Superfast Broadband Business Exploitation Project

Horizon Scanning report

The transformative potential of cloud technologies for SMEs in Wales

26th April 2017

WELSH ECONOMY RESEARCH UNIT

Yr Uned Ymchwil i Economi Cymru

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Cardiff Business School
Ysgol Busnes Caerdydd

UNDEB EWROPEAIDD
EUROPEAN UNION

Llywodraeth Cymru
Welsh Government

Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

Contents

Figures

Summary

The key findings of this report can be summarised as follows:

- The adoption of cloud technologies is evolving rapidly in both existing businesses and start-ups. Adoption is being driven by IT modernisation and faster broadband speeds. It offers businesses the potential to significantly reduce upfront investment and ongoing costs. Other benefits include enabling businesses to reconfigure internal processes, and develop new and existing services.
- In the coming years cloud technologies are expected to underpin a growing range of business processes in many businesses (KPMG, 2013). This is anticipated to have significant impact on businesses, enabling more flexible and scalable operating models and faster entry into new markets and geographies (Microsoft, 2016).
- Research by WERU (2017) indicates that there are significant gaps in SME adoption of cloud technologies in Wales, with three out of ten businesses surveyed reporting none of their employees used cloud enabled services. Further challenges identified include the relatively low adoption of superfast broadband, and comparatively slow upload speeds in Wales (Ofcom, 2016).
- Few sectors in Wales are likely to be untouched by the growth of cloud computing. While there is some potential for it to disrupt sectors and jobs, new economic activity is also likely to emerge based on IT modernisation, business efficiencies, and opportunities to create activity in rural areas.
- Despite the importance of cloud computing (and IT generally) it is not sufficient, on its own, for business competitiveness. Such technologies are readily imitable and unlikely to differentiate a business from its competitors. As a consequence cloud technologies should not be treated in isolation, and should be seen as part of a wider strategic development of a business.
- The main lessons for Superfast Business Support in Wales are:
    - *Evolving promotional messages over time to emphasise the changing importance of benefit types* – for example emphasising the flexibility, scalability and the likelihood that customers and competitors will be seeking to engage through cloud technologies in future years.
    - Encouraging businesses to expand their use of cloud technologies across the full range of business processes – highlighting the benefits of cloud computing to all processes, while building confidence and signposting to specialist support.
    - Supporting businesses as they become more digitally mature – helping businesses to become more digitally mature, with more advanced workshops and advice.
    - Allying fears with hard evidence (security and risks) – working to contextualise the risks faced by businesses, and encouraging them to take measures to protect their businesses.

1 Introduction

Cardiff University is undertaking research in association with the Welsh Government's Superfast Broadband Business Exploitation (SFBBE) programme, over the period 2016-2020. This research examines the economic impacts associated with business adoption and use of superfast broadband enabled digital technologies.

The Horizon scanning series of reports are designed to raise awareness of challenges and opportunities associated with new and emerging digital technologies in Wales. They seek to inform the work of the Superfast Broadband Business Exploitation programme, and to stimulate discussion about the response of Wales to the emergent technologies enabled by superfast broadband.

This paper is the first of a series of Horizon Scanning outputs which will be made available on the Cardiff Business School website: http://www.cardiff.ac.uk/superfast-broadband-project/horizon-scanning

The author of this paper is Dylan Henderson

2 Overview of cloud computing

Cloud computing is at the heart of recent developments in digital technologies. Such technologies have already made rapid inroads into business and personal computing, and provide businesses with the potential to access computing services, without the costs of installing and maintaining physical computing hardware.

Cloud computing can be defined as:

> "… a model for enabling ubiquitous, convenient on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance, 2011 2).

This definition highlights important characteristics of the cloud, namely the ability of businesses to flexibly access computing services without having to own (or indeed maintain) the underlying infrastructure hardware or software.

While cloud computing use across business and households is already evident, research suggests that it is likely to become more pervasive in future, with implications across all aspects of business processes (KPMG, 2013). This is being facilitated both by the rapid pace of technological change generally, but also by improvement in broadband speeds (Ofcom, 2016).

The cloud enables businesses to reduce costs and ICT employee numbers, increase flexibility, mobility and information access (Caldarelli et al., 2017 174). Unlike other technologies, however, cloud adoption transfers responsibility of data hosting to cloud providers. This represents a fundamental change with respect to management of internal business resources, interactions and relationships (Carcary et al., 2014 313).

