
- Reinvigorating our high technology based, exporting industries to take advantage of emerging opportunities on world markets.

Cloud Computing can play a key role in both of these tasks. Cloud Computing will act in two ways on the economy. The combination of these effects will achieve these aims of restoring competitiveness and reaching new export markets. First, adoption of Cloud Computing by all IT users including foreign owned and indigenous firms in all industries will:

- Directly reduce the IT costs of Irish businesses;
- Increase productivity and improve business practices;
- Reduce the costs of Government and improve the quality and responsiveness of Government services.

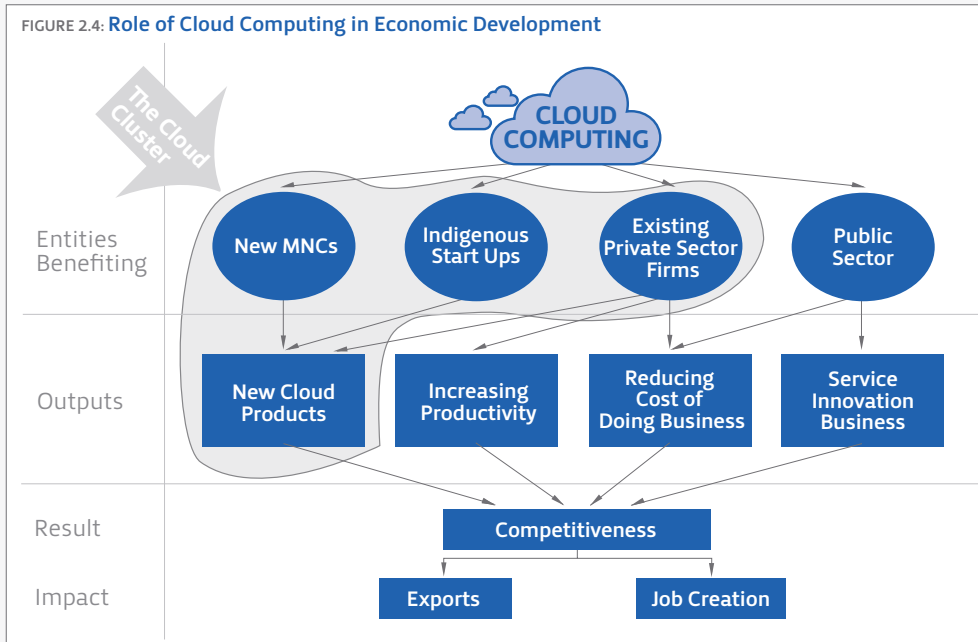
These effects will increase the competitiveness of all parts of the Irish economy which will lead to increased exports and job creation.

Secondly, an emerging cluster of firms is starting to provide Cloud Computing services to customers in Ireland and around the world. This cluster includes foreign owned and indigenous Irish firms and will grow to include new foreign investors and start-ups. As these markets grow and the cluster reaches a critical mass the export of Cloud Computing Services will become an important source of exports, growth and employment. It is worth noting that computer services are already a vital source of export growth for the Irish economy<sup>11</sup> and also worth noting that the advent of Cloud has spawned a number of new markets and services which are enabled by technology but are outside of the IT sector - opening up significant potential for economic growth in the years ahead.

10. Forfás "Making it Happen – Growing Enterprise for Ireland" 6th October 2010

11. "Computer services stands out as one of the main service export growth sectors, contributing over 30 per cent to total service exports and experiencing one of the highest annual growth rates between 2003 and 2009", Forfás Press Release of 17<sup>th</sup> November 2010 on publication of "Enterprise Statistics at a Glance"

This relationship between Cloud Computing and the economy is summarised in Figure 2.3 below



Source: Goodbody Economic Consultants

#### 2.4 Role of Heritage and Culture in Recovery

There are a number of other Cloud Computing applications that can be deployed which will enhance Ireland's reputation and ultimately our competitiveness. As discussed at the 2009 event at Farmleigh, Ireland has a unique heritage and culture which if marketed correctly can be leveraged as part of our plan to restore economic growth and competitiveness. The international showcasing of the talent and creativity that exists in Ireland and our cultural heritage which is of such interest to Irish diaspora across the globe is a key differentiator for Ireland when seeking to attract FDI. The Cloud can play a significant role in helping to bring our Irish culture and heritage to increased audiences of people helping to rebuild Ireland's reputation in the eyes of many abroad.

The National Library of Ireland is already successfully deploying technology to increase access to its collection at both a national and an international level. The model used by this Institution could be replicated by many others and the Cloud can be used as a key mechanism for increasing access to data rich content to people across the globe.

CASE STUDY: **National Library of Ireland****CHALLENGE**

The National Library of Ireland is home to some of Ireland's greatest treasures and among its eight million items are very rare and delicate documents. The NLI has a global reputation, has works of historical relevance that are known the world over but could only be examined by visitors who came to the library. The Library faces a number of challenges when organising exhibits and displays:

- Exhibition space tends to be limited and that means that only 26 artefacts can be displayed in its current exhibition.
- At times, artefacts can be too fragile or large to be placed on public display in exhibition cases.
- It also was aware of the important role that Irish history and culture plays in building and maintaining Ireland's reputation globally and attracting cultural tourism. The library has a large number of international visitors each year and growing numbers of queries from international students and people from both within and outside Ireland who are interested in Irish culture and history. The library wanted to increase access to the documents, manuscripts and materials without compromising their quality while attracting new audiences.

**SOLUTION**

The Library looked at how it could use new and emerging channels and technology to increase access to the library's eight million items and started a project that embraced the web and new types of display solutions, such as surface technology.

The Library used a number of technological advances to design a unique Exhibition, **Discover Your National Library: Explore, Reflect, Connect**. For example, it used the *Microsoft Surface* 'discovery table', a computer which responds to natural hand gestures, and which holds every object in the exhibition (and many which are not currently in the exhibition but will be in the future through a series of revolving temporary exhibits) as the exhibition's central repository. The images are tagged in such a way that if the visitor finds an item they are particularly interested in, the technology automatically links them to other similar items likely to be of interest.

In addition, the library, who wanted to broaden the reach of its exhibits to visitors who are unable to go to the Library, has also made the interactive tables available online on [www.nli.ie/discover](http://www.nli.ie/discover). Any consumers who have a touch screen computer can enjoy the same interactive experience that visitors to the library do. Those without touch screen capability, can also view the images in detail online at [www.nli.ie/discover](http://www.nli.ie/discover).

**OUTCOME**

As a result of the project, the library has now completely transformed how it shares its collection with people and its target audiences have expanded significantly as it is now actively seeking to engage with a wide variety of virtual visitors across the globe.

Currently, the *Microsoft Surface* tables display more than seven hundred rare documents, some of which are either too fragile and large to be placed on public display in exhibition cases. Visitors can now view images of objects from the collections in amazing detail that has hitherto been possible for only a limited number of researchers, academics and other specialists.

During its first six weeks alone, the Discover website received 1,000 unique visits.

Reviews of the exhibition have acknowledged that the NLI has managed to introduce its collection to a wider public, and that fragile and delicate documents can be easily found, examined, magnified and manipulated as never before.

## 2.5 Conclusion

In summary, the Irish economy is undergoing a crisis. Our recovery from this crisis and return to long term, sustainable prosperity depends on:

- Improving the competitiveness of Irish businesses; and,
- Developing new export markets for high technology goods and services.

The remainder of this study details how Cloud Computing represents a significant opportunity to achieve these objectives. Cloud Computing has a significant role to play in:

- Reducing costs and increasing production for indigenous firms and local subsidiaries of multinationals;
- Supporting Ireland as an attractive venue for Foreign Direct Investment;
- Providing an opportunity for indigenous start ups and for the expansion of existing firms into new markets; and,
- Creating an opportunity to develop a cluster of Irish software firms in the field of Cloud Computing.

## 3.1 Introduction

The adoption of Cloud Computing by users will bring benefits in terms of cost savings and improved information technology resources. If a significant number of firms and public sector bodies in an economy are early adopters of Cloud Computing, these individual benefits will combine to produce an overall improvement in economic efficiency and competitiveness.

These competitiveness benefits of Cloud Computing can be divided into three groups:

- Cost savings for all users, including firms, across the economy;
- The fact that Cloud Computing delivers higher quality IT services to users.
- Encouraging start ups in industry generally.

Each of these is considered in more detail in the following sub sections. The extent of these benefits will depend on the level of take up of Cloud Computing. Some industry forecasts conservatively assume that the majority of IT users will continue to use conventional approaches to filling their IT needs and so will forego the cost and performance benefits of Cloud Computing. For example IDC forecasts of the growth of Cloud Computing assume that it will account for 12 per cent of spending on IT when fully implemented. Other industry figures, including notably *Microsoft* which is highly committed to the Cloud Computing approach, believe that the inherent advantages of Cloud Computing over conventional approaches will lead to very widespread adoption.

Section 3.2 below includes an estimate of the total value of cost saving realised as a result of the adoption of Cloud Computing by Irish IT users. This has been conservatively based on the IDC forecast that Cloud Computing will grow to account for 12 per cent of spending on IT. If Cloud Computing is in fact widely adopted the actual savings will be far in excess of this estimate.

## 3.2 Cost Savings for Users

Cloud Computing can allow an organisation to meet its information technology needs at a lower cost than traditional approaches. There are three potential sources for these cost savings:

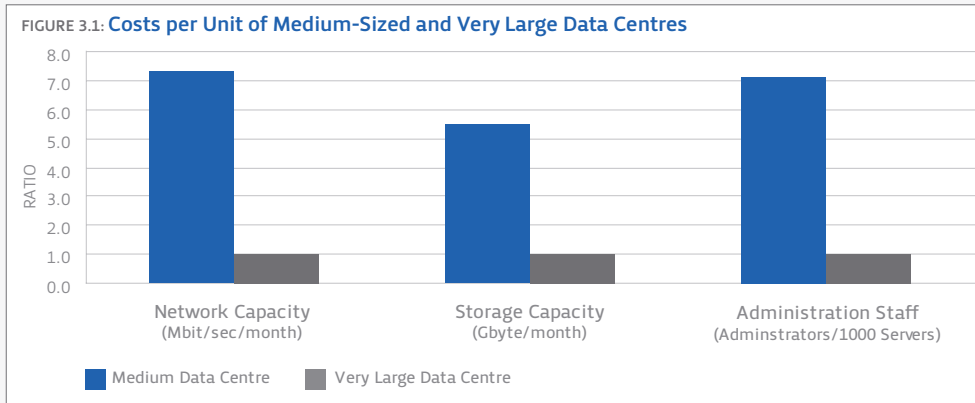
- Purchasing economies for computer power;
- Savings on input costs; and,
- Efficient management of peak demands.

### 3.2.1 Purchasing Economies for Computer Power

In a Cloud Computing model, the computer hardware and software are owned and operated by providers who operate extremely large data centres. There is scope for economies of scale in the operation of these data centres, for example through discounts from bulk purchase of hardware to efficiencies in staffing the larger data centre. A large data centre will provide a given amount of computing capacity at a lower cost than it would cost an individual firm to provide the same amount of computing power for its own needs.

In 2009 a UC Berkeley research centre produced a study which indicated the potential for such cost savings<sup>12</sup>. This study compared the costs per unit of computing power of operating a medium-sized data centre which might have 1,000 servers to the costs of a very large data centre with some 50,000 servers. The results of this exercise are reproduced in Figure 3.1 overleaf:

12. "Above the Clouds: A Berkeley View of Cloud Computing" Armbrust et al, UC Berkeley Reliable Adaptive Distributed Systems Laboratory. <http://radlab.cs.berkeley.edu/>



Source: University of California Berkeley RAD Laboratory

In this example, if a firm currently uses 1,000 servers in an in house data centre to meet its information technology needs, a large scale supplier of Infrastructure as a Service could provide a similar level of computing power at one seventh of the cost of a smaller entity. Moving from conventional to Cloud Computing would therefore lead to large cost savings for the economy as a whole. In practice, these cost savings would be partly realised by the customer and partly captured by the Cloud Computing provider as its profit margin.

### 3.2.2 Savings on Input Costs

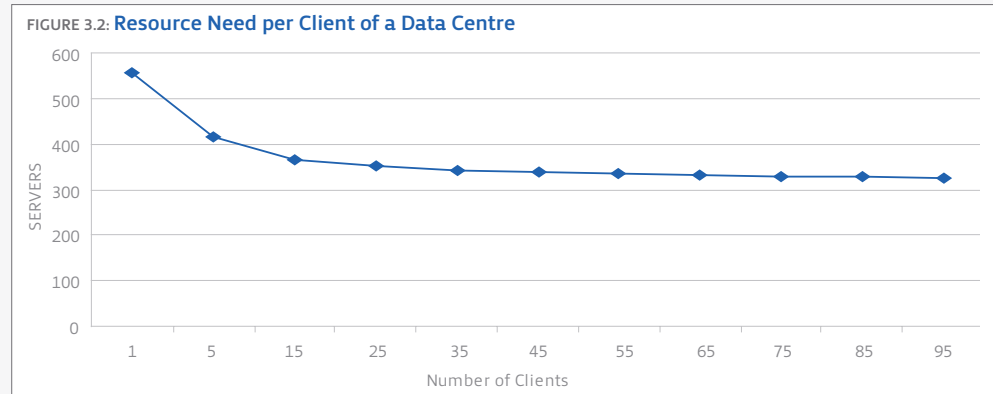
There are also potential savings in other input costs. Data centres, whether in-house or operated on a Cloud Computing basis, are significant users of electricity. If there are significant variations in the cost of electricity and cheap reliable data transmission is possible, moving to a Cloud Computing approach with data centres located where electricity tariffs are low can realise significant cost savings. This is a significant factor in the US where there are significant regional variations in the cost of electricity.

This factor is unlikely to influence decision making on Cloud Computing in Europe as differences between electricity tariffs for industrial users are less marked than in the US. It is worth noting that this is an area where Ireland's competitiveness has already started to improve. In 2008 the Irish electricity tariff for industrial users was 37 per cent higher than the euro area average. This tariff decreased by 24 per cent during 2009, with the result that the Irish tariff for industrial users is now only 5 per cent above the Euro area average<sup>13</sup>.

