

Executive Summary

the silver lining

Economic Potential of Developing Cloud Computing Industry in Northern Ireland

Prepared by Oxford Economics

For Whisple Cloud Services

Supported by EMC and Invest NI

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The global cloud computing services market is forecast to grow at 18.9% annually from 2011 to 2015, more than 2.5 times faster than its traditional products and services counterparts.

Northern Ireland has made and continues to make significant investments in its underlying communications infrastructure, creating one of the world's best digital platforms for the development and delivery of cloud computing services.

We have set out in this report a potential growth scenario whereby if Northern Ireland focuses on developing a cloud computing cluster to exploit the global growth in cloud computing and its world class digital platform, it could double employment within the software and IT services sub sector by 2020 with an extra 10,200 jobs above the current Oxford Economics regional model baseline.

It is estimated that under this high growth scenario the region will benefit from the creation of an extra 16,200 jobs to the Northern Ireland economy by 2020 when taking into account direct, indirect and induced effects of accelerating the development of a cloud computing cluster, with a corresponding £1.2 Billion financial boost to the economy.

Whisple will help lead a programme of action in cooperation with key stakeholders across Northern Ireland to develop an integrated cloud computing cluster strategy to include data centre facilities, G-Cloud, FDI, Venture Capital, Skills and R&D in order to achieve these economic development goals.

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Cloud Computing – a global opportunity

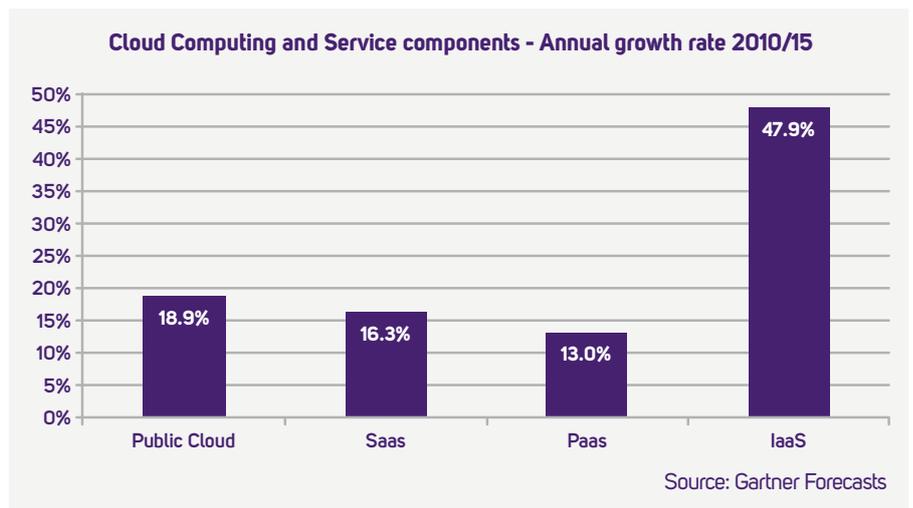
Cloud computing is a profound and evolving paradigm shift that is changing the way Information and Communications Technology (ICT) services are delivered and one with the potential to transform business opportunities across the economy.

What is Cloud Computing?

Cloud Computing is a network based set of ICT services with pooled and elastic computing resources (e.g., networks, servers, storage and applications) that can be self-provisioned (with minimal management effort or service provider interaction) on-demand (up or down) as and when required, with charges made against metered usage. The US National Institute of Standards and Technology defines a number of Service and Deployment Models for cloud computing, as set out in the following table.

Service Models	Deployment Models
<p>SaaS - The provision of software applications running on a cloud infrastructure. The consumer accesses applications through thin client or a program interface. The provider manages the underlying cloud infrastructure.</p>	<p>Private - The cloud infrastructure is provisioned for exclusive use by a single organisation with multiple users. It may be owned, managed and operated by the organization or a third party and may exist on or off the premises.</p>
<p>PaaS - The provision of a platform to support the deployment of consumer-created or acquired applications. The consumer has control over the deployed applications. The provider manages the underlying infrastructure.</p>	<p>Community - The cloud infrastructure is provisioned for exclusive use by a specific community of users from organizations that have shared concerns.</p>
<p>IaaS - The provision of processing, storage, networks etc where the consumer is able to deploy and run arbitrary software. The provider manages the underlying infrastructure while the consumer has control over operating systems, storage and deployed applications.</p>	<p>Public - The cloud infrastructure is provisioned by a service provider for use by the general public.</p>
	<p>Hybrid - The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public).</p>

There has been an increasing amount of attention at examining the implications of the rapid growth of this technology on specific economies, including a recent study in the Republic of Ireland that anticipates the sector could create 8,300 direct jobs and create up to 2,000 businesses across the wider economy by 2014¹.



Who is pioneering cloud computing?

Pioneers of cloud computing, including Salesforce.com, Amazon Web Services (AWS) and Rackspace Hosting are becoming, in relative terms, large vendors and their brands increasingly well known.