Cloud computing encompasses several forms, which vary by deployment scale, reach and access. While private cloud access is restricted to single organisations, public cloud providers are generally available to all. Hybrid clouds contain elements of both forms. Examples of major public cloud providers include Amazon Web Services, Microsoft and Google (Gartner, 2016)

A number of service models for cloud computing are evident, and illustrate the scope and flexibility for businesses to access digital services (OECD, 2015):

- Infrastructure as a service (IaaS) refers to hardware equipment operating from the cloud, and can include computational resources, storage and networks. This allows businesses to access computing resources with a high degree of flexibly. Examples of services that fall into the IaaS category include Amazon Elastic Compute Cloud (EC2) and Zimory.

- Platform as a service (PaaS) provides users a more structured platform to deploy their own applications and services. Typically, users rely on programming languages and further tools of the cloud provider to deploy these applications. Cloud users do not manage or control the underlying infrastructure such as networks or operating systems, with the service provider managing the virtualisation operations. Suppliers of PaaS use dedicated application programming interfaces (APIs). Examples of services that fall into PaaS include the Windows Azure Platform and the Google App Engine.

- Software as a service (SaaS) model, provides users with access to a service providers' applications from the cloud. This allows them to access services from a range of different devices such as web browser, tablet etc. Such services do not require the user to manage the infrastructure of capabilities underlying the service. It includes a diverse range of services including applications for a diverse range of business processes, for example, customer relationship management (CRM), human resources (HR), accounting, document management and so on. Well known examples include GoogleDocs, Gmail, Salesforce.com, and Online Payroll.

Gartner (2016) indicate that there is a steady trend towards businesses replacing their traditional IT infrastructure with cloud services, and estimate that so-called 'cloud shift' will reach $216 billion in 2020. This is being driven both by cost reduction, but also modernisation of IT, which is seeing the focus of IT providers and consultants shifting towards cloud-based solutions (Gartner, 2015). Start-up companies face a far simpler challenge with respect to implementing cloud technologies. Unlike established companies they do not have legacy IT systems, and are able to adopt cloud services from launch. This has the potential to significantly reduce upfront investment, and allow for business models to be fully adapted to the cloud.

The emergence and growth of cloud-enabled services illustrate potential for businesses to access a wide array of computing resources and services. The charging models for such services are similarly varied, but characterised by the lack of an upfront capital spending. While many entry-level SaaS applications are provided on a free basis to individual users, businesses users can access more sophisticated services and improved service level agreements. The potential to make full use of cloud-enabled services, however, varies according to the IT maturity of a business/sector (WERU, 2017).

The wider adoption of internet accessible devices (smart phones, laptops, tablets etc.) by individuals and households represents a further important feature of cloud development, with emergence of business strategies such as bring your own device (BYOD). This has the potential to promote more flexible working, with staff able to access data remotely. It also raises concerns about data protection and security, as well as work-life balance issues.

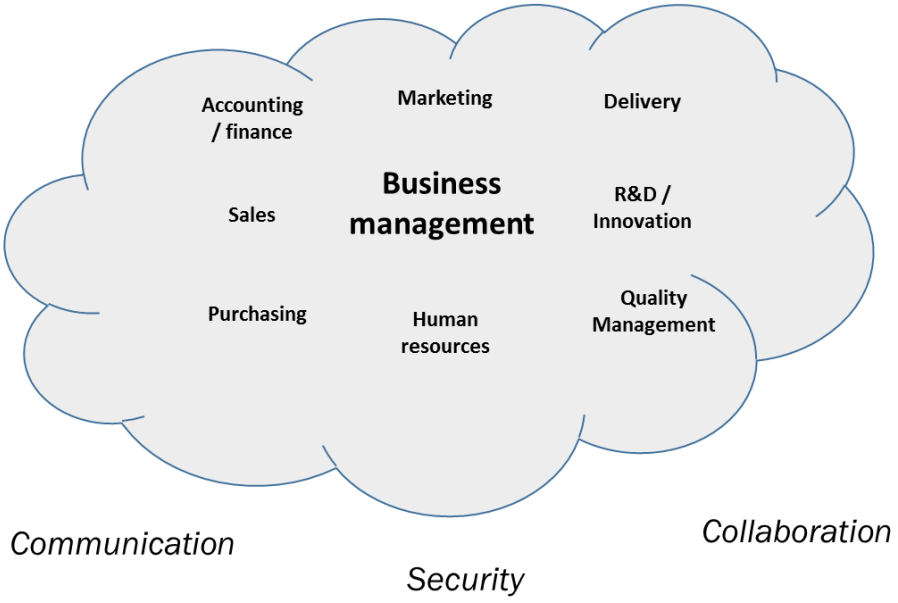
For many SMEs, concerns about cloud risk and security are barriers to adoption (Doherty et al., 2015). As such technologies require network access at a sufficient (upload and download) speed there is potential for businesses to lose access to data and services for a period (Zullick and Varol, 2014). Such 'outages' could have important impacts, with respect to delays and disruption of important business activities (Cristina et al., 2013). Additional risks are security-related, with concerns about hacking into sensitive date. While this is possible, cloud provider security protocols often exceed those implemented by SMEs. Indeed, Gartner (2015) suggests that the 'cloud is more secure than operating a standalone server maintained in-house'. There is, however, a challenge of educating users in taking sensible security steps, and for businesses to incorporate cloud computing into their risk and recovery plans (Zullick and Varol, 2014).