### 3.2.3 Efficient Management of Peak Demands

Perhaps the most significant way that Cloud Computing can reduce the costs of ICT users comes from the nature of the service. One of the greatest challenges facing IT managers in firms is managing the variability in demand for computing power. A firm must have sufficient computing resources to deal with the highest levels of demand for computing power that it experiences. Inevitably much of this computing capacity will be unused for much of the time. With a Cloud Computing approach, a firm obtains computing resources from a third party provider that provides similar services to other firms. The mere fact of combining the needs of several users in this way smooths out the variability of demand for computing resources. The Cloud Computing provider will have less need to have unused reserve computing power to deal with peak demand. This will reduce the total amount of computer resources needed, leading to costs savings for individual customers and the economy as a whole. This cost saving will be significant. Goodbody estimates that combining the needs of different users could reduce the total amount of computing resources needed by some 40 per cent. Details of this estimate are set out in Appendix 4 to this study.

13. National Competitiveness Council "Annual Competitiveness Report 2010 Volume 1 – Benchmarking Ireland's Performance" July 2010



Source: Goodbody Economic Consultants

### 3.2.4 Estimating the Size of Cost Benefits for Users

Information and Communication Technology represent a significant expense for business and public sector users. According to Eurostat, spending on information technology by Irish businesses and public bodies in 2009 amounted to €4,192m.

It is clear that moving to Cloud Computing could realise huge savings on this amount. Cloud Computing is a cheaper way to provide a given amount of computer resources than conventional approaches. In addition, it reduces the amount of computer resources needed by users by dealing efficiently with peaks and troughs in individual users' needs. One of the case studies prepared for this study illustrates just how large these cost savings can be. A group of adjoining local authorities is using a Cloud Computing approach to allow residents to track planning applications online using a map based interface. The new application was developed at a very low cost by the Local Government Computer Services Board. In addition, the operating costs of this system are as low as €11.76 per week. (Full case study set out in Section 4 below)

It is also clear that these saving can be realised by a large proportion of IT users. Cloud Computing is central to the development plans of the majority of major IT suppliers and Cloud Computing approaches are available or being developed for a huge range of applications and potential clients.

For the purposes of this study Goodbody has estimated a conservative, minimum value for the cost savings that might be realised by Irish IT users, in both the private and public sectors. This estimate limits the cost savings realised by individual users implementing Cloud Computing to 50 per cent of current costs. The estimate also assumes that the take up of Cloud Computing is in line with a conservative IDC forecast that when Cloud Computing is fully implemented that it will account for 12 per cent of all spending on IT<sup>14</sup>. On the basis of these conservative assumptions the minimum cost savings for the Irish economy as a whole would be €450m per annum. The calculation of this estimate is set out in Table 3.1 below. If Cloud Computing is adopted widely by IT users the actual saving will be far in excess of this conservative estimate.

	€m	€m
Annual cost of IT		4,192
Annual cost of IT if Cloud Computing Adopted		
Applications moved to Cloud Computing	900	
Less 50% saving on Cloud Computing	(450)	450*
Applications on conventional platform (4,192-900)		3,292
		3,742
Saving on IT costs		450

\*Lower cost Cloud Computing is 12 per cent of new spending level

Source: Goodbody Economic Consultants

14. See for example IDC press release referenced in footnote 5.

### 3.2.5 Cost Savings for Small Businesses

A significant share of Irish business activity is carried out by firms that employ fewer than 10 people. Firms with fewer than 10 employees account for over a quarter of all employment in business<sup>15</sup>. If the cost savings for these small firms were proportionate to their share of the total economy (including the public sector) they would realise savings of almost €100m per annum.

However, the cost savings from Cloud Computing will disproportionately benefit smaller firms. The cost savings arising from Cloud Computing all flow from the enormous scale of the data centres used to supply Cloud Computing services. In essence Cloud Computing provides all users, regardless of size, with the cost efficiencies of operating on an enormous scale. Larger firms will already benefit from some of the efficiencies of having a large scale computer system. Small businesses have the most to gain in cost terms from adopting Cloud Computing, and will have the fewest barriers to adopting this new technology. Small businesses should capture at least half of the cost savings estimated above, i.e. at least €225m per annum.

### 3.3 Quality Benefits for Users

In addition to these flexibility benefits, a user of Cloud Computing, in particular a small or medium enterprise, will benefit from obtaining its computing resources from a large scale specialist in computing rather than managing limited in-house resources. In general, the services provided by a Cloud Computing supplier will be of higher quality than would be possible with in-house provision. For example:

- Applications will always be kept up to date for all users. Updating software can be a significant burden on the ICT staff of a small or medium enterprise;
- Virus controls will be of the highest standards, and will be kept updated;
- Backup and disaster recovery precautions will be carried out to the highest standards by specialists;
- Security and data protection technology and procedures will be state of the art; and,
- Maintenance and support can be provided centrally.

In essence, Cloud Computing will provide all users with the level of quality that is currently only available to the very largest and best resourced IT users. Small businesses stand to benefit most from this feature of Cloud Computing, so this advantage will be of particular benefit to the small business sector. Cloud Computing will put even the smallest firms on a level playing field with their larger competitors with respect to IT resources.

### 3.4 Flexibility and Extra Business Formation

As well as possible cost savings moving to Cloud Computing brings significant flexibility benefits for users. Cloud Computing Customers pay only for the resources they actually use and can increase or reduce the amount of computing resources available to them instantaneously.

This flexibility is in addition to the potential cost savings discussed above. It will be particularly useful for new and growing businesses. As explained above, Cloud Computing converts IT costs from a capital to an operating cost. The benefits of this are particularly apparent now when, due to conditions in the banking market, credit can be hard to obtain. Cloud Computing will free businesses from the need to raise money to invest in computer equipment. Instead, they can pay for their IT needs on an ongoing basis as they use Cloud Computing.

The availability of computing resources on a pay per use basis significantly reduces the capital required to start a small business. The ability to increase the computing resources available to a business as and when extra resources are needed significantly reduces the capital requirements of a growing business, and eliminates a significant business risk from growing businesses.

15. CSO "Business Demography by NACE Rev 2" 2008 statistics

Recent research suggests that these flexibility benefits for new and growing businesses can actually increase the rate of new business formation in an economy. The results of this research are summarised below:

**CASE STUDY: Cloud Computing as a Driver of Business Formation**

During 2009 Federico Etro of the University of Milan published a ground-breaking paper which applied a macroeconomic modelling approach to estimate the impact that the introduction of Cloud Computing might have on business formation and competition in Europe. The paper pointed out that Cloud Computing would remove a significant cost of entry for new firms, ie the capital cost of providing their own ICT needs. This would increase rates of business formation. The extra competition from these additional businesses would increase overall economic output and employment.

The author developed a model to predict the magnitude of this effect, and estimated effects on GDP, employment and business creation for Europe as a whole and for individual European economies.

	Short Term	Medium Term
Additional GDP growth	0.05%-0.15%	0.1%-0.3%
Reduction in Unemployment rate	0.5%-0.6%	0.2%-0.3%
Additional Business Formation	73,000-378,000	83,000-431,000

This work was initially published in the Review of Business and Economics<sup>16</sup> and reached a wider audience when a summary paper was published in the World Economic Forum’s “Global Information Technology Report”<sup>17</sup>.

The total number of extra businesses that will be formed in Ireland if Cloud Computing is widely available and adopted could exceed 2,200. Full details of the number of extra businesses that could be formed are set out in Table 3.2 below, together with estimates of the impact this would have on economic growth and employment. These estimates for Ireland were presented in the Etro paper on the economic effects of the diffusion of Cloud Computing.

**3.5 Conclusion**

Cloud Computing is a low cost, high quality way of delivering IT services to all users. Adoption of Cloud Computing by IT users in the private and public sector will:

- Significantly reduce the costs of doing business in Ireland. Even a low level of adoption would yield total cost saving of almost €0.5bn per annum. Much of these savings will flow to small businesses.
- Improve the quality of IT services available to businesses, and in particular to small and medium enterprises; and,
- Improve the environment for entrepreneurship by converting IT from a capital to an operating cost. This factor alone could lead to the formation of 2,200 new businesses across all sectors of the economy.

16. Etro “The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe” (2009) Review of Business and Economics 2009/2 pp 179

17. World Economic Forum “The Global Information Technology Report 2009-2010” Chapter 1.9 “The Economic Consequences of the Diffusion of Cloud Computing”

	Slow Adoption	Fast Adoption
	€m	€m
<b>SHORT RUN BENEFITS</b>		
New Business Formation:		
Manufacturing	19	97
Wholesale and Retail Trade	135	699
Hotels and Restaurants	56	289
Transport, Storage and Communications	30	156
Real Estate and Business Activities	148	767
<b>Total</b>	<b>388</b>	<b>2,008</b>
<b>Faster Economic Growth:</b>		
Extra growth in GDP	0.05%	0.15%
Extra GDP per annum	80	240
<b>Job Creation:</b>		
Reduction in Unemployment Rate	0.5%	0.5%
Number of Jobs	11,000	11,000
<b>MEDIUM TERM BENEFITS</b>		
New Business Formation:		
Manufacturing	21	111
Wholesale and Retail Trade	154	795
Hotels and Restaurants	64	329
Transport, Storage and Communications	34	177
Real Estate and Business Activities	169	872
<b>Total</b>	<b>442</b>	<b>2,284</b>
<b>Faster Economic Growth:</b>		
Extra growth in GDP	0.1%	0.3%
Extra GDP per annum	160	480
<b>Job Creation:</b>		
Reduction in Unemployment Rate	0.2%	0.3%
Number of Jobs	4,400	6,600

Source: Etro (2009)

## 4.1 Introduction

Efficient and customer-friendly services from government and public services are a key element of competitiveness. More importantly, they are a core obligation of a state to its citizens. This Section:

- Describes the commitments that the State has made to improve government services through better use of technology;
- Outlines how key features of Cloud Computing are ideally suited to meet the challenges of delivering high quality public services in a modern society;
- Identifies the benefits of Cloud Computing for the education sector; and,
- Highlights successful Cloud Computing developments by other jurisdictions.

## 4.2 Policy on e-Government

In 2008 the Government established a “Task Force on the Public Service” which developed a three year plan to deliver improved services and outcomes from Irish public services<sup>18</sup>.

This body specifically recommended that greater use be made of a shared services approach to managing Information and Communication Technology. This shared service approach could be on either an outsourced basis, or “insourced” where the shared service centre is internal to the public sector.

Cloud Computing represents an ideal way to implement a shared service approach. Although Cloud Computing normally uses data centres that are independent of the service users, the technology can be adopted to manage internal implementations where an organisation owns a data centre that serves a range of internal customers. (“Private Cloud”). More recently, “An Bord Snip” also recommended greater sharing of ICT facilities and services in Government and the Public Sector<sup>19</sup>.

The task force also expressly recommended further moves to eGovernment, allowing firms and businesses to interact with public bodies via communication technology such as the Web and mobile phones. Again, there is clear potential to use a Cloud Computing approach to achieve this objective. The promotion of eGovernment has been identified as a key way that technology can be used to advance the “Smart Economy” agenda<sup>20</sup>.

## 4.3 Benefits of Cloud Computing for Government

All of the user benefits of Cloud Computing described in Section 3 above apply equally to government users. In particular the cost savings described there could be realised by Government by implementing Cloud Computing.

The Local Government Computer Services Board (“LGCSB”) has already carried out an interesting pilot implementation of Cloud Computing for a group of local authorities which illustrates the type of cost savings which may be possible.

### CASE STUDY: LGCSB - Tracking Planning Applications

#### OVERVIEW

In 2009, the LGCSB embarked on a highly successful pilot project to deploy a cloud computing solution to local authorities. The project consisted of an application that amalgamated planning information in several adjoining local authorities, so that the status of planning applications could be assessed and tracked through one portal.

#### PROJECT PURPOSE

Geographic Information Systems (GIS) have evolved quickly in recent decades: they have moved from paper based systems to desktop applications; then to Intranet, Extranet,

18. “Transforming Public Services – Citizen Centred – Performance Focused” Report of the Task Force on the Public Service. November 2008. Available at [www.taoiseach.gov.ie](http://www.taoiseach.gov.ie)

19. Report of the Special Group on Public Service Numbers and Expenditure Programmes” Section 2.12 “Shared ICT Services”. 16<sup>th</sup> July, 2009. Available at [www.finance.gov.ie](http://www.finance.gov.ie)

20. See Section 7 of “Technology Actions to Support to Smart Economy

CASE STUDY: **LGCSB - Tracking Planning Applications**

CONTINUED

**PROJECT PURPOSE (CONT)**

and the Web. Some GIS have now begun to move to cloud, and this area was seen as a suitable theme with which the LGCSB could better learn about and experience cloud technology, while delivering a worthwhile project. At present, the public access element of the planning system consists of locally hosted planning archives that can be accessed through the website of each local authority. Each system is standalone but the dataset is uniform across the authorities, with planning applications stored in both lists and maps. There is no facility to undertake a national search of applications and to pan and zoom in on areas of interest. One of the primary purposes of the pilot project was to demonstrate that data on a common theme but relating to different geographic areas and organisations could be accessed via a common portal. Planning applications in different local authority areas are of interest to users such as residents on the border of the areas or to construction professionals whose work covers a wide region. For this reason, the application was written for two groups of adjoining local authorities: Waterford City, Waterford County and Cork County which are contiguous; and Carlow County, Offaly County and Laois County which are also contiguous. In planning to take applications onto the cloud, the LGCSB had to consider such issues as standards, new techniques, the potential to learn from the project, and any security and legal aspects that needed to be addressed.

**PROJECT CONCEPT**

The system is based on Open Government Standards. The architecture leaves the existing standalone systems as they were, and takes a data feed from these to the cloud application. This then amalgamates the data together and puts it on a map. This allows users to pan and zoom across County Boundaries. They can then select the documents relevant to a particular planning case. There are no data protection issues because the data never leaves the servers on which it normally resides and so the actual data still under local protection. The cloud application simply undertakes a metadata search and then guides the user to the relevant local authority site to access the relevant documentation.

**PROJECT DELIVERY**

The application was deployed on the *Microsoft Windows Azure* platform, which allowed for speedy deployment. The only in-house infrastructure required was two laptops: the usual requirement to wait for database, internet base and prototype servers to be installed did not exist. There were also no licensing issues. A Virtual Local Area Network (LAN) was constructed and a development environment was set up. This allowed the project to progress quickly through the stages of (i) a development area (ii) a test area (iii) a deployment area and finally (iv) to a live system. The human resources required for the project consisted of one member of *Microsoft* and in house staff of the LGCSB. There were no more than two to three people working on the project at any one time. The entire application was developed in five weeks.