These big cloud services brands have also been growing at a very rapid rate compared with the historical growth of their traditional counterparts. Last year Salesforce.com became the first enterprise cloud computing company to achieve \$2bn in revenue, with full year revenue (to 31 January 2012) at \$2.27bn being a 37% growth over the previous year; Salesforce.com are now poised to deliver the first ever \$3bn within this financial year. Although Amazon do not publish separate revenue figures for AWS, many analysts now believe that annualised revenues for AWS have

surpassed \$1.2bn and are heading very fast towards the \$2bn milestone at an annual growth rate exceeding 50%. Meanwhile Rackspace Hosting have recently announced their first quarter 2012 results with revenue in the quarter of \$301m, a 31% growth over the previous 12 months.

The importance of knowledge

The NI Knowledge Economy Index³ was launched in Autumn 2011 by NISP CONNECT to provide a set of indicators to track the health of the Northern Ireland knowledge economy⁴ and help inform future policy.

An ambitious goal has been set to transform Northern Ireland's knowledge economy into a global player that can have a transformative effect on the entire economy by increasing direct and indirect employment and GVA and rebalancing private and public sectors.

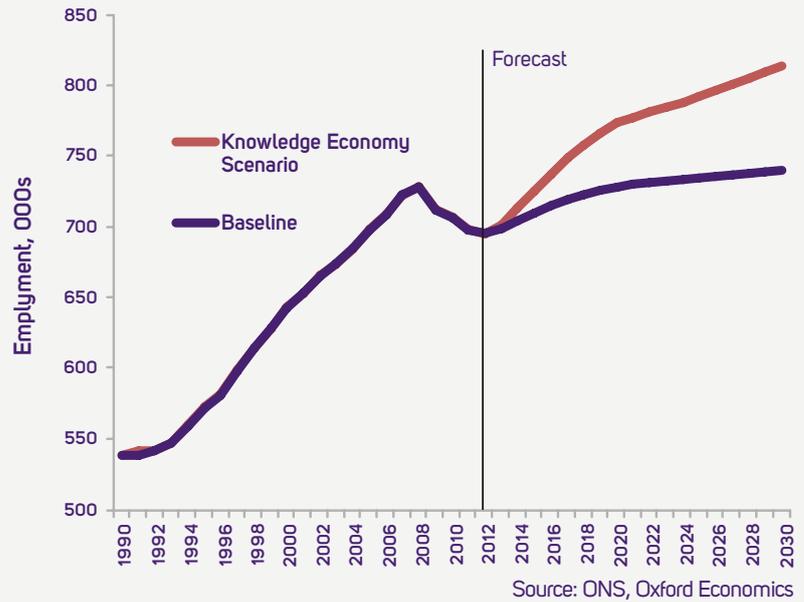
A number of targets were developed by an expert panel from the Science Park and the private sector earlier this year to guide such a transformation⁵. These included amongst others (over the period 2009/2030):

- 40,700 more people employed directly in the knowledge economy;
- 5,000 more knowledge economy businesses;
- Growing venture capital from £12m per annum to £90m per annum; and
- Over doubling the current levels of annual R&D to £1bn per annum.

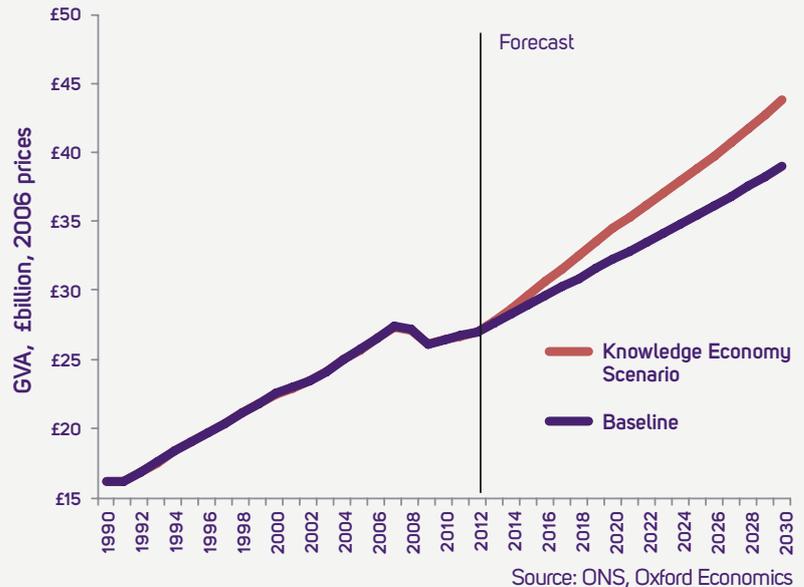
The total impact of developing the knowledge economy along these lines could be as much as 74,000 jobs (including those in the knowledge economy) above the baseline and £4.8bn of extra GVA generated across the entire Northern Ireland economy by 2030⁶.