While the costs of adopting cloud computing services, relative to investing in infrastructure, are often emphasised, there is a growing recognition that cloud technology has the potential to underpin many business processes. In this respect, it has been argued that cloud computing can have a transformative impact on a business through more flexible and scalable operating models and faster entry into new markets and geographies (KPMG, 2013 11). Such transformation is said to go beyond IT activity, with potential for it to 'reinvent services for a mobile world…permeat[ing] the very fabric of an organisation' (Microsoft, 2016 1). While extensive cloud-enabled business processes can be seen in many sectors, with examples both in large businesses such as Netflix (Izrailevsky, 2016), AirBnB (Amazon Web Services, No date), and smaller start-up businesses. These changes illustrate the potential for the cloud to act as a platform for businesses to innovate in their digital business processes and services (OECD, 2014).

Wholesale enablement of business processes through cloud computing services is likely to be a challenging task for most businesses, and may represent a more incremental, piecemeal approach. There are, however many business process applications already available, as indicated in the figure 2-1 below, and this picture is likely to develop in future as new applications emerge[1]. This rapidly evolving picture may highlight the need for ongoing external support given the size and sector variations in digital maturity that are evident in Wales (WERU, 2017).

[1] Further examples of cloud enabled applications can be found in the annex of this report.

Figure 2-1 Business processes enabled by cloud applications



Other areas where cloud applications have the potential to impact on business activity are set out below. These represent potential areas for future Horizon Scanning papers:

Mobility and collaboration

The accessibility of cloud services from devices outside the businesses premises opens the potential for greater home / mobile working (Carcary et al., 2014). This may have an impact on the accommodation requirements of businesses, as well as greater responsiveness to customer needs. In this respect, it may allow businesses in remote geographical areas to trade and collaborate with partners outside the region. Concerns about the security of employee-owned devices, and the potential impact on work life balance, will need to be taken into account.

New business models

The cloud provides possibilities for new digital business models, including fully online business models, and hybrid models that provide aspects of 'bricks and mortar' and online business models (OECD, 2015). The enabling role of the cloud and associated digital technologies represents an important area of business model innovation (Teece, 2010), and an opportunity for businesses to address competitiveness challenges.

Data analytics

The development of cloud technologies is associated with the growth of data collection and storage. Some sectors are more 'data heavy' and require greater levels of storage (e.g. creative industries, and those industries with high numbers of users). The emergence of cloud technologies can substantially increase the opportunity for business to capture and store larger amounts of data about business processes and customers, as well as make use of a wide range of analytical tools (Assunção et al., 2015). This developing area is expected to increase in future with associated developments of sensors, and the emergence of the so-called 'Internet of Things' (IoT).

Artificial intelligence (AI)

AI represents a rapidly emerging business technology. Technology companies are increasingly making use of technologies in customer support (so-called chat bots), as well as in consumer products (for example, Amazon Dot). AI technologies are increasingly being enabled by cloud technologies (PaaS) and made available to businesses through graphical interfaces. These technologies provide the potential for SMEs to offer new services to customers (Oracle, 2016).

Business continuity and disaster recovery

While concerns have been expressed about the security, durability and availability of data stored in the cloud, such issues are not specific to the cloud. In this respect it has been claimed that the cloud offers the opportunity for businesses to include it in their plans for business continuity and disaster recovery, as data in the public cloud is stored away from the businesses' premises and backed up in multiple geographical locations (Carcary et al., 2014).

The technologies reviewed above occupy a rapidly changing context for business. Over the course of this research project new technologies and issues are likely to emerge, and existing technologies evolve. A key feature of the horizon scanning research will be to consider these developments in the context of Wales and explore the implications for business and policy.