**PROJECT RESULTS**

Although a pilot project, a number of results have been delivered:

- ⊙ The project did not require investment in capital resources: and therefore involved minimum cost and commitment. This alone made it very feasible to undertake as a pilot.
- ⊙ If a decision is taken to expand the application for use nationwide, then it can be done so because the cloud approach means that it is entirely scalable.
- ⊙ The LGCSB has now direct experience of cloud technology and can consider it in a better informed way for future uses
- ⊙ The ongoing costs of running the application with the present volume of data is €0.07 per hour i.e. €11.76 per week.

In addition certain specific features of Cloud Computing make it very suitable for Government and the public sector. The implementation of IT in Government and public services presents particular challenges. For example:

- The “*Business Rules*” governing a firm’s or an individual’s dealings with the public sector are subject to frequent complex changes. The tax code is extremely complex and is subject to regular additions and amendments. The rules on welfare entitlements are also subject to frequent changes. Any system must be capable of responding to these changes in an efficient, centralised way.
- The activity of processing firms’ and individuals’ dealings with the Public Sector must meet onerous and legally enforced standards of confidentiality, security and reliability.
- A major advantage of moving to eGovernment is to allow firms and individuals to deal with Public Administration as and when they want. This will inevitably lead to huge peaks and troughs in demand for processing power. For example the Revenue Online system must be able to deal with huge volumes of transactions close to filing deadlines. Traditional approaches to dealing with the Public Sector allowed its resources to be rationed by limiting access to office hours, or requiring people to apply in writing for services. This effectively meant that firms and individuals could be forced to wait until resources were available to deal with their request. With eGovernment requests can come at any time, and resources must be available to deal with them immediately.
- The Government and Public Sector is an extremely large user of information and communication technology. Any opportunities for economies of scale must be pursued.

Cloud Computing is, by its very nature, very well suited to deal with these challenges and take advantage of these opportunities.

- Maintaining data and software at a central data centre allows efficient centralised updating of business rules;
- Centralising data and software also allows state of the art measures for confidentiality, reliability etc. to be put in place and maintained;
- The scalability of Cloud Computing is ideal for meeting the peaks and troughs in demand that Government and Public Services face. The use of a Cloud Computing approach would mean that enormous resources could be made available to meet short term peaks in demand for computing resources; and,
- As described above Cloud Computing is expressly designed to capture the economies of scale available from centralising computing resources.

#### 4.4 Cloud Computing for the Education Sector

The Irish education sector could benefit greatly from the adoption of Cloud Computing. The sector is made up of a large number of autonomous schools and other institutions all of which must share information and communicate.

Schools in Ireland have varying levels of IT resources and the level of skills that exists amongst teachers in schools across the country varies significantly. There is a huge opportunity to leverage the Cloud as a way to share information, share content and to even share class work. It also opens up communication and transparency between parents, students and teachers by increasing access to course ware and content that traditionally has resided in the classroom.

Content created by one school could be shared and accessed by another - helping to dramatically improve efficiencies as well as quality across all schools.

Cloud Computing is ideal for meeting the challenges of this type of structure.

In addition the education system should clearly be introducing students at all levels to Cloud Computing, so the availability of Cloud Computing would also be a valuable teaching resource.

Cloud Computing needs to be a central part of the IT strategy for the education sector if the vision of the Smart Schools = Smart Economy strategy is to be achieved.

**CASE STUDY: Miami Dade County Public Schools**

**CLOUD COMPUTING IMPROVES EDUCATION IN SCHOOL DISTRICT BY LINKING TEACHERS, STUDENTS, PARENTS ONLINE**

Miami-Dade County Public Schools (M-DCPS) is the fourth largest school district in the United States, with some 367 public schools and 47 charter schools. Serving an area of over 2,400 square miles, M-DCPS has 345,000 students, 50,000 employees and an annual budget of more than €6bn.

**OVERVIEW**

In late 2005, the M-DCPS published a comprehensive five-year IT Blueprint plan included objectives to encourage student use of technology to manage their own learning, provide parents with the opportunity to participate in their children's education, and give teachers the tools and information to maximise their resources. The plan also aimed to provide administrators and operations/support staff with the tools and information needed to make informed decisions, communicate effectively, and optimally deploy resources.

**ADVANTAGES OF CLOUD COMPUTING FOR M-DCPS**

- **Students:** Students can view their class list, grades, stored documents, school announcements and events, and a district calendar. The portal links to the districts instructional content, an online student-advising system and an online resource that reinforces reading and Maths skills.
- **Parents:** Parents can view their child's class lists and grade, assignments, school bus information, graduation requirements, immunisation guidelines, and links to other resources.
- **Teachers:** Teachers can view personal information; e-mail messages and calendar; stored files; class lists; a roster of students in each class; detailed data that shows each child's performance and learning trends.
- **Principals:** Principals can see personal information and documents, calendars, weekly district briefings, reports from key district systems, and links to other relevant resources.

**RESULTS OF CLOUD COMPUTING APPROACH FOR M-DCPS**

**Improved Access to Information:** All stakeholders make the most efficient use of resources while achieving greater levels of participation and higher results.

**Enhancing Productivity and Decision Making:** Consolidated access to information is improving productivity for teachers, helping them to make more use of data. The need to switch between operating systems is eliminated. Resources are used more effectively.

**Improved Collaboration:** Collaboration drives educational achievement. Built in workflow capabilities allow people to work together more effectively.

**Rapid Time-to-Benefit at Reduced Cost:** *Microsoft* software provides cost benefits and extensive prebuilt functionality.

A Web-based portal allows all stakeholders to access relevant information using one communication channel, rather than navigate a maze of stand-alone resources, saving teacher/student time, increasing productivity and driving results.

#### 4.5 Government Cloud Computing in other Jurisdictions

Governments in other jurisdictions are already seeking the benefits of Cloud Computing. Early implementations and studies are being carried out in the United Kingdom, Japan and the United States. These are summarised below:

#### 4.5.1 United Kingdom

**G-Cloud:** The UK Government's ICT strategy has a cloud computing initiative – the G-Cloud – at its heart. The G-Cloud is an onshore, government-owned cloud infrastructure that enables public bodies to select and host ICT services from a secure, resilient and cost-effective shared environment. Multiple services will be available from multiple suppliers, which will make it quicker and cheaper for public sector bodies to switch suppliers if they face service or delivery issues.

The program will include Infrastructure-as-a-Service (IaaS), Middleware/Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The government intends to establish a Government Application Store to deliver SaaS. The Government Cloud is a key enabler of a £3.2 billion savings per year program foreseen by the UK Government.

#### 4.5.2 Japan

**The Kasumigaseki Cloud:** The Japanese authorities have announced the development of a nation wide Cloud Computing infrastructure called the Kasumigaseki Cloud. This Cloud will enable various ministries to collaborate to integrate and consolidate hardware and create platforms for shared functions. The Japanese authorities also plan to develop Green Cloud Data Centres. These will reduce data centre energy consumption by locating in cold regions, utilizing wind and solar power, employing low-loss direct current, and using tunnels and other underground sites with strong earthquake resistance and stable temperatures.

#### 4.5.3 United States

**Federal Cloud Computing Initiative:** The United States government cloud computing plan is intended to migrate the federal government's information technology infrastructure to web-based IT services. It was launched in September 2009 by President Obama's administration.

The initiative seeks to identify common services and solutions amongst the government's agencies and adopt a cloud computing business model to support them. Federal agencies can purchase government cloud-based IT services through [Apps.gov](http://Apps.gov), a one-stop website maintained by the General Services Administration (GSA). Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS) vendors must be approved by the GSA before being allowed to provide services to government agencies and get listed on [Apps.gov](http://Apps.gov).

**Defense Information Systems Agency (DISA):** The DISA is developing a number of Cloud Computing solutions for the US military, DoD government civilians and DoD contractors for Government authorized use.

The principal cloud initiatives are as follows:

**The Rapid Access Computer Environment (RACE)** is a development testing environment provided in the cloud by the Defence Information Systems Agency (DISA). It delivers platforms for developers that are quick, inexpensive and secure.

**Forge.mil** is a family of services provided to support the DoD's technology development community. The system enables the collaborative development and use of open source and DoD community source software.

**The Global Information Grid (GIG) Content Delivery Service (GCDS)** provides a Defense Information Systems Network (DISN) enterprise level service to accelerate delivery and improve reliability of web applications. GCDS is a globally distributed computing platform comprised of servers deployed across the DISN. GCDS leverages commercial Internet best practices to provide state of the art web content and web application delivery via standard web protocols: HTTP and HTTPS.

**NASA Nebula:** Nebula is an open-source cloud computing project and service developed to provide an alternative to the costly construction of additional data centres whenever NASA scientist or engineers require additional data processing. Nebula also provides a simplified avenue for NASA scientists and researchers to share large, complex data sets with external partners and the public.

**US Department of Energy (DOE):** The Magellan program is funded by the American Recovery and Reinvestment Act through the US Department of Energy (DOE). Magellan is a research and development effort to establish a nationwide scientific mid-range distributed computing and data analysis test bed. Its purpose is to examine cloud computing as a cost-effective and energy-efficient computing paradigm for scientists to accelerate discoveries in a variety of disciplines.

**Department of the Interior National Business Center (NBC) Cloud Computing:** NBC's private federal cloud enables federal users to benefit from a pool of networks, servers, storage capabilities, and desktop applications in a National Institute of Standards and Technology (NIST) certified secure dedicated Federal environment; and Platform as a Service (PaaS) for software and middleware capabilities. Federal organizations and agencies can take advantage of end-to-end development and production pipelines in a hosted environment on an as-needed basis. The NBC is offering this technology as a designated Federal shared service provider. It is intended to allow for a secure, shared environment for Federal organizations to meet the Office of Management and Budget (OMB's) recent CLOUD computing requirements for greater efficiencies and savings.

#### 4.6 Conclusion

The cost savings and quality benefits inherent in adopting a Cloud Computing approach to IT are available to the Irish Government and Public Sector, and will help meet its commitments to efficiency and better public service. In addition Cloud Computing is, by its nature, well suited to meet the IT needs of public administration, and in particular the needs of the education sector. Other jurisdictions are already taking steps to realise these benefits.

## 5.1 Introduction

The previous sections of this report have described the benefits that will flow from early adoption of Cloud Computing by Irish IT users. Cloud Computing also represents a huge new set of markets which could be served by exports from Ireland. This Section describes the potential for the emergence of a cluster of IT firms in Ireland serving these new global markets.

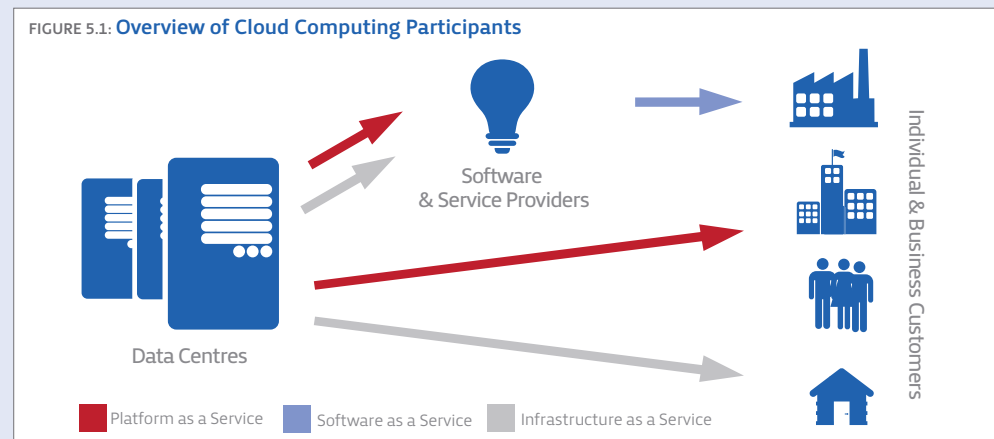
The emergence of Cloud Computing will create new services and markets, which will in turn create opportunities for Irish firms to form or expand to provide these services. Firms active in the Cloud Computing sector will serve a global market. An Irish cluster of Cloud Computing providers could capture significant shares of these global markets. This Section:

- Gives an overview of the broad categories of Cloud Computing services that are emerging and the potential size of the world market for these services;
- Describes the emerging Irish Cloud Computing services sector based on consultations with stakeholders and case studies;
- Presents the results of a survey of the Irish IT industry and its preparations for Cloud Computing carried out by Goodbody;
- Estimates the potential scale of the Cloud Computing cluster that could develop in Ireland; and,
- Describes the significant amount of investment that has already taken place in data centres in Ireland.

## 5.2 Emerging Cloud Computing Markets

It is not possible to be specific or exhaustive as to the business opportunities that will arise from Cloud Computing. As with other fundamental shifts in the Information and Communication Technology sector, entrepreneurs will identify new products and services that the new technology makes possible. For example the Internet is now used for purposes that could not have been guessed at the early stages of the adoption of Internet technology. Activities such as large scale sharing of streaming video and social networking were undreamt of when the underlying technology was first adopted.

However, it is possible to identify broad categories of products and services that will arise from the move to Cloud Computing. These categories are sufficiently broad and numerous to indicate that the Cloud Computing sector will be large and will create the opportunity for a great deal of economic activity and employment. Figure 5.1 below gives a stylised view of the emerging Cloud Computing industry.



Source: Goodbody Economic Consultants

Cloud Computing services are often broken into three broad groups:

- Infrastructure as a Service (“IaaS”) where a customer pays for the use of computer hardware at a remote data centre;
- Platform as a Service (“PaaS”) where a customer pays for the use of a development and delivery platform consisting of hardware and software at a remote data centre. This platform is used to develop new software, and to deliver this new software to its end users as a service; and,
- Software as a Service (“SaaS”) where a customer pays to use a piece of application software running at a remote data centre.

These three types of Cloud Computing service can simply be used as a new and innovative way of organising traditional IT services. This study has described the benefits of using this new approach to meeting the IT needs of businesses, government bodies and individuals. Costs are reduced, flexibility is increased as what was previously a capital cost becomes an operating cost and all IT users, however large or small, have access to state of the art IT services of a type that used only be available to the largest corporate or government users.

However, the full potential of Cloud Computing lies in innovative new services that are being developed and delivered using Cloud Computing. These include:

- Business functions and services that are currently carried out in house or procured from specialist consultants;
- Social networking services;
- Multiplayer Games; and,
- Gaming products.

These services will be software intensive and will be delivered to end users on a Cloud Computing basis. However, the activities and the markets involved will go beyond current software markets. Some innovative Irish firms are pioneering some of these new services, and case studies of these are discussed in the next sub-section.