Today within the broad knowledge economy sector, Northern Ireland enjoys strengths in a number of specialist areas each containing world class firms. These specialist areas include: transport and defence; software and digital content; manufacture of computing and electronics; and life sciences. Building on these comparative strengths and broadening the sector's reach into new and evolving areas of the knowledge economy will be necessary to realise the full economic potential in Northern Ireland.

Total Employment - Impact of Northern Ireland Knowledge Economy Scenario



Total GVA- Impact of Northern Ireland Knowledge Economy Scenario



³ To view the full report, please refer to <http://www.nisp.co.uk/wp-content/uploads/2011/10/Northern-Ireland-Knowledge-Economy-Index-Baseline-Report-20113.pdf>

⁴ In the Knowledge Economy Index the knowledge economy is modelled on the original CONNECT sectors used in San Diego and defined as an aggregation of the following sectors: Pharmaceuticals and biotechnology/life sciences; Medical devices; Software & digital content; IT services; Telecommunications; Computing and advanced electronics; Other technical services; and, Aerospace and other transport equipment. These represent research intensive sectors where new ideas, new products and new processes are key determinants of competitiveness

⁵ Please note these targets have not been published but are consistent with the Knowledge Economy Index baseline report.

⁶ Based on updated analysis by Oxford Economics following the final CONNECT targets.

Challenging economic context

Northern Ireland (NI) has experienced the impact of the recession, perhaps to a greater extent than any other UK region. Pre-recession, NI enjoyed a consistent period of normalisation with a steady rise in employment levels and a significant housing boom. Consumer and government spending provided major injections into the local economy which in turn created more job opportunities and attracted new migrants to the region.

However according to Oxford Economics baseline growth², employment growth is not expected to return until 2013. Furthermore, jobs growth is dependent on a limited number of sectors, particularly business services, whilst the public sector will remain a dominant employer.

It is in this context that the NI Government is implementing the Economic Strategy which provides a vision for 2030 where the region will become a globally competitive economy with a strong private sector, increased employment and prosperity. There is an emphasis on achieving this through significantly increasing exports, private sector growth and increased

global competitiveness. Importantly, knowledge based sectors such as telecommunications & ICT will be crucial for promoting private sector and export led growth. It will be fundamental to address underlying structural issues, such as the balance between private and public sectors, will be key to addressing long term economic stability.

Cloud computing could form an important sub-sector of the ICT sector and wider knowledge economy

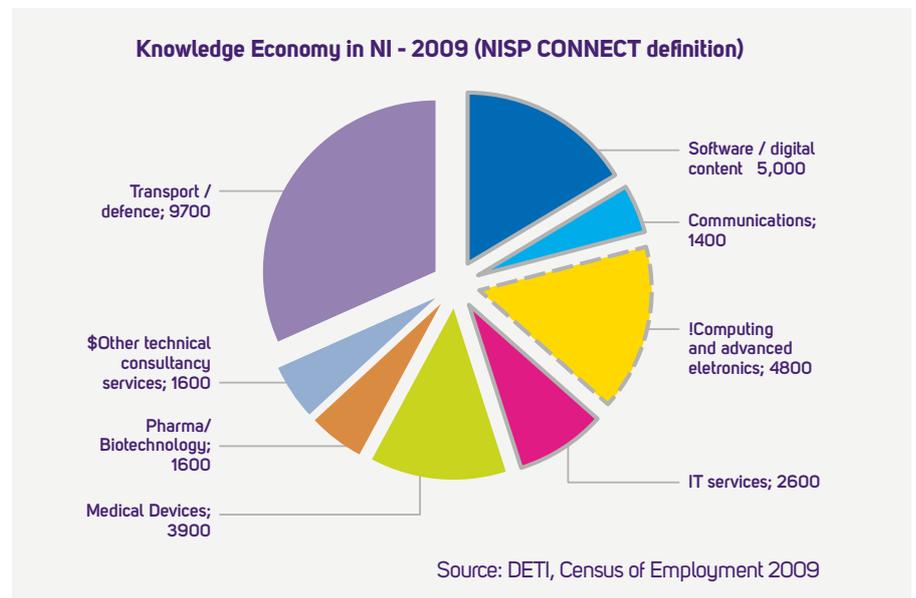
Moving forwards, it is crucial that NI examines tangible ways in which it can achieve growth in the knowledge economy by developing new sectors such as cloud computing that can make an important contribution.

NI has had many strategies and targets in the past but has failed to meet a number of these targets because it has not explored in enough detail how they can be tangibly met. The world remains highly competitive and small nations, such as the Republic of Ireland, are looking to grasp an advantage in emerging sectors. For example, it was recently announced that the ROI government are planning to invest €1.2m into a Cloud Computing Technology Research Centre, which will bring academic researchers together aimed at generating business ideas and boosting growth in the sector.