3 Implications for businesses in Wales

The transformative power of the cloud and associated digital technologies represents a significant opportunity for both existing businesses and start-up businesses in Wales. Research by the Cardiff University's Welsh Economic Research Unit (WERU) has found that there are significant gaps in business adoption of technologies enabled by superfast broadband. Indeed three in ten businesses surveyed reported that none of their employees used cloud enabled services at the business premises. This suggests that there is still further progress needed to raise awareness of the cloud along with its capabilities, and to support more widespread use of it (WERU, 2017).

While there is potential for the cloud to help SMEs transform the efficiency and effectiveness of their business processes, the WERU research reveals several factors that may limit its full exploitation. First, the majority of businesses in the survey do not have superfast broadband. Second, download speeds are particularly important to the full use of cloud enabled technologies (OECD, 2014, 2015). Here, research suggests that average download speeds are significantly higher (29 mbps) than upload speeds (3 mbps) in Wales (Ofcom, 2016). This implies that progress is needed to reach symmetry between upload and download speeds. Third, the average size of Welsh businesses is micro (fewer than 10 employees). Here, larger businesses will often have access to more IT support resources, however many cloud-enabled technologies, most notably SaaS, provide similar functionality to their non-cloud offerings.

While the cloud and associated digital technologies are important to businesses in Wales, it is important to recognise that IT alone is not sufficient for business competitiveness. Such resources are readily imitable and unlikely to differentiate a business from its competitors. In this respect research has found that developing a strategic approach to digital technologies, underpinned by cultural change and skills development across a business, are equally important (Carr, 2003). The implication for businesses in Wales is that the cloud should not be treated in isolation, but should be seen as part of a wider transformation of business processes.

4 Likely scope and scale of impact on businesses

The transformative potential of cloud and enabled technologies suggests that there is unlikely to be any sector that will be untouched by its growth. A recent global survey, for example, has found that 76% of businesses believe that digital technologies are disrupting their industries (Kane et al., 2015). While there is potential for cloud-enabled technologies to be disruptive to jobs and sectors (for example IT hardware suppliers) the overall nature of its impact is less clear as new economic activity is likely to emerge based on cloud-related modernisation. The findings indicate that those businesses and sectors best able to understand and engage with the cloud and associated digital technologies, will be best placed to respond to competitive digital challenges in the future.

While there may be a disruptive element to cloud computing, there are a number of areas in which cloud computing presents opportunities to improve productivity and innovation in Wales. For example, in addition to costs savings and greater flexibility, there is also potential for cloud computing to act as a platform for businesses to offer new digital services in rural and remote areas. This can result in businesses increasing their reach to customers and collaborators outside their immediate area. The flexibility provided by the cloud may encourage existing and new businesses, as well as others wishing to move to rural areas for factors such as quality of life (of which Wales is well placed). In this respect cloud computing has the potential for greater levels of economic activity in rural areas.

Ensuring access to fast broadband using a wide range of technologies, and preparing and addressing the future developments in technologies and standards such as 5G will be important in maximising the opportunity for digital technologies, and subsequent benefits for businesses in Wales.

5 Lessons for superfast broadband support in Wales

While cloud-enabled digital technologies are likely to grow in importance in the coming years, their impact is likely to vary according to size, sector and location of businesses. The challenge facing the SFBBE programme is not necessarily one of making business aware of high tech and complex technologies of the future, but rather enabling more businesses to understand and adopt many technologies that are already available to companies today. The key implications for the programme can be summarised as follows:

Evolving promotional messages over time to emphasise the changing importance of benefit types

The primary benefit associated with cloud computing is currently expressed in terms of cost reduction (Gartner, 2015). This is clearly a key driver for established companies with legacy IT systems. In future, however, drivers are likely to be concerned with factors such as flexibility - availability on multiple devices, scalability (KPMG, 2013), and the likelihood that competitors and customers will be seeking to engage through cloud enabled technologies.

Supporting businesses to expand their use of cloud technologies across the full range of business processes

For many businesses cloud technologies are perceived as being relevant to individual or a small number of business processes (for example, back office data storage). As a platform, however, cloud and enabled digital technologies have the potential to transform all aspects of a business and its processes. This does not mean that all businesses need to become technology businesses. The role of the programme will be one of building confidence, and enabling businesses to access specialist support, both within, and outside of the programme.

Supporting businesses as they become more digitally mature

Businesses whose core activity is IT are not the target market for the programme. Such businesses are often able to satisfy their own cloud/IT needs internally. Digital maturity in the majority of businesses in Wales, however, is likely to evolve over time, driving more sophisticated use of cloud technologies. The challenge for the SFBBE programme will be supporting businesses on this journey towards maturity, for example, through more advanced workshops and information on more sophisticated uses of the cloud (SaaS, IaaS, PaaS etc.). In this respect cloud