Estimates exist of the potential size of Cloud Computing, and some of these are discussed in Appendix 2 to this Report. These forecasts must be considered a minimum scale for Cloud Computing in the future. These forecasts assume that Cloud Computing will remain a small part of the overall IT market, and attempt to predict the movement of current IT activities to a Cloud Computing approach. Even on this restrictive basis the global market for Cloud Computing is expected to reach approximately between €40bn and €110bn by 2014 from a current size of approximately €12bn.

In reality the Cloud Computing market will be much larger than this. Many commentators expect a large proportion of current IT activities to migrate to the Cloud. This will lead to a global market larger than the €40bn predicted by the most conservative analysts by 2014, and will generate significant business opportunities for consultants and system integrators in assisting this transition.

In addition, new services made possible by Cloud Technology will create large new markets. The potential size and significance of the market for these new services can be judged from the phenomenal growth of social networking services such as *Facebook* and *Twitter* which are early examples of the type of new services that will arise from Cloud Computing.

In order to predict the likely impact of Cloud Computing activity on output and employment in Ireland (See Section 5.5), Goodbody took a mid range figure of €70bn for the value of global Cloud Computing sales by 2014. This conservatively reflects the emergence of new Cloud Computing services and widespread adoption of Cloud approaches.

FIGURE 5.2: **Multinationals active in the Cloud**

	Infrastructure as a Service	Platform as a Service	Software as a Service
	✓	✓	✓
	✓		
	✓	✓	
	✓		
		✓	✓
			✓
	✓		
	✓		
		✓	✓
			✓
			✓
			✓

Source: Source IDA 2010

### 5.3 The Emerging Irish Cloud Computing Cluster

A significant number of multinational software firms in Ireland carry out Cloud Computing activities in Ireland. Figure 5.2 indicates some of these firms and the areas in which they operate:

In addition, innovative Irish firms are entering these new markets and developing Software as Service offerings. Case studies of some of these firms were prepared for this study and are set out in Appendix 3 to this Report.

- Clavis Technology who have developed a specialist utility to validate data as it is captured or sourced;
- HR Locker which provides large and small businesses with tools to manage their human resources; and,
- Lucey Technology who have developed online payment and collaborative working offerings.

These case studies indicate that indigenous Irish firms are entering the area of Software as a Service. The range of different products is also interesting. Clavis and Lucey technology have developed innovative software to perform technical tasks and are offering this on a pay per use basis rather than a traditional licensing approach. HR Locker is also providing access to software on a pay per use basis. However, this is perceived by the user as a complete service for helping to manage human resources. This type of software intensive service shows the potential for Cloud Computing to give rise to innovative new services as well as proving a new, improved approach to existing IT activities.

These case studies also highlight the advantages for developers, and particularly new start-up developers, of using a Cloud Computing approach. The case study companies have all found Cloud Computing to be a cost effective and powerful way to develop new products. Cloud Computing has also delivered value for their customers who have access to advanced, flexible software and services at a low cost.

A significant number of indigenous software firms are active in Cloud Computing. In particular there is a large and active community of start ups developing new Cloud Computing software and services. Many of these benefit from *Microsoft's BizSpark* Network. *BizSpark* is a global initiative operated by *Microsoft* that nurtures next-generation start-ups. *BizSpark* members receive free technology services in the early years of operation. Ireland is host to the largest *BizSpark* community per capita outside the USA, with over 400 firms participating. A high proportion of this community are developing Cloud Computing products.

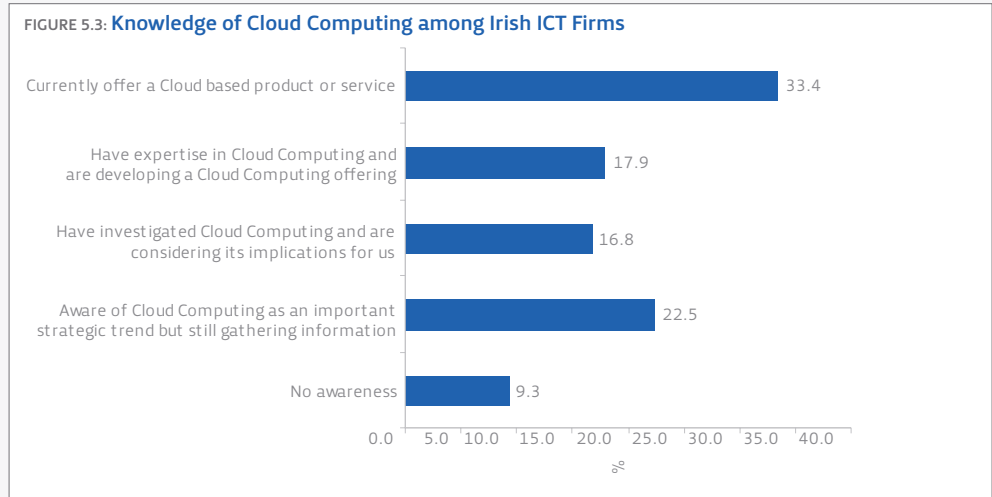
A questionnaire was distributed to approximately 100 companies in the *BizSpark* community as part of this study. Over 80 per cent of the companies that responded were either offering or developing a Cloud based product or service.

### 5.4 Goodbody Survey of Irish ICT firms

Goodbody carried out a statistical survey of the Irish ICT sector as a whole to identify the extent to which the sector was pursuing opportunities in Cloud Computing, and so estimate the potential scale of Cloud Computing in Ireland. A comprehensive list of firms in the ICT sector was compiled and a detailed telephone survey was administered to a random sample of this population. This approach means that the survey results provide good estimates of the characteristics of the ICT sector as a whole.

#### 5.4.1 Awareness of Cloud Computing

Irish ICT firms are highly aware of Cloud Computing and its potential. Over 90 per cent of the sector is aware of Cloud Computing. Over half of the firms in the sector either offer a Cloud based product or service or are developing one. However, 9 per cent of firms stated that they

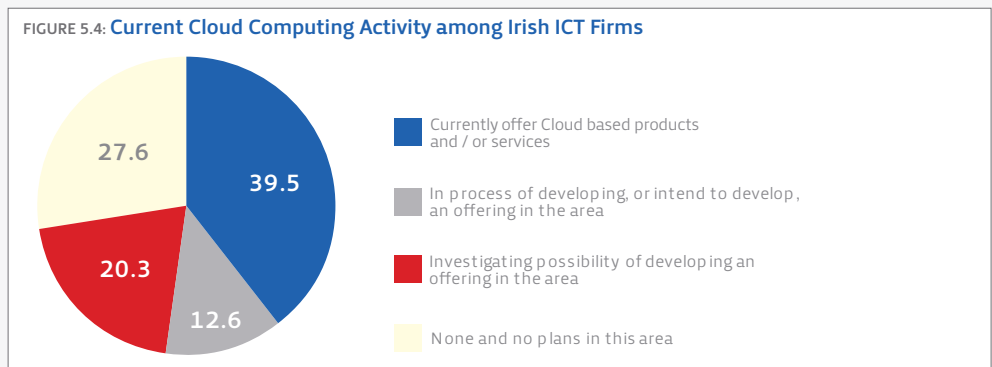


Source: Goodbody Economic Consultants

had no awareness at all of Cloud Computing. A further 22 per cent of firms said they were aware of it as an industry trend but were still gathering information. To maximise the potential benefits of Cloud Computing for Ireland this needs to be addressed. The full details of the survey response are set out in Figure 5.3 on the next page:

**5.4.2 Current Cloud Computing Activity**

An encouragingly large proportion of the firms that are aware of Computing are already active in the area. Almost 40 per cent of firms in the ICT sector are already offering Cloud based products or services. A further 33 per cent of firms are either actively developing, or considering developing and offering in the area. Figure 5.4 below shows the current activity of Irish ICT firms in Cloud Computing.

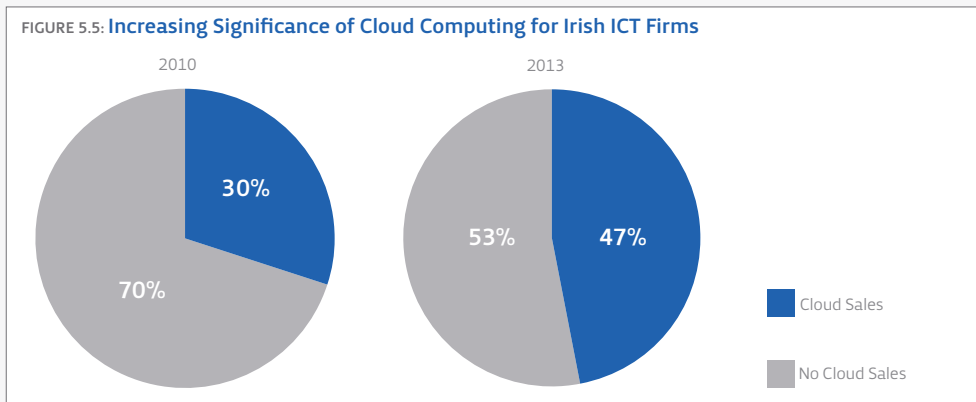


Source: Goodbody Economic Consultants

Where a firm is providing a Cloud Computing services these typically account for 30 per cent of its turnover.

**5.4.3 Future Plans for Cloud Computing**

The firms who are already active in the field of Cloud Computing were able to answer questions on their future expectations and plans for Cloud Computing. They expected Cloud Computing to increase in significance for them. On average they expected Cloud Computing to account for approximately half of their business by 2013.



Source: Goodbody Economic Consultants

As a group, the firms involved in Cloud Computing are very export oriented and expect more than half of their sales in 2013 to be exports. This export orientation applies to both large and small firms. Firms with fewer than 10 staff expect that 49 per cent of their Cloud Computing sales will be exports, while larger firms expect that 54 per cent of their Cloud Computing sales will be exports.

### 5.5 Potential Size of Cloud Sector in Ireland

As discussed in Section 5.2, conservative estimates by industry observers predict that Cloud Computing sales will reach €40bn per annum by 2014. Cloud Computing sales will be well in excess of this amount.

Ireland is poised to take a disproportionate share of this market. Foreign owned software firms have already made Ireland a centre for their Cloud Computing strategies. In addition Ireland's indigenous software sector is successfully entering this exciting new sector, as indicated by the case studies and survey results set out above.

As part of the survey carried out for this study, existing Irish ICT firms were asked to estimate the future value of their sales of Cloud Computing services. Understandably, only a small number of respondents were able to make such an estimate. On average these relatively small firms expected to sell €9m worth of Cloud Computing services per annum by 2013 and to employ 8 people in this activity. This implies that existing, indigenous software firms already have plans to make sales of Cloud Computing services worth €4.4bn per annum and to employ 4,000 people in this area. The future value of the sector will consist of this activity, plus sales by foreign owned firms, new start ups and firms selling Cloud Computing services of types that have not yet been developed.

A conservative estimate of the future size of the Irish Cloud computing sector has been calculated based on:

- Global sales of Cloud Computing services reaching €70bn per annum by 2014. The basis for this estimate is set out in Section 5.2
- Irish firms capturing a similar share of Cloud Computing sales as they currently have of total software sales, i.e. almost 14 per cent<sup>21</sup>.
- Using the results of our survey to estimate the ratio between employment and turnover in the emerging Cloud Computing sector.

On this basis the Irish Cloud Cluster could have total sales of €9.5bn per annum by 2014 and employ approximately 8,600 people<sup>22</sup>.

### 5.6 Data Centre Activity

Data Centres are an essential element of Cloud Computing. Widespread adoption of Cloud

21. According to the CSO ("ICT Ireland 2008") sales of software and related services by Irish firms amounted to €29.4bn in 2006. At the same time global software sales amounted to approximately €215bn. (Deutsche Bank Research quoted in [www.zdnet.com/](http://www.zdnet.com/)). Irish firms account for almost 14 per cent of global software sales.

22. Reflecting expected employment levels in Cloud activities from the Goodbody survey of Irish ICT firms.

Computing approaches by users of ICT would lead to huge demand for data centres. Data centres do not in themselves employ many people. However, there could be significant advantages for the Irish economy in having a significant number of data centres established in Ireland.

- The construction of a data centre is a large scale, sophisticated building project. This type of project would preserve and expand construction skills and provide welcome employment and activity during the current slump in construction activity. For example, the *Microsoft* data centre completed outside Dublin in late 2009 is a 303,000 square foot facility incorporating state of the art energy saving technology and design approaches. Up to 2,100 people were involved in the construction of the facility;
- A number of stakeholders, including the Department of Communications, Energy and Natural Resources and the IDA emphasised the links between the location of data centres and the location of other activities of an ICT company. Large ICT firms will often site a data centre in a campus type setting with other business functions. If an ICT firm establishes a data centre in Ireland it will deepen the links between the firm as a whole and Ireland, and may lead to further functions such as finance or R&D being sited in Ireland.
- Having data centres locate in Ireland can improve the quality of services available to Irish developers of Cloud Computing services. It can also improve the quality of service received by users of Cloud Computing services by reducing latency.

A major operating cost of data centres is electricity to operate computer hardware and to cool the data centre. Cooling systems in data centres also consume large amounts of fresh water. These costs are very high relative to the cost of proving data transmission between a data centre and its users. There has been a strong tendency to locate data centres where electricity prices are low and/or where the climate is cool.

Until recently this has not favoured Ireland, as electricity prices have been relatively high and lower temperature locations are available. However, recent developments mean that Ireland can now be an attractive location for data centres:

- Electricity prices for large users are declining and are now at or around the average for our peers; and,
- Advances in the design of data centres mean that a data centre in Ireland can now be passively cooled, leading to huge reductions in power use and making Ireland a location where the climate favours data centres.

The IDA estimates that there are already 25 data centres operating in Ireland. A number of major international ICT firms including *Microsoft*, *Vodafone*, *Google*, *EMC*, *Yahoo!* and *EMC* use Irish data centres to provide services throughout Europe. Significant capacity is available for independent vendors looking for data centre capacity from vendors such as *Eircom* and *IBM*<sup>23</sup>.

## 5.7 Conclusion

Cloud Computing will be an extremely large, new, part of the Global IT industry. Significant portions of existing IT activity will migrate to the Cloud because of its cost and quality advantages. In addition the Cloud will give rise to innovative new services.

Ireland is well placed to capture a significant share of these important new markets. Ireland is already a significant base for most of the worlds leading IT firms, and most of these have made Ireland a centre for their Cloud Computing activity. In addition Ireland has a thriving indigenous Cloud Computing industry.