The telecommunications & ICT sectors are highlighted as key areas for potential for growth within NI, alongside agrifood, advanced materials, advanced engineering, advanced manufacturing and life sciences, as set out in the NI Economic Strategy (as identified by the science/industry MATRIX panel).

The ICT sector is a key driver of the NI economy not only in terms productivity, employment and skills, but also its contribution to the value added of many other sectors in the economy including financial services, security, healthcare and many consumer products. Importantly, this is demonstrated by cloud computing, which could have significant productivity impacts across the entire economy (discussed in the full briefing paper to be published shortly).

Today the ICT sector (using the latest figures from DETI's (Department of Enterprise Trade and Investment) Quarterly Employment Survey⁷) accounts for approximately 12,200 employee jobs and 1.7% of the NI total. The NI Knowledge Economy Index included a number of sub-sectors incorporating at least some activities across ICT including IT services, software and digital content, communications and computing & advanced electronics. As shown below collectively these accounted for 2% of total employee jobs in 2009⁸.



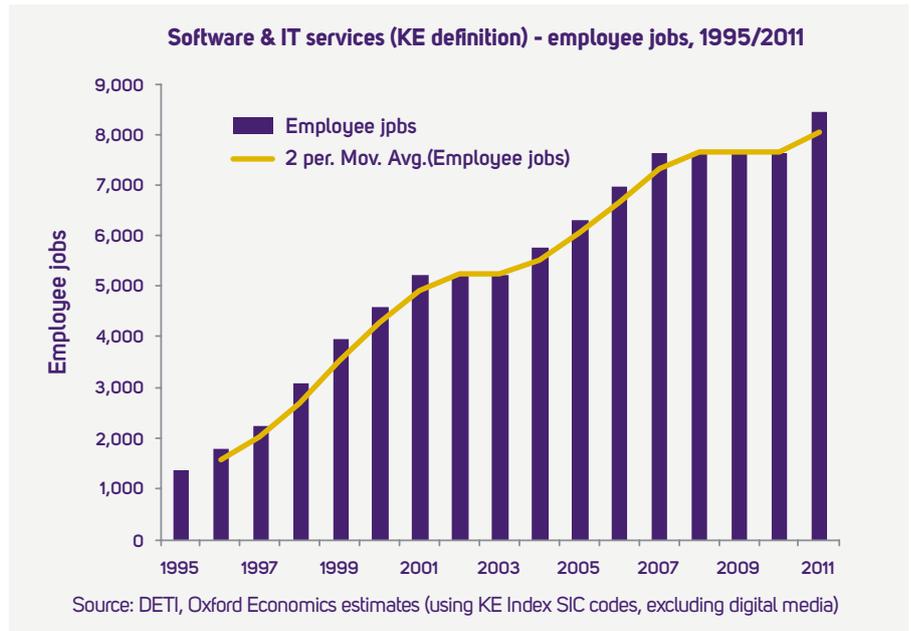
⁷ Based on SIC 07 codes 61, 62 and 63.

⁸ This total excludes self employment which is captured in other data sources that are less reliable at this level of SIC detail.

For the purposes of this paper the contribution of a cloud computing cluster is modelled against the growth it could deliver for software and IT services following the NI Knowledge Economy Index definition⁹. As shown below this sub-sector has experienced good growth over the last ten years, with growth only slowing down around the dot.com crash and the latest recession. It has been one of the few sectors that is still doing well and remained resilient to the current macroeconomic environment and is actually experiencing skill shortages.

In 2008, the Matrix ICT Horizon Panel published its recommendations for accelerating the future growth of the ICT sector in Northern Ireland through a focus on the region's niche strengths and capabilities. The Panel highlighted the key areas of technical strength as including software development, a high level of skills in new and emerging technologies, and the world-class ICT R&D expertise in our universities. It further highlighted the underpinning features of these key strengths as being agility, proximity, language and multidisciplinary.

The Panel recommended that the ICT sector focus on three areas, namely packaged application software, nearshoring (IT and Business Process Outsourcing) and high performance embedded systems. It also set out target global customer sectors, which for software and nearshoring included the financial services, telecommunications and healthcare sectors. SaaS is the new cloud paradigm for the delivery of packaged application software and is a natural progression for the NI software development sector focus envisaged by the Matrix ICT Horizon Panel; whereas PaaS and IaaS are the natural progression for its IT Outsourcing focus, whilst cloud computing also provides a new platform for the delivery of Business Process Outsourcing.



Over recent years Northern Ireland has made and continues to make significant investment in its underlying communications infrastructure creating one of the world's best digital platforms, which in a global cloud computing market, is an invaluable asset; this investment includes:

- The direct transatlantic Kelvin link, which complements the existing link of the island of Ireland to North America and also the numerous links via the mainland UK to the rest of Europe and the world.
- The Next Generation Broadband programme, which extends fibre to a significant proportion of the exchanges in Northern Ireland and onward to the street boxes.
- Previous waves of investment in core fibre capacity across Northern Ireland, resulting in a situation where approximately 95 per cent of the population is within three km of fibre access.