This emerging cluster of Irish Cloud Computing firms will have total sales of €9.5bn per annum by 2014 and would employ approximately 8,600 people provided that the right steps are taken now to allow it to reach its potential.

## 36 Realising Cloud Computing Potential: Needs and Priorities

### 6.1 Introduction

Cloud Computing is clearly going to be a significant area of growth for the global ICT sector. As outlined so far in this study, there is significant potential for Ireland to benefit from the trend to Cloud Computing. In particular there is a clear opportunity for Irish firms to successfully enter the market for Cloud related software and software intensive services. However, it is also clear that this rapidly developing sector has a number of key needs that should be met as soon as possible to ensure that this opportunity for the sector and for the economy as a whole can be taken. In addition there are a number of policy and regulatory actions that could be taken now to maximise the benefits to Ireland of Cloud Computing. These are outlined further below.

### 6.2 Key Needs of the rapidly developing Irish Cloud Computing Sector

Goodbody's survey of Irish ICT firms has produced a profile of the Irish firms that are already active in the Cloud Computing sector or that are developing products and services. It has also produced a statistically accurate picture of what these firms see as their key needs at this stage. This has been supplemented with wide-ranging consultations with industry representatives and other stakeholders and in-depth case studies of some individual firms. The key needs identified by the firms in the Sector are set out in Figure 6.1:



Source: Goodbody Economic Consultants

The overriding concern expressed by all firms is a need for more staff with technical and marketing/sales skills and a need to train existing staff. Eurocloud Ireland raised the issue of education and training when consulted by Goodbody. Eurocloud praised the emergence of courses that taught participants how to use current technologies and warned of a tendency for curricula for computer technology courses to be based around programming languages that are no longer current. They also urged that technology education be made an integral part of first and second level curricula.

The "other" concerns raised by firms related to shortcomings in the broadband infrastructure in Ireland. The survey carried out also identified a lack of awareness and knowledge of Cloud Computing among a significant minority of firms in the Sector.

### 6.3 Policy Priorities for Cloud Computing

Consultations and a representative survey of the Irish ICT sector have also identified some key policy priorities to ensure that the environment exists for a successful Irish Cloud Computing industry to emerge and grow. Many of these priorities are extremely worthwhile in general in addition to being important for the success of the Cloud Computing sector. The main priorities are:

#### 6.3.1 Broadband Infrastructure

Users of Cloud Computing services depend on internet connections to connect with their service providers. Universally available, high quality broadband connections are therefore essential if Cloud Computing is to be widely adopted by Irish users, and if Irish suppliers are to have access to a local market. Significant progress has been made in improving Irish broadband coverage. Vigorous competition in the private sector is delivering a choice of broadband options to Irish users. As a result the level of connectivity has been steadily increasing in recent years. For example, according to Comreg, 59.7 per cent of Irish households had a broadband internet connection of some form by the end of 2009. This was greater than the equivalent rate for the EU as a whole (56.7 per cent), and represented an increase of 9.7 percentage points since the end of 2007. In December 2008 the Department of Communications, Energy and Natural Resources announced a “*National Broadband Scheme*” to provide access to broadband connectivity to all parts of the country. When this scheme is completed all parts of the country will have access to at least one source of broadband connectivity. However, the availability of reliable broadband connectivity remains a concern for the industry, and this area needs to be kept under review. A recent survey published by Cisco highlights that download speeds have increased in Ireland by 35% in the last year and by 87% since 2008 and according to the study Ireland is now rated as a country that is meeting the needs of today’s applications. However, Ireland is still not ready for the applications of tomorrow. It is essential that we prepare for the applications of tomorrow in order to ensure that our credentials as a Centre of Excellence for Cloud continue to stand out from the rest.

#### 6.3.2 International Connectivity

For the Irish Cloud Computing Sector to thrive high quality, high speed communications in and out of the country will be required. If Cloud Computing services are being provided from Ireland to international customers there will be a need for fast reliable connections out of Ireland to the international IP “*backbone*” that carries internet traffic. Currently internet traffic in and out of Ireland is routed through hubs outside the country. This causes “*latency*” or delays in communications between Irish data centres and users outside the country. Ideally, Irish users should have access to at least one “*tier-1*” backbone provider with a point of presence in Ireland. This would require a significant investment of the order of €2bn by such a provider. This need has been identified by the Department of Communications, Energy and Natural Resources and the IDA.

#### 6.3.3 Privacy and Data Protection

European Legislation<sup>24</sup> and the needs of customers require the highest standards of data protection and privacy from any computer system, whether in house or contracted from a third party. The EU Data Protection Directive requires that personal data on a computer system must be held:

- Within the EEA, so that the individuals concerned will have the protection of the Directive; or,
- In a country outside the EEA where a Member State or the Commission have determined that the legal protections for personal privacy in that country are equivalent to those in the Directive; or,
- In any part of the world, provided that the contract between the European entity responsible for the data and the provider of the computer system contains sufficient protections for the privacy of the data in question.

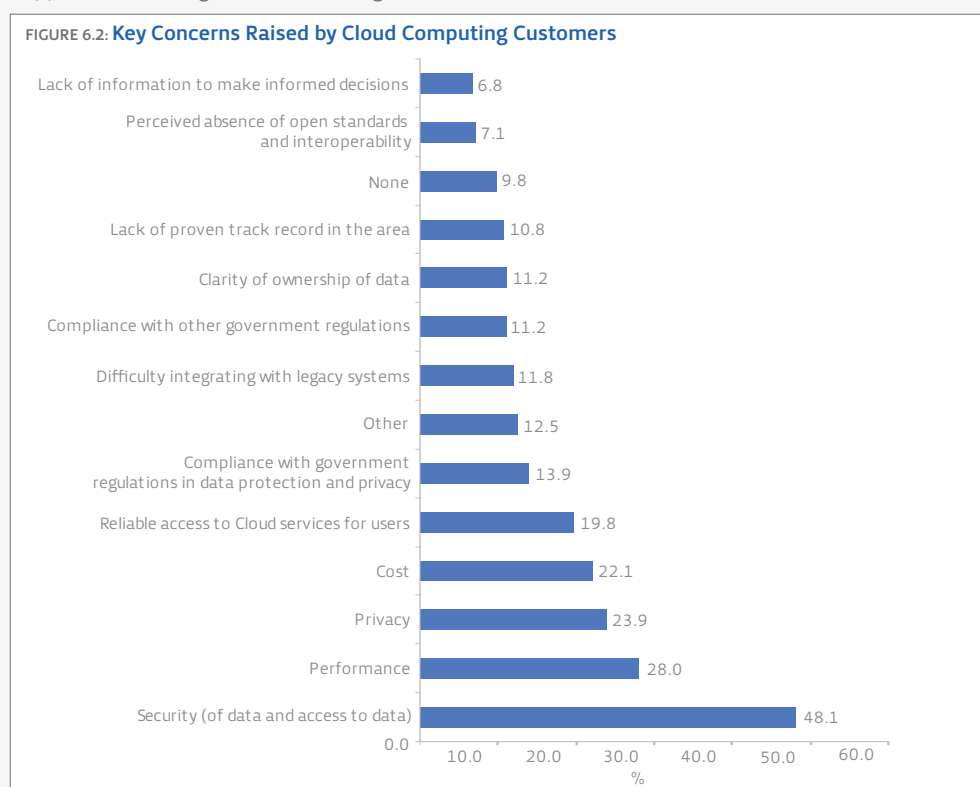
24. Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data. 24<sup>th</sup> October 1995. OJ L 281/31 of 23.11.1995

This requirement should not present any obstacle to the adoption of Cloud Computing by European users, or to the sale of Cloud Computing services by Irish firms. The Commission has designated a number of locations outside the EU, including the US, as being acceptable places to hold data<sup>25</sup>. A standard set of contractual conditions has also been published by the Commission to govern data held in countries without the relevant legal protections in place. In addition, a Cloud Computing provider specialising in providing computing services is more likely to have the knowledge and resources to ensure that its customer is complying with these requirements than an individual firm trying to meet its computing needs in house.

However, it is clear from comments from surveyed firms and consultations with industry bodies that there is a degree of uncertainty and doubt about this question among potential users of Cloud Computing. Clear guidance from the relevant Irish authorities on the actual legal requirements in place is needed to remove this obstacle to an emerging Irish industry.

#### 6.3.4 Security and Access to Data

Concerns about data protection and legal requirements seem to have led to a broader concern about the security and ownership of data when Cloud Computing is implemented. In particular some potential customers are concerned that they will not “own” their data which could create difficulties in accessing their data or in moving to another Cloud Computing supplier. Nearly half of the firms surveyed by Goodbody indicated that this was a concern of potential customers for Cloud Computing. The survey findings on the customer concerns that Cloud Computing suppliers are facing are set out in Figure 6.2 below:



Source: Goodbody Economic Consultants

In reality, Cloud Computing does not present a higher level of information security risk than traditional approaches. The perceived risks of a Cloud approach are more than outweighed by the advantages that come with a Cloud approach. For example, a small firm moving to a

25. As of September 2009 the Commission had determined that Argentina, Australia, Canada, Switzerland, the Faroe Islands, Guernsey, the Isle of Man, Jersey and the United States had adequate protection for privacy.

Cloud approach might fear that the data centre they use would be a tempting target for attack. However, a Cloud data centre will be large and well resourced and will use state of the art security technology and procedures. It will actually be more secure than the relatively small, less up to date, in house IT system that a small firm might have.

### 6.3.5 Government Procurement Policies

Procurement of Cloud Computing services by Irish government and public bodies will be a key step in the development of this industry. As described above, government and public sector users have much to gain from the adoption of Cloud Computing. In addition, sales by Irish providers will reinforce the credibility of Cloud Computing, and of Irish suppliers of Cloud Computing, with domestic and foreign customers. There have been some encouraging early adoptions of Cloud Computing by Irish public bodies such as that by the Local Government Computer Services Board, described in Section 4 above. However, there are also concerns in the public sector about the perceived risks of using Cloud Computing. Rational procurement decisions cannot be made in an atmosphere of uncertainty. The Irish State has significant resources of technical and procurement know how. The relevant specialists in the public service should engage with Cloud Computing suppliers, investigate the doubts and fears that have been raised and issue guidance for the whole public sector on the appropriate use of Cloud Computing.

### 6.3.6 Research and Development

Research and Development by Irish universities and publicly funded research institutes has a key role to play in:

- Advancing Cloud Technology;
- Providing expertise and investigating particular issues for Irish Cloud Computing firms; and,
- Ensuring that there is a pool of highly qualified technologists available for firms operating in Ireland.

The IDA emphasises the importance of a relevant applied research community to attracting high technology industry to Ireland. The State is already funding much relevant research and development through Science Foundation Ireland and the Programme for Research in Third Level Institutions<sup>26</sup>. Matching some of this activity to the needs of Cloud Computing will play a major role in the future success of this industry.

26. The DCENR Report "Technology Actions to Support the Smart Economy" July 2009 contains a good overview of these research programmes.

## 40 Conclusions and Recommendations

Cloud Computing is a major evolving industry that is revolutionising the way that Information Technology is developed and used. It will deliver enormous benefits to business, government and private users and create exciting opportunities for new and existing firms to provide new services in new markets.

New Cloud Computing based products and services represent a huge opportunity for new product development and exports by Irish firms. Large new markets for exports, which Irish based firms are ideally placed to enter, are opening up at exactly the time that Ireland needs to seek export led growth. Ireland is well placed to become a world centre of this important evolving technology.

Widespread adoption of Cloud Computing by Irish businesses and government will produce competitiveness gains for the economy as a whole. In particular, early adoption of Cloud Computing by computer users will lead to:

- Cost saving of at least €0.5bn per annum;
- The formation of some 2,200 new small and medium enterprises outside the IT sector by;
- The creation of 8,600 new jobs;
- Significant cost savings and improvements in the services delivered to citizens for government and the public sector.
- Enhanced delivery of education services
- Competitive advantage for SMEs and start ups

Cloud Computing represents a huge opportunity for Irish firms, public bodies and the economy as a whole. This study found encouraging evidence that Irish businesses and the public bodies charged with promoting economic development, are aware of these opportunities and are taking many of the right steps. However, this progress needs to be continued and prioritised.

**The key actions that need to be prioritised and reinforced include:**

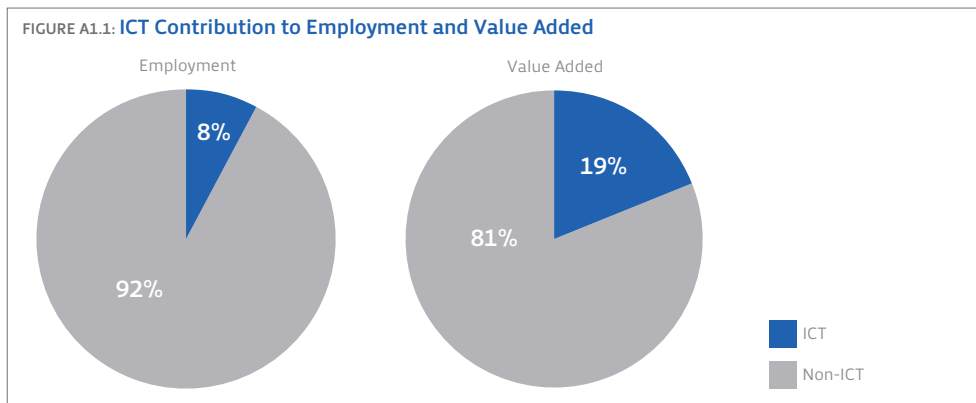
- **Organise existing publicly funded and Government Agency Supports into a Cloud Cluster Programme.** Ireland is an excellent environment for Cloud Computing firms and good incentives exist to promote this activity. Enterprise Ireland and the IDA are already doing a great deal to promote Cloud Computing based on these incentives and environmental factors. This work should be organised into a formal programme to promote the Irish Cloud Computing Cluster. An express commitment by these agencies to promoting Cloud Computing would also send a valuable signal to Irish businesses on the importance of this emerging sector.
- **Fill the gaps in awareness of Cloud Computing.** Goodbody's survey of the Irish ICT sector found an encouragingly high level of awareness of Cloud Computing and a widespread commitment among firms to develop Cloud Computing activities. However, a small but significant minority of firms indicated little or no awareness of Cloud Computing. This knowledge gap needs to be addressed to maximise the impact of Cloud Computing for Ireland. A specific focus by Enterprise Ireland and the IDA on the Cloud Sector could be an effective way of doing this.
- **Labour force development.** Irish ICT firms developing Cloud Computing products identified a need for additional marketing, sales and technical staff with the relevant skills for Cloud Computing, and a need for training for their current employees. This needs to become a focus for existing public and private training and education providers.