The Digital Northern Ireland 2020 programme has, following extensive consultation, proposed and is helping to progress a number strategic projects to exploit proactively the potential of Northern Ireland's digital platform, to maximise economic growth, improve quality of life

and assist social regeneration. Although all of these strategic projects are relevant to enabling the growth of cloud computing and the ICT sector in Northern Ireland, the specific cloud computing projects identified in the original DNI 2020 report are the Global Cloud Computing Node and Cloud R&D Centres, as well as the Data Centre Facilities project that will deliver the cloud computing platform requirements. The DNI 2020 report further envisaged how these projects could be delivered, at least in part, through the development of a cluster of cloud computing companies (or "cloud computing ecosystem"). DNI 2020 highlights priority target customer sectors as financial services, like the Matrix ICT Horizon Panel, and extends the target areas to include digital media and government, in particular health and education.

Whisple Cloud Services was created by a number of NI ICT companies to bring together cloud computing expertise as part of Invest NI's collaborative network programme, a programme that includes DNI 2020 and whose development has included taking on board the Matrix Panel recommendations. Whisple's objective is to help drive forward the cloud computing opportunities in NI, including those identified by DNI 2020.

⁹ Using the following SIC codes: Software (8210 Publishing of computer games, 58290 Other software publishing, 62011 Computer programming activities, 62012 Business and domestic software development, 63120 Web portals) and IT services (62020 Computer programming, consultancy and related activities, 62030 computer facilities management, 62090 other information technology and computed service activities and 63110 Data processing, hosting and related activities).

So how might cloud computing affect the NI economy?

Understanding how new waves of technology interact with the economy is very complex, since they not only open up new markets directly related to new technology products and services but can also bring about fundamental productivity shifts across the entire economy, which are often very significant.

Regardless of these complexities it is still important to investigate the scale of potential reward that new areas of growth offer, to enable a proactive approach towards policy.

In summary it is helpful to categorise the key economic impacts likely to occur from cloud computing into two main areas (as depicted in the Figure below):

- **Direct economic impacts** linked to NI's ICT industry capturing a share of the global market for cloud computing services, generating additional output, jobs and export opportunities. The degree of direct economic benefits will depend on how well NI is placed to capture new economic activity opened up by cloud computing to enable a new cluster of activity. The direct impacts will originate from all or some of the following: the growth of existing ICT companies who move into cloud computing, new businesses created to exploit the opportunities and potential FDI (Foreign Direct Investment) into NI. This will include both firms supplying cloud computing services but also those involved in the infrastructure to enable cloud computing.

- **Catalytic economic impacts** can be thought of as impacts that are spillovers and have the capacity to affect other areas of the economy. There are a number of potential channels by which cloud computing could generate positive economic impacts across the economy, including:

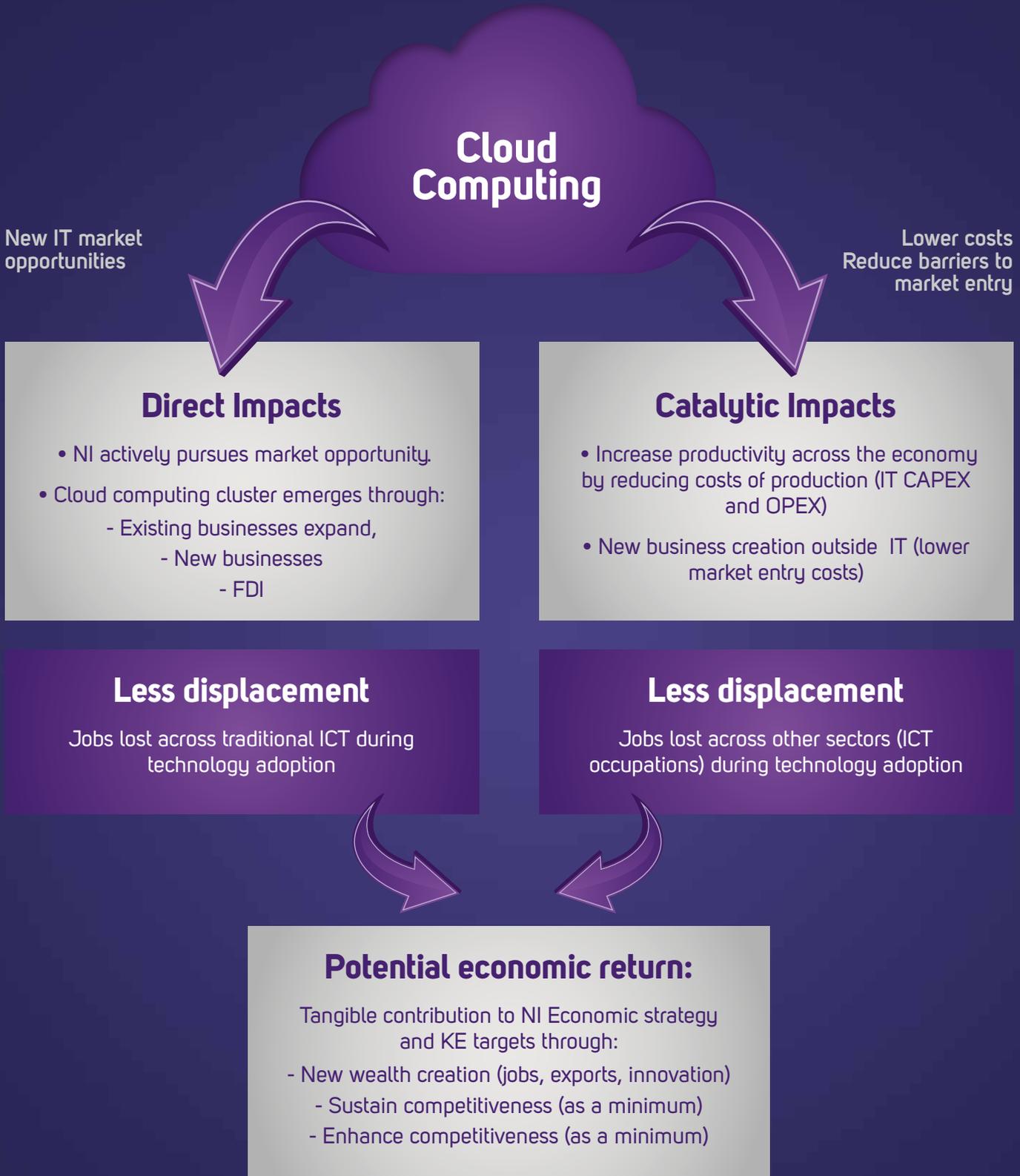
- Revolutionising operating costs by reducing the fixed ICT costs within firms, with significant benefits for competitiveness that could enhance further growth.
- Reducing market barriers to entry and promoting new business creation across the economy (outside of ICT).