- **Infrastructure.** In the longer term the Irish Cloud Computing industry will need additional infrastructure. Connections between Irish internet users and tier-1 backbone connections are currently made via hubs outside the country. As the Irish Cloud Cluster grows, firms providing services to customers around the world will need at least one tier-1 internet backbone provider with a point of presence in Ireland. This infrastructure should be self financing, and not require the investment of public funds.
- **A high profile implementation of Cloud Computing by the Irish Public Sector.** A new system, based on Cloud Computing, to carry out a relatively small administrative task such as issuing passports or processing examination results would:
  - Promote Ireland as a world centre for this important new technology;
  - Act as a valuable reference site for Irish firms selling Cloud Computing around the world;
  - Demonstrate the benefits of adopting Cloud Computing to all Irish users; and,
  - Improve service and lower costs for the Irish government.
- **Ensure that small firms and start ups adopt Cloud Computing.** Cloud Computing provides significant cost savings and higher quality IT services to users. Even the smallest user benefits from cost efficiencies and service quality that are currently only available to the very largest IT facilities. This represents a particularly important opportunity for small businesses. Agencies supporting small business in Ireland such as Enterprise Ireland and the County Development Boards should advocate the adoption of Cloud Computing. Where facilities are provided to small businesses, for example at the Digital Hub or other incubators, these should include Cloud Computing facilities.

### Appendix 1 THE IRISH ICT SECTOR

The ICT sector has been one of the enduring success stories of the Irish economy. Large scale investments by leading international firms in this sector have played a leading role in Ireland's economic development for many years. In addition, a vigorous indigenous sector has grown up and Irish-owned firms are making their mark on the market.

The CSO produced a major review of the information society in Ireland in 2008. It reported that the ICT sector employed 87,200 people and had an aggregate turnover of €75.4 billion. The ICT industry contributed €15.5bn to gross value added. The ICT industry is highly productive. Each employee in the ICT sector generated an average of €177,758 in gross value added compared with €70,117 average gross value added per employee in non-ICT firms. Figure A1.1 below highlights the high value of ICT jobs and the disproportionate contribution that the sector makes to the economy.

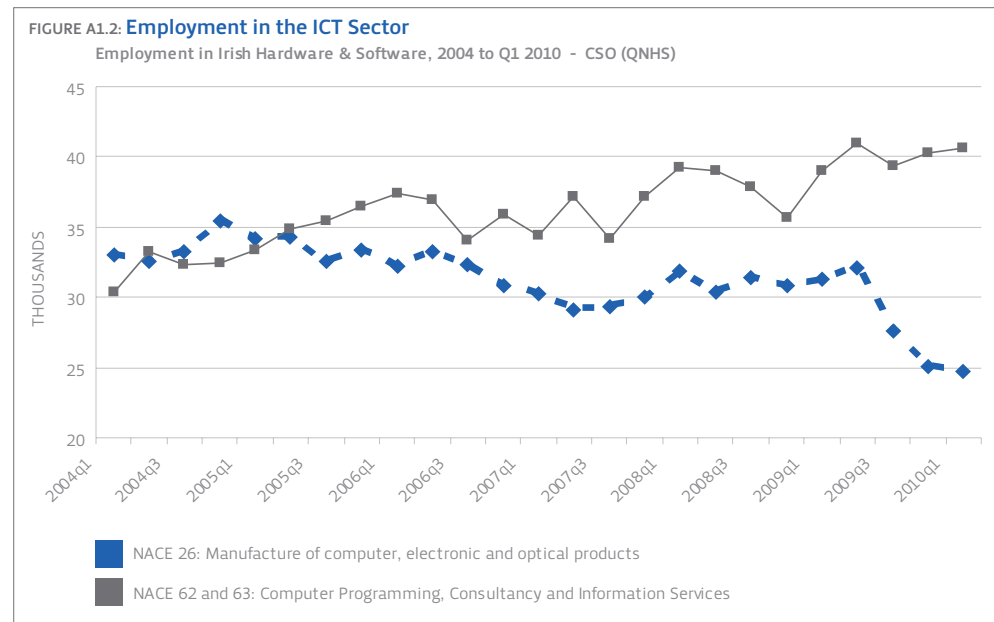


Source: CSO, Goodbody Economic Consultants

The success of the Irish ICT sector is the result of constant migration to higher skill, higher value activities. Globalisation has meant that many relatively low value-added activities, which once might have taken place in Ireland, are now located in economies at an earlier stage of development. The Irish ICT industry has continued to thrive and grow over the long term by constantly moving up the value chain to carry out higher value activities that require more highly skilled staff.

One indication of this has been the increasing importance of software in the ICT sector. Since 2004, the number of people engaged in ICT services, including software and IT consultancy has exceeded the number of people engaged in the manufacture of ICT products.

According to the CSO 40,600 people were employed in computer programming, consultancy and information services industries in March 2010. In contrast, the manufacture of computer, electronic and optical products employed 24,700 people in March of this year. Figure A1.2 below tracks employment in the service and manufacturing parts of the ICT sector since 2004.



Source: CSO, Goodbody Economic Consultants

Multinational firms investing in Ireland have always played a key role in our ICT sector. In 2010, seven of the ten largest ICT firms in the world had operations in Ireland. In Ireland, at the end of 2006 there were approximately 220 foreign-owned ICT enterprises employing 20 people or more people. These firms employed 25,698 in ICT manufacturing and 32,799 in software and services. They therefore accounted for 67.1 per cent of total employment in the ICT sector. More critically, they accounted for 85.5 per cent of Gross Value Added in the sector.

Developing the ICT sector remains central to national policy for economic recovery and development. The Government’s medium term strategy for economic recovery is set out in “Building Ireland’s Smart Economy”<sup>27</sup>. This set out five “Key Action Areas” to address the current crisis and return the economy to prosperity and growth:

- Securing the Enterprise Economy and Restoring Competitiveness;
- Building the Ideas Economy – Creating the “Innovation Island”;
- Enhancing the Environment and Securing Energy Supplies;
- Investing in Critical Infrastructure; and,
- Efficient and Effective Public Services and Smart Regulation.

Supporting and developing ICT and other high technology activities in Ireland is central to many of these actions. A key element of the strategy is large scale investment of public money in research and development, and improved incentives for multinationals to carry out research and development in Ireland. This is intended to promote the development of foreign-owned and indigenous firms operating in high technology sectors in Ireland. Much of this research is targeted at the ICT sector in general and is particularly relevant to Cloud Computing. Science Foundation Ireland has implemented this part of the “Smart Economy” strategy by funding the establishment of 29 research centres, including centres devoted to software engineering and advanced communications. In general, the ICT sector is central to the development of indigenous and foreign owned high technology industries in Ireland.

27. “Building Ireland’s Smart Economy: A Framework for Sustainable Economic Renewal” December 2008. Available at [www.taoiseach.gov.ie](http://www.taoiseach.gov.ie)

## Appendix 2 THE DEVELOPMENT OF CLOUD COMPUTING

### A2.1 Overview

Cloud computing is an innovative new way of managing and providing computing services, made possible by technological advances in communication and in the management of computer resources.

One useful formal definition of Cloud Computing is that produced by the US National Institute of Standards and Technology:

“Cloud Computing is a pay-per-use model for enabling, available, convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”<sup>28</sup>

A business or individual using “*Cloud Computing*” gets computing resources as and when they are needed and pays for them on a per use basis. The computer hardware and software used are located in a central data centre or data centres operated by a service provider, and are accessed by the user via high speed internet connections. A key feature of Cloud Computing is its scalability. If a Cloud Computing user needs more computing power this is available from the service provider on request, without delay or a requirement for capital investment. More servers and more working copies of the software in question are made available at the data centre to meet the needs of the user. When these resources are no longer being used they are automatically reassigned to other users of the data centre or left idle. The user only pays for the resources actually used, and has access to effectively infinite resources to meet peaks in computing power requirements.

Cloud Computing represents a huge change in the way that computing power is organised and bought. The change in approach involved is at least as large as that when enterprises started to use networks of personal computers to provide computing facilities to employees rather than simple terminals connected to central mainframes.

A change of this magnitude will lead to entirely new services and ways of doing business. For example, a large portion of internet use is now driven by access to streaming video on sites such as *YouTube* and social networking sites such as *Facebook* and *Twitter*. These services were not foreseeable when the internet and World Wide Web were first adopted. In the same way, the eventual uses and applications of Cloud Computing may not be foreseeable at this stage.

### A2.2 Cloud Computing Services

Some Cloud Computing services are already being provided, and three broad areas where Cloud Computing can be applied are emerging. These are:

- Infrastructure as a Service (“*IaaS*”);
- Platform as a Service (“*PaaS*”); and,
- Software as a Service (“*SaaS*”).

Infrastructure as a Service refers to a customer paying for the use of computer hardware at a remote data centre. The customer will have access to processing power, computer memory and storage at the data centre. All of the software used, including operating systems and applications will be provided by the customer. Amazon was a pioneer in Infrastructure as a Service, and offers a computing capacity service (Amazon EC2) and storage as a service (Amazon S3). Other firms such as IBM and HP have long provided hosting services to clients where they operate dedicated computer facilities on behalf of customers. These firms are moving to providing these hosting services on a more flexible Cloud Computing basis.

28. National Institute of Standards and Technology, information Technology Laboratory, USA, May 2009. Quoted in Department of Communications, Energy and Natural Resources “Knowledge Society Strategy – Technology Actions to Support the Smart Economy” July 2009.

Platform as a Service refers to a customer paying for the use of a development and delivery platform for software at a remote data centre. The service provider gives the customer access to the computer hardware and the operating system and programming language software needed to develop and run application software. The customer can use the platform to run the software for his or her own use, or can charge third parties for use of the software, i.e. can use the Platform to operate as a provider of Software as a Service. Suppliers of Platform as a Service include *Microsoft* with its “*Azure*” product and *Google* with *Google App Engine*.

Software as a Service refers to a customer paying for the use of a piece of application software running at a remote data centre. The customer accesses the software via the internet. This access can be achieved via a web browser running on the customer's own computer. However,, as the customer does not need computer processing power or storage on the device that they use to access the Software as a Service, they can also use simpler devices such as smart phones. *Google* pioneered Software as a Service for individual users with its *Gmail* and *GoogleApps* products. *Microsoft* also offers Software as a Service to individuals with such products as *Hotmail* and *Xbox Live*.

### A2.3 “Private” and “Hybrid” Cloud Computing Services

As described above, Cloud Computing usually refers to the procurement of computing resources as a service from a third party supplier. However, it is possible for a large scale of computing resources to organise their own in-house resources in a Cloud-like way. For example a large firm might centralise its computer resources in a data-centre or data-centres and have the operating parts of the company access these in house computer resources as and when they need them using a Cloud type interface. This is sometimes referred to as a Private Cloud Computing. Another variation on Cloud Computing might be for a firm to maintain in-house computing resources to meet the majority of its needs, and then supplement these with third party Cloud Computing resources at times of peak demand. This can be referred to as Hybrid Cloud Computing.

Private and Hybrid Cloud Computing aim to capture some or all of the benefits of standard (“Public”) Cloud Computing without having to rely on an independent third party supplier for computing resources.

### A2.4 Economic Scale of Cloud Computing

The idea of providing computer power as a service or a utility similar to electricity or water has been discussed for a long time. Amazon’s launch in 2006 of Amazon Web Service (“AWS”), an Infrastructure as a Service offering, represented the first large scale commercial implementation of Cloud Computing. Within a year most of the leading players in the software industry were developing products and the term “*Cloud Computing*” had gained wide currency.

By 2009 Cloud Computing was already a significant part of the overall market for information technology and services and was expected to be one of the fastest growing segments of the market.

- Analysys Mason estimates that the global market for Cloud based services for businesses will be \$12.1bn in 2010 and will grow to \$35.6bn by 2015<sup>29</sup>;
- International Data Corporation (“IDC”) estimates that revenues from Cloud Computing services reached \$16bn in 2009 and will grow to \$55bn by 2014<sup>30</sup>.
- Gartner estimates that worldwide revenues from Cloud services will be as high as \$68bn in 2010, and will increase to \$148bn by 2014<sup>31</sup>. These figures include Cloud Computing services provided to third parties and spending by companies on internal or “private” clouds where a company uses a Cloud Computing type approach to the organisation of their internal computer system;

29. Quoted in Forbes “Cloud Computing Is No Fad” 12th July, 2010.

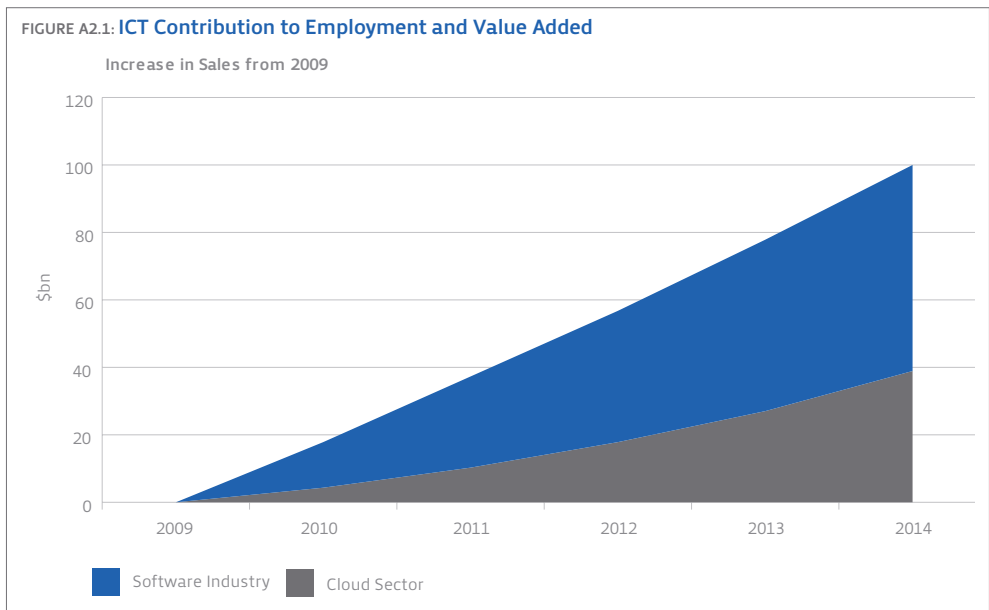
30. IDC Press Release 23rd June 2010.

31. Quoted in “Cloud Service Sales Worldwide To Exceed \$68B In 2010” [www.itchannelplanet.com](http://www.itchannelplanet.com) 24<sup>th</sup> June, 2010.

These estimates naturally vary somewhat as the future of an emerging technology is inherently difficult to assess. However, they are unanimous in predicting exceptional growth for the sector.

Although the revenues from Cloud Computing form a relatively low share of the total ICT market, they are substantial in themselves and the Cloud Computing sector is expected to account for a large share of the growth of the ICT sector over the coming years. This will create opportunities for new, export-based, activity and employment in Ireland. The future growth of Cloud Computing will create opportunities for indigenous firms to enter these new markets. It will also create new activities and business units in multinational firms, which could be attracted to Ireland.

The IDC report referred to above suggests that Cloud Computing accounts for approximately 5 per cent of software revenues at the moment. However, the Cloud Computing sector is forecast to grow at a rate of over 27 per cent per annum over the next five years. This is in the context of expected total sector growth of 5 per cent per annum. As Figure A2.1 illustrates this would mean that almost 40 per cent of the net new activity in the software sector by 2014 will be Cloud Computing related.



Source: IDC/Goodbody Economic Consultants

### Appendix 3 CASE STUDIES

As part of this study, case studies were prepared of some implementations of Cloud Computing. These covered:

- An implementation of Cloud Computing by a private firm highlighting the speed, low cost and flexibility of Cloud Computing applications (Aer Lingus Dynamic Route Maps);
- A new indigenous software developer using Cloud Computing to bring state of the art software technology to users. The Cloud model makes it possible to sell advanced specialist products to Small and Medium enterprises with limited budgets (Clavis Technology); and,
- New indigenous firms using Cloud Computing to deliver innovative services to a global market (HR Locker and Lucey Technology).

#### CASE STUDY: **Aer Lingus Dynamic Route Maps**

##### REQUIREMENT

Aer Lingus is an international airline that flies 10 million passengers per annum. Until 2010, the airline's website had only a static map: the map identified the airline's routes, but it did not incorporate a call-to-action that guided potential passengers from the map to the reservations and booking system. The airline saw this as a shortfall in their web offering, and sought a solution that would integrate with their booking system and offer a more interactive experience to passengers.

Any web application that was implemented needed to satisfy some key requirements:

- It needed to be scalable, so as to cater for peak traffic in times of high demand
- It needed to take up minimum bandwidth and computing resources on Aer Lingus' existing IT infrastructure.

##### SOLUTION

Aer Lingus commissioned software consultancy iPLANiT, a *Microsoft Certified Partner*, to deliver an interactive map. The new application was developed on Microsoft's Windows Azure. This is a PaaS offering that serves as a development, service hosting, and service management environment for cloud computing solutions. A team of three staff at iPLANiT designed and implemented the solution – which is known as Dynamic Route Maps – over a three month period between November 2009 and January 2010.

##### BENEFITS

The cloud computing approach has delivered a number of key benefits:

**Prompt Delivery:** There was a commercial need for an interactive route map so as to increase bookings and increase revenue. The application was designed and implemented in a short time-frame. As a cloud-based Software as a Service (SAAS) offering iPLANiT can now provide its service to other airlines immediately in a process that is as easy as creating an online account.

**Cost-Effectiveness:** By adopting a cloud computing approach, Aer Lingus saved on the capital cost of procuring, hosting, and managing its own physical servers to run Dynamic Route Maps on its Web site. Instead, the airline pays only for the computing power as they use it; but the solution can scale up for periods of peak demand.

**High Performance:** Users of the Aer Lingus website are located across the world, and it is essential that the website performs to a high standard without any time-latency for the user. The Windows Azure Content Delivery Network (CDN) avoids that latency by using a data centre in Dublin that feeds through Windows Azure to multiple other data centres to the nearest location to the user. If a cloud computing approach had not been used, the company would have had to purchase additional, expensive bandwidth in order to avoid poor performance.

CASE STUDY: **Aer Lingus Dynamic Route Maps**

CONTINUED

**Product Development with Global Reach:** Dynamic Route Maps is a solution that iPLANiT can offer on a global scale, without the need for local field support. As an application built by a *Microsoft Certified Partner* and deployed on *Microsoft* facilities, the product has credibility amongst potential customers as an enterprise-class service.

**Future Proofing:** Aer Lingus and iPLANiT are partnering on providing additional enhancements for the future. iPLANiT plans to extend the functionality in the future. For example, iPLANiT plans to integrate Bing Maps for Enterprise into the application. Bing Maps is a geospatial mapping platform that allows developers to create applications that layer location-relevant data on top of the map imagery. This will allow Dynamic Route Maps to deliver detailed zoom levels and to provide other information on the airline route map about nearby car rental agencies, hotels, and other attractions and places of interest.

CASE STUDY: **Clavis Technology****CLOUD COMPUTING DELIVERING KEY FUNCTIONS WHERE AND WHEN THEY ARE NEEDED**

Clavis Technology was founded in 2007 and released its software late in 2008. The company's products allow data to be validated and monitored in real time at all points inside and outside the enterprise where data is first captured or sourced. These products are delivered as Software as a Service (SaaS).

**PRODUCT AND MARKET**

High quality data is essential to the smooth running of processes. In addition, governments and regulatory authorities require increased levels of data to be assigned to products, especially consumer packaged goods. Most solutions that manage and check the quality of data for organisations do so as data is entered into an in-house Master Data Management application or portal. However, only a minority of the data used by an organisation is actually compiled in this manner as:

- ⦿ Organizations use a wide variety of forms, documents and spreadsheets to collect data, making it difficult to guarantee the quality of master data as it is created; and,
- ⦿ Data is no longer created at a single point within one organisation, and often comes from third parties.

Clavis Technology has developed software that enforces data quality controls wherever data is first created, whether by users within an organisation, or by external parties. Because the applications are hosted in the cloud, no specialist software is required by users. Users simply access a service as and when it is required.

**ADVANTAGES OF THE CLOUD APPROACH**

The use of cloud technology to deliver data quality solutions has several advantages:

- ⦿ The solution can be quickly and effectively delivered to an entire organisation and to relevant third parties;
- ⦿ The business rules and reference data used in an organisation can easily be developed by a large group of stakeholders in the client company;
- ⦿ Enhanced Data Security and Business Continuity: Clavis software is hosted across multiple, highly secure facilities, and systems are monitored around the clock to ensure that any problems are quickly identified and fixed.
- ⦿ Low demands on existing IT resources;
- ⦿ Maintains business focus;
- ⦿ Latest versions are always available; and,
- ⦿ Lower total cost of ownership.

**CASE STUDY: HR Locker****CLOUD COMPUTING AS THE IDEAL PLATFORM TO DEVELOP AND DELIVER NEW SOFTWARE**

HR Locker is the trading name of Assembly Point Ltd, a privately-held software company based in Cork. Assembly Point is a Web 2.0 provider of Human Resource Solutions to Business.

**PRODUCT AND MARKET**

Assembly Point's key product is HR Locker, a set of online tools that allows both large and small companies to manage their human resources. The product allows documents, employee records and contracts, annual leave and absence, electronic signatures, timesheets and reports to be stored and managed online. If required, the system can manage staff located in a range of global locations.

Larger companies have long managed many of their human resource (HR) with specialised software. However, such solutions are expensive and are not available at a low cost to smaller businesses: this makes it expensive and time consuming to manage staff, especially if they are distributed in several countries. HR Locker was developed to provide an affordable, easy-to-use system for businesses of any size.

**ADVANTAGES OF A CLOUD COMPUTING APPROACH FOR HR LOCKER**

There were several potential business models that HR Locker could have adopted

- (i) To host on their own, or virtual, infrastructure with a web hosting company. This would have been feasible at an early stage but would have proved very difficult to scale up.
- (ii) To install their application on the premises of their clients. This was regarded as a poor option because the sales and delivery process is too lengthy. There is also typically a heavy after-sales and support cost, which does not allow for a low cost model.
- (iii) To develop native in the Cloud. The cost comparison with the above option (i) is similar at an early stage but trends exponentially in favour of cloud solution as the business scales. The cost comparison is far superior to the second option (ii) above at all stages.

On this basis, the company decided from the outset that their solution would be developed using Cloud Computing that would allow them to scale the business as required and to quickly establish an international presence.

The product was built using a browser-based application on Windows Azure hosted in the cloud in *Microsoft's* data centres. This avoided the need to invest in hosting infrastructure and allowed the company to invest instead in software development, localisation and marketing. The use of Cloud Computing technology also gave reassurance and credibility with customers: all accounts include Secure Sockets Layer (SSL), data encryption and data back up as standard.

Like any start up, HR Locker faced a number of challenges in raising finance and convincing potential investors that the business could become profitable. It needed to minimise capital investment, quickly prove the product concept and demonstrate that the business was scalable. Cloud Computing helped HR Locker to overcome these barriers.

**ADVANTAGES OF THE CLOUD COMPUTING APPROACH FOR HR LOCKER'S CUSTOMERS**

The product itself needed to have a number of key attributes if it was to meet the needs of the market:

- ⊙ It had to be affordable and easy to use
- ⊙ The service had to be accessible from any location and at all times

CASE STUDY: **HR Locker**

CONTINUED

- ⦿ It had to be capable of being multilingual and internationalised.
- ⦿ It had to allow staff to electronically sign documents

Cloud Computing allowed HR locker to meet all of these needs. Having a product with a user-friendly interface available online meant that HR Locker could address markets in a range of different countries and their clients did not have to invest in server infrastructure, training or IT support and maintenance. It also meant that as the product developed and grew, existing customers automatically could benefit from upgrades.

All of the above factors, along with the elastic use of computer resources inherent in cloud computing, meant that HR Locker could be sold at an affordable price and on a pay per employee basis. HR Locker has calculated that the cost of managing, approving and administering annual leave requests falls from approximately €80 per employee per annum when done in the traditional manner with paper processes to €25 per year when using HR Locker.

CASE STUDY: **Lucey Technology****COMBINING SOFTWARE AND SERVICES TO DELIVER VALUE AND COST SAVINGS FOR CUSTOMERS**

Lucey Technology was established in February 2009 by co-founders, Ian Lucey and Joe Healy. The company has developed a range of offerings for the SME sector using a Cloud Computing approach. Lucey Technology now has over 200 clients.

**PRODUCTS**

Lucey Technology's current service offering covers two main areas: collaborative working and online payments.

**Collaborative Working**

The company has developed an Online Customer Engagement (OCE) platform which is implemented as an extension of a client's existing website. The OCE offers a number of tools such as unified communication that were previously only available to large organisations. Key features of the OCE include the following:

- ⦿ Communication tools such as instant messaging; Voice Over Internet Protocol (VOIP); and video conferencing.
- ⦿ Document sharing for such items as company accounts, sales orders, contracts, legal documents, quotes, technical drawings, patient records and media files.
- ⦿ Digital signatures that allow for documents and transactions that would have previously been signed off using a pen and paper to instead be approved remotely using digital signatures.

**Online Payments**

Lucey Technology also offers an online facility that allows SMEs to process credit card payments quickly and at a cost-effective rate. Traditionally, smaller firms with modest volumes of online transactions have been obliged to pay up to 5% of a transaction value to the bank providing the processing facility. Lucey Technology has negotiated a reduced rate of 1.24% with a merchant bank that allows them to offer a low-cost processing facility to small businesses. Payments are processed in data centres using *Microsoft Great Plains*.

A typical example of a small firm using the service would be a high-street accountancy firm that wishes to save costs, offer a better service and ensure prompt payment of their fee.

CASE STUDY: **Lucey Technology**

CONTINUED

The firm uploads their logo and Web links to the OCE platform and invites their clients to log and interact with them via an internet portal. Instead of posting out tax returns for sign-off, the accountants can load them up on their mini site and have them approved by the client using a digital signature. If a professional fee is also to be paid at that time, the client can be asked to do so using the online payment processing facility.

**MARKET**

Lucey Technology offers its services in Ireland and abroad, and over 70% of its clients are now based outside of Ireland. The company's primary market is in Professional Services such as accountants and solicitors firms. About 60% of clients have signed up simply to take advantage of the online payments facility. Lucey Technology's pricing structure begins from €10 per staff-user per month with additional monthly charges for extra functions. There are no other charges such as set-up costs or up-front fees, and so clients can avail of the service without any initial investment. There is no limit to the number of customers a business can invite to work with OCE

**COST SAVINGS FOR CUSTOMERS**

An SME using these services from Lucey Technology can make significant savings compared to an in-house approach. A medium sized business with ten employees might have three servers: one each for email, file storage and sharing; and applications such as accounting packages and Customer Relationship Management. The cumulative capital cost of ten high-end computers (€6,000), a network of servers (€12,000-€14,000), and applications software (€2,000-€10,000) would be in the order of €20,000 to €30,000, and these might be expected to last three to four years. With such equipment on premises, the company would also be required to have a support and maintenance agreement with a local ICT firm that would cost in the order of €5,000 per annum. By moving all of its activities into the cloud, the company would now invest in lower specification computers (€4,000), have a greatly reduced support and maintenance agreement, and pay an annual subscription of about €6,000 for the remaining infrastructure with associated applications. Such a scenario would require that all of the applications used by the firm were available on the cloud, but it serves to demonstrate the scale of savings that cloud computing can bring to certain companies.

**STATE OF THE ART TECHNOLOGY FOR CUSTOMERS**

Lucey Technology developed their web-facing platform - Online Customer Engagement (OCE) - in-house. OCE allows small firms to avail of a variety of *Microsoft* products that are typically used only by large organisations. Clients using the OCE can now avail of products such as *MS Sharepoint*, *MSN*, *Great Plains*, *Windows Live* and *MS Dynamics*. They do so using the familiar user interfaces of *Microsoft Outlook* or *Microsoft Internet Explorer*. Thus, the service offering developed by Lucey Technology allows small firms to avail of cutting edge tools at a low entry price, using a *Microsoft* architecture with which they are familiar, and using a solution that complements their existing systems.