There is a wide body of academic literature on this subject which is summarised further in the full briefing paper.

Finally, reference must be made to displacement as all new areas of economic activity are disruptive to the status quo and cloud computing is no different. It is not unthinkable that cloud computing will to some degree displace traditional ICT jobs within the ICT industry and within individual firms in other sectors, through changing cost and delivery structures. The role of displacement is considered further in the full briefing paper¹⁰.

The research has considered the potential direct impacts in detail for the software and IT services industry as a whole, but a full assessment should examine the overall 'net' jobs position fully covering catalytic impacts and the level of displacement. Importantly, a cloud computing strategy should still look at how to promote cloud computing across other sectors (particularly the public sector and the Business Process Outsourcing sector) and how to limit displacement (the full briefing paper discusses these aspects further).

¹⁰ This research has focused on the direct impacts of developing a cluster only rather than the wider catalytic impacts and potential for displacement. Although these are very interesting and significant areas they are out of the scope of the full briefing paper.



Modelling the scale of opportunity for NI

Assessing the potential economic return of cloud computing to the NI economy has many different dimensions, meaning that modelling the economic impact is complex and subject to important caveats. Consequently, the range of estimates presented here should be seen as indicative rather than absolute.

Given the infancy of the cloud computing sector, the activities within it that are not directly captured by Standard Industrial Classifications (SIC) and there is a lack of data on its current size within the ICT sector (both in NI and internationally). The direct impacts have been modelled in terms of how an active cloud computing strategy could lead to higher growth within the software and IT services sector (KE definition) as a whole, by the creation of a new cluster of services and markets delivered by existing or new ICT firms. The analysis is to provide an indication of the relative scale of potential economic return rather than an exact economic impact assessment.

The potential impact of scale and economic return to NI from developing, or not developing, a cloud computing cluster has been modelled by examining the difference between the baseline forecast for the software and ICT services industry (using the KE definition described earlier) and a higher growth scenario that assumes a cloud computing cluster develops.

- **A Baseline Scenario** where the software and IT services (KE definition) grow in line with the overall projection for the ICT¹¹ industry within Oxford Economics regional model, driven by the national and sectoral trends across the UK economy. Under the baseline scenario cloud computing still develops to some degree in NI (given its rapid deployment and centrality to the software industry) but under this

scenario NI is not assumed to actively target and develop the cloud computing sector over and above what may happen anyway. The key impacts are the difference between the baseline growth and accelerated growth under the alternative scenario (described below).

- **High Growth Scenario:** a more ambitious scenario where NI's software and IT services (KE definition) industry grows at the global cloud computing software rate given a targeted strategy to promote and develop the industry. This rate is based on the global Gartner forecasts and have been accepted by the consulted stakeholders as ambitious but realistic. More specifically:
 - From 2011 onwards growth in the industry accelerates over 2011/2014 to reach 16.3% per annum by 2015 and maintaining this rate up until 2017, before moderating to 6% per annum up to 2020. This is in line with the annual growth rate from Gartner for the global SaaS (software) and is actually the most conservative of the forecasts across the different service models. The scenario also assumes that ICT services, particularly in relation to infrastructure services are now needed to support cloud computing software and growth in NI. Compared to the baseline the cloud infrastructure services also develop rapidly.

¹¹ Software grows in line with SIC code 62 and IT Services in line with SIC code 63 (representing the KE Software and IT Services sectors)

A source of significant potential for NI's economy and future prosperity

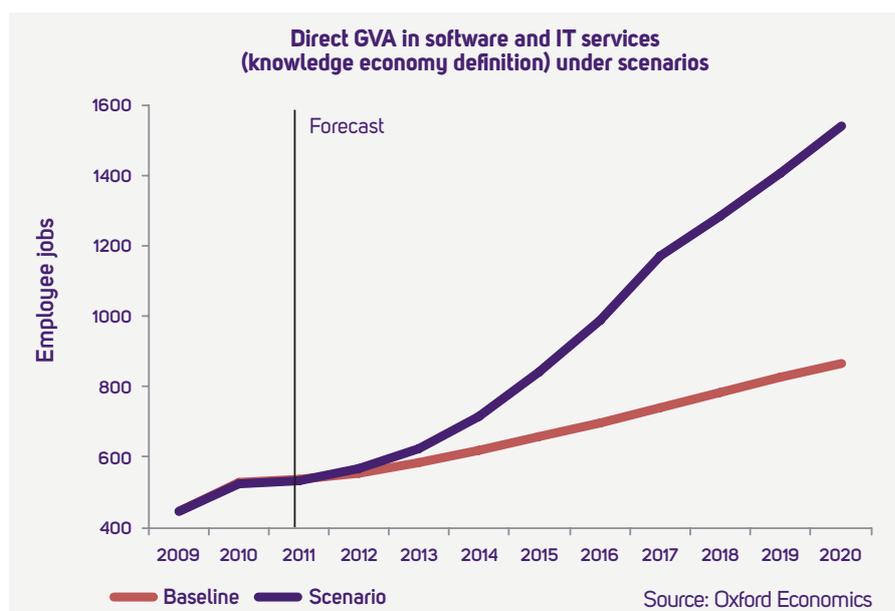
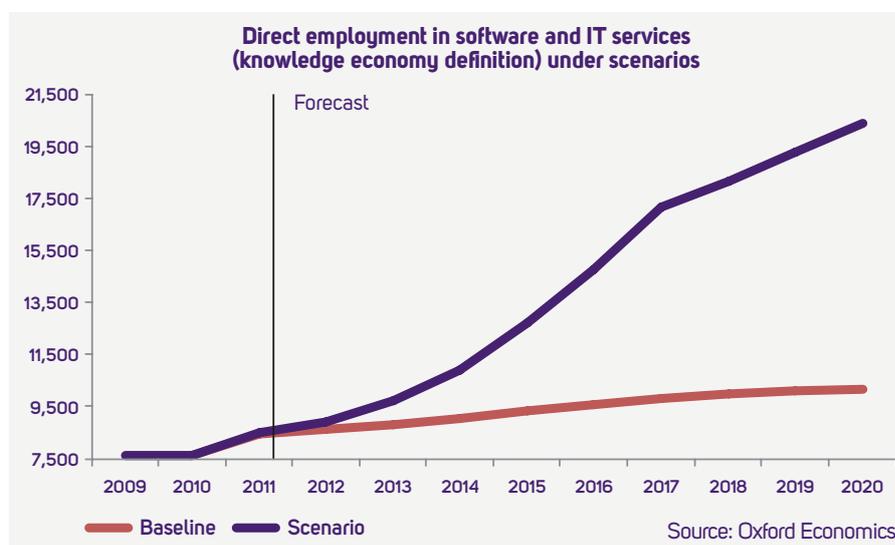
The overall results indicate that growing the cloud computing industry in line with the high growth scenario could result in the following direct impacts:

- Over 10,200 additional jobs in the NI software and IT services industry (KE definition)¹² resulting in total employment of 20,400 by 2020 compared to 10,200 under the baseline projection (rounded figures), which is almost exactly double the number of jobs.
- This level of employment growth would represent approximately 34% of the knowledge economy job creation targeted under the NISP CONNECT targets between now and 2020.
- Direct GVA in the NI software and IT services industry (KE definition) would also reach £1.5bn by 2020, compared to a baseline projection of £0.8bn.

The rapid growth of the software & IT services sector due to the emergence of a cloud computing cluster could also have significant indirect and induced effects across the economy as whole. Based on modelling these effects¹³ it is estimated that a further 6,000 jobs above a baseline in the economy would be created from the software & IT services sectors in total as businesses make purchases and staff spend their wages.