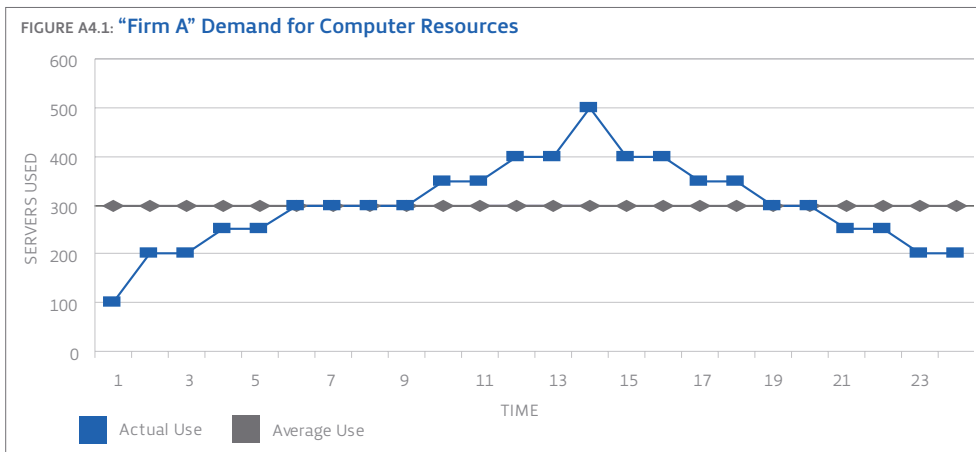
256 Bit encryption comes as standard for Lucey Technology customers, and transactions are governed by *VeriSign* and *Microsoft Passport*. Furthermore, the data centres that house the solution provide 9 layers of data security and are *CyberTrust* certified with secure access via SSL. These data centres operate operational practises that are IT Infrastructure Library (ITIL) and *Microsoft Operations Framework* (MOF) compliant. Service Level Agreements provide 99.9% uptime.

**Cloud Computing has allowed Lucey Technology to develop products that bring state of the art technology to SMEs in an affordable package.**

### Appendix 4 EFFICIENT MANAGEMENT OF PEAK DEMAND

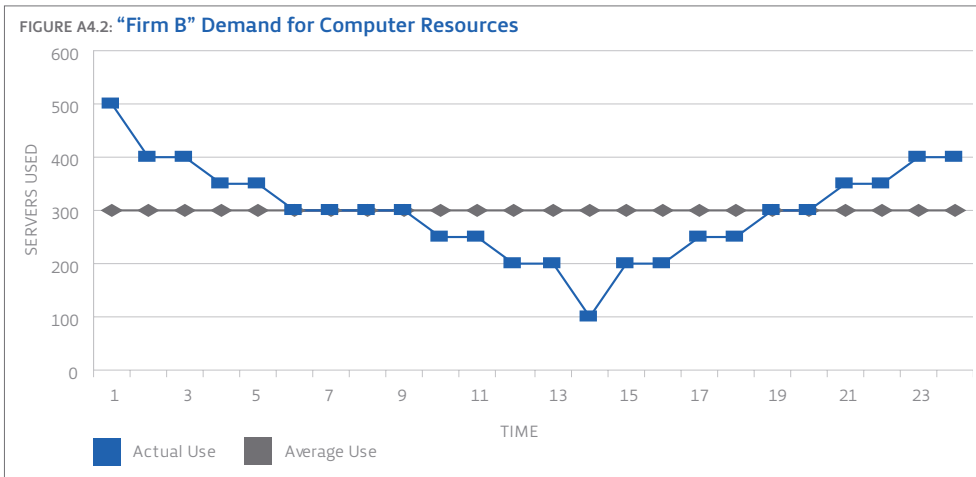
An individual firm's need for computing power will vary over time. For example payroll calculations might be performed on a weekly or biweekly basis or an online retailer might be much busier in the weeks leading up to Christmas than at any other time of the year.

The diagram below presents a stylised example of this. "Firm A" has an average need for computing power equivalent to 300 servers operating around the clock. However, its actual use varies over the day as shown in the graph. Because of this variability the firm must buy and operate 500 servers in order to meet peak demands for computer resources.



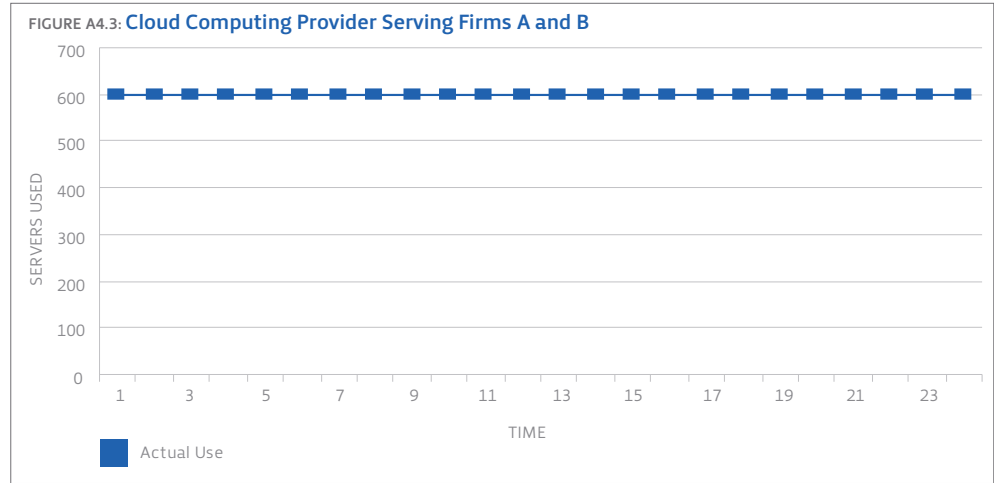
Source: IDC/Goodbody Economic Consultants

Firm B has the same average use of computing power but a different pattern of use. If Firm B provides its own computing power in-house it also must buy and operate 500 servers.



Source: IDC/Goodbody Economic Consultants

If Firm A and Firm B both move to Cloud Computing and use the same provider, that provider faces the following demand for computing power through the day.



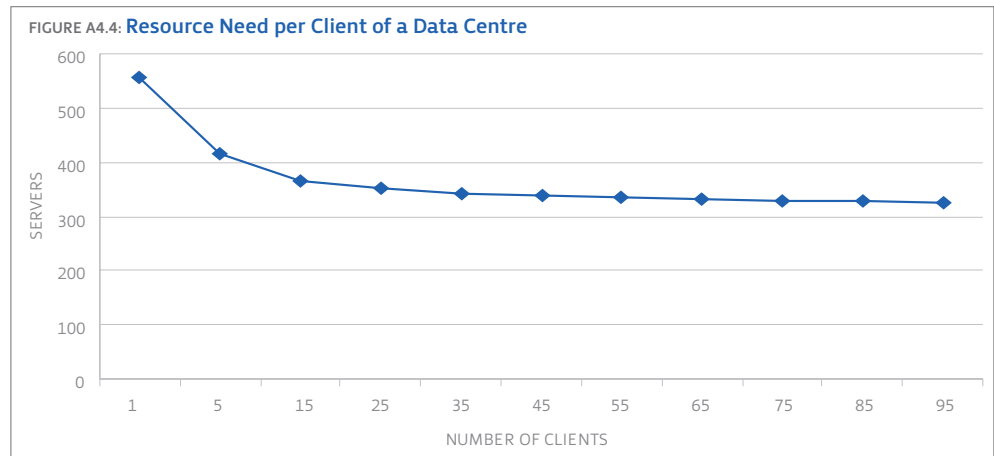
Source: IDC/Goodbody Economic Consultants

The peaks and troughs of the two firms needs have exactly cancelled each other out. The Cloud Computing provider faces a constant demand for computing resources of 600 servers an hour. The Cloud Computing will only have to buy and operate 600 servers to meet the computing needs of the two firms. The cost of the computer resources needed by these firms has reduced by 40 per cent.

This is obviously a highly stylised example. However, the insight that combining the computing needs of more than one firm reduces the variability of demand and so reduces the resources needed applies generally.

The graph below illustrates how the cost of serving a client of a data centre will reduce as more clients are added. This model makes the following assumptions:

- Each client has a standard average need for computing power of 300 servers;
- The client’s actual use of computer resources varies randomly around this average with a standard deviation of 100 servers; and
- Clients require 99.5 per cent coverage from their computer system.



Source: IDC/Goodbody Economic Consultants

## Appendix 5 SUPPORTS AVAILABLE TO INDIGENOUS CLOUD FIRMS

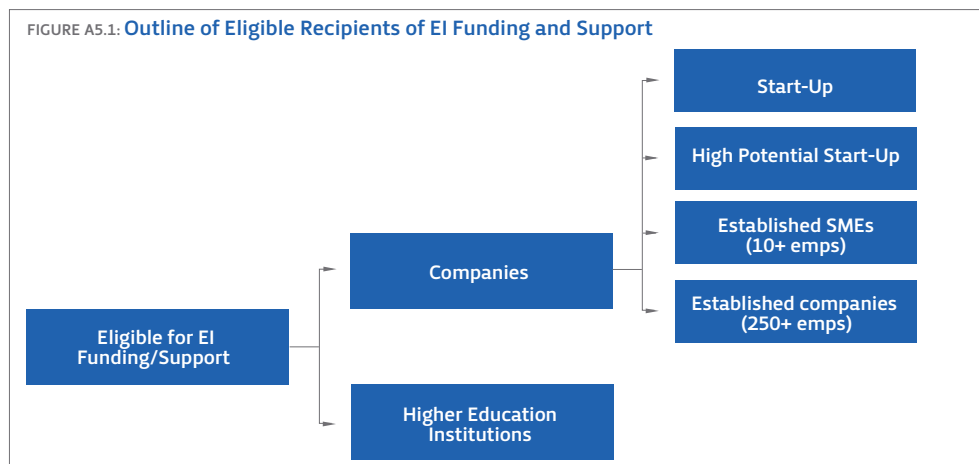
### Introduction

Enterprise Ireland (EI) is the state agency in Ireland with responsibility for supporting the development of manufacturing and internationally traded services companies. The Agency provides funding and supports to companies including entrepreneurs with plans for a start-up as well as companies expanding their activities in a bid to improve efficiency and grow export sales.

There are four broad company types eligible for EI support dependant on the company's stage of development. These are namely:

- Businesses with a Start-up idea;
- Businesses with High Potential Start-up ideas;
- Established SME companies (with 10+ employees); and,
- Larger established companies (with 250+ employees)

In addition, researchers and academics based in Higher Education Institutions are also eligible recipients of EI funding and support. See Figure 5.1.



Source: IDC/Goodbody Economic Consultants

### Enterprise Ireland Funding and Supports available to Companies

As outlined above, the type of EI funding and support available to companies is determined by a company's stage of development.

#### Start-Ups

Funding and support is made available to individuals with new business ideas in Ireland through the network of 35 City and County enterprise boards located throughout the country. Supports available include:

- Start-your-own-business training courses;
- Market research information;
- Business planning advice and templates;
- Access to experienced business mentors; and,
- Feasibility grants and co-investment for your plans.

## High Potential Start-Ups

Start-up businesses with the potential to develop innovative products or services for sale on international markets and the potential to create 10 jobs and €1m in export sales within 3 to 4 years of starting up, can qualify for assistance from Enterprise Ireland as a High Potential Start-up (HPSU).

HPSU clients are initially assigned an EI Development Adviser. EI funding available to HPSUs is offered in three ways. Initially grant funding is available to help build an investor-ready business plan. Once the HPSU has developed a sound business plan and identified investors, they can apply to the Innovative HPSU Fund for an Enterprise Ireland equity investment. Having secured the necessary investment to start the business, further supports are available to assist in the implementation of key aspects of the business plan, including:

- **The Business Accelerator Programme** - The Business Accelerator Programme is a programme designed to support EI clients targeting worldwide markets. Business Accelerators are industry experts within a specific sector and market, with the experience, knowledge and contacts to support a company's expansion and development into an export market.
- **iGAP** - The Internet Growth Acceleration Programme (iGAP) is an intensive management development programme aimed at high potential internet companies. Over six months, iGAP equips managers with the practical tools needed to formulate international growth plans and scale their businesses through the use of experienced facilitators and implementation coaches.
- **First Flight Programme** - The First Flight Programme offers tailored assistance to help companies research, prepare and develop an export strategy by making available workshops, business intelligence and mentors.
- **Excel at Export Selling** - Excel at Export Selling is a series of workshops offered to HPSUs aimed at embedding the tools of good international selling practice into their sales teams.
- **Mentor Grant** - The Enterprise Ireland Mentor Network was established to help companies identify and overcome obstacles to growth. Mentors are assigned to companies to provide tailored advice, guidance and support, to help companies accelerate growth and build management capability.
- **Business Expansion Scheme Certification** - The Revenue Business Expansion Scheme (BES) allows individual investors to obtain income tax relief on investments made, in each tax year, into BES certified qualifying companies. Enterprise Ireland has the authority to certify certain HPSU client companies as qualifying companies in respect of the BES.

## Established Companies – Small and Large

The level of EI funding and support made available to established companies is determined by the client's:

- need for financial support for a project;
- potential employment and sales growth;
- regional location; and,
- previous funding received.

Client companies are initially assigned a Development Adviser (DA) who act as a liaison between the clients and EI as subsequent applications for funding and support are made. The types of EI supports available fall under the following five headings:

- Sales and Marketing

- Research and Innovation
- Productivity and Efficiency
- Management Development
- Expansion

Varying levels of support are available, according to whether the company is a SME (with between 10 and 250 employees) or whether the company is large in size (250+ employees).

### El Funding and Supports and their Applicability to Cloud Computing Companies

Many of EI's supports are geared towards the traditional notion of companies that have, or are in the process of developing a product or service for sale in export markets. There are substantial supports available to these companies to develop their business and selling capabilities in international markets.

There are EI supports available. However, that could be availed of by Cloud Computing companies as they currently stand. There are also supports available that could be amended so as to be useful in the future to companies moving into Cloud Computing.

Existing EI supports that could currently be availed of by Cloud Computing companies include:

- R&D Fund – small projects
- R&D Fund – large projects
- R&D Fund Stimulation Grant
- Innovation Partnerships
- Telecoms Standards Initiative

Other supports, if amended so as to incorporate Cloud Computing expertise, could be of benefit to Cloud Computing companies, these include:

- **Mentor Assignment** – mentors with Cloud Computing expertise could be made available to EI clients;
- **eBusiness Management Initiative** – consultants and trainers with Cloud Computing knowledge could be made available to EI clients;
- **R&D Advocates** – Advocates with Cloud Computing knowledge could be made available;
  - **Lean Start** – Cloud Computing could be developed as a business process improvement methodology in a similar fashion to Lean and Agile;
  - **Lean Plus** – Grants could be made available to assist companies undertake a Cloud Computing project;
  - **Lean Transform** – Grants could be made available to assist companies undertake extensive Cloud Computing projects;
- **Key Manager** – Key Managers with Cloud Computing expertise could be made available;
- **Transform Programme** – Cloud Computing could be incorporated into the educational Transform Programme.







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