To summarise the total economic contribution of the high growth cloud computing scenario above the baseline scenario would be:

- an additional 16,200 jobs across the economy (direct, indirect & induced) above the baseline, representing 1.9% of total NI jobs in 2020.
- an additional £1.2bn of GVA across the economy (direct, indirect & induced) above the baseline, representing 2.6% of total GVA in 2020. The contribution to economy GVA is higher than the employment contribution due to the high productivity levels within the sector.



Impact of High Growth Scenario for NI Software & IT services (KE definition) from developing a cloud computing cluster

	Impacts - summary
Direct Jobs	10,200
Indirect & induced jobs	6,000
Total jobs	16,200
% of total economy jobs	1.9%
Direct GVA, £m	£700
Indirect & induced GVA, £m	£500
Total GVA, £m	£1,200
% of total GVA jobs	2.6%
Source: Oxford Economics	

These benefits are significant and represent substantial gains for employment and prosperity within NI if the global market opportunities can be exploited successfully

¹² This does not represent the entire ICT industry in NI just the software and IT services sub-sectors.
¹³ Using Type I and Type II multipliers from the UK input-output tables for SIC codes 62 and 63

What next?

The proposed next step following publication of our full briefing paper is that Whisple leads a programme that will consult widely and work with key stakeholders across Northern Ireland to develop a cloud computing cluster strategy that can be acted on, monitored and reported against within the context of complementary strategies and measures such as Matrix, DNI 2020 and the NISP Connect Knowledge Economy Index.

The strategy should be high level but with very specific actions to deliver against the following key areas that can assist the development of a cloud computing cluster in NI including:

- Develop a clear sector proposition: Appraisal of the key strengths and opportunities, in relation to SaaS, IaaS and PaaS, as well as the wider opportunities across the economy including within the public sector (exploiting G-Cloud) and the business process outsourcing sector (as included in the Matrix definition for nearshoring). Gartner forecasts anticipate that business processing cloud services could grow by 17.2% per annum over 2010/2015, representing significant additional opportunities for NI above those presented in this paper for the software and ICT services sectors.
- Promoting and marketing Northern Ireland as a location for cloud computing FDI. Through Ministerial support and active targeting by Invest NI of high growth global cloud computing companies. Delivering lower corporation tax would also be an undoubted help to attracting these target companies.
- Promoting collaboration and research. This might include providing government research grants or funding conditional on university links and collaborative bids.
- Procuring creatively. The government can look to procure innovative solutions to its needs through adopting the cloud, helping to promote a vibrant local market for cloud computing firms.
- Ensure pipeline of skills is in place. Ensuring the ICT industry as a whole as the high end specialist skills it needs to compete globally.
- Ensuring sufficient Venture Capital funds are available. A good supply of VC funds is critical to help drive the creation of new cloud computing start-up companies.
- Ensuring suitable infrastructure: By investigating further the key data centre facilities required to support the development of a cloud computing cluster.
- Further research into the wider benefits of cloud computing. Understanding the catalytic impacts the technology could have across the entire NI economy and how displacement can be kept to a minimum.

Notes: Background on briefing paper

Whisple Cloud Services has engaged Oxford Economics to assess the potential economic contribution that cloud computing could make to the Northern Ireland economy. The research is intended to facilitate a more informed understanding of the potential impact of developing a cloud computing within the context of developing the knowledge economy in Northern Ireland, which can be used by stakeholders to inform a detailed strategy for developing capabilities.

The overall objective of the research is to assess the potential direct economic impacts of developing cloud computing in Northern Ireland and to discuss the wider impacts, which we term 'catalytic' impacts across the economy as a whole. The research has been undertaken by examining the national and global literature on cloud computing, including global growth projections to model a scenario for developing a cloud computing cluster in Northern Ireland and the potential economic prize. The work has also been undertaken in the context of the wider goal to develop NI's knowledge economy, for which ambitious growth targets have been set by the NISP CONNECT stakeholders.

The briefing paper of which this handout is a summary will be released shortly and is an initial piece of research to heighten awareness of cloud computing and how it might support future economic growth in Northern Ireland, in the context of tough macroeconomic

conditions and the difficulties developed nations face in finding sources of growth. A situation exacerbated in NI where there is an under-developed private sector, over dependence on the public sector and relatively low export base. The intention is to then for Whisple to develop a strategy with key actions and steps to realise the opportunities, in collaboration with stakeholders.

The full briefing paper will be released shortly following the Is Northern Ireland Speaking Cloud and Clear? event at Titanic Belfast on June the 28th 2012.

Limitations of this paper and its use

As cloud computing is an emerging sector and as yet there is very limited information about its size within NI and the UK the paper is not a definitive assessment of the economic impacts. It provides an indicative assessment of the range of potential benefits that could accrue if the cluster was to grow at a rate similar to the global predictions.

The paper also only discusses the wider catalytic impacts of cloud computing and focuses on the direct impacts. The wider economic benefits are an important aspect, including the potential for displacement, but undertaking primary research in this area is out of the scope of this paper. Instead a summary of the key literature on these aspects is discussed.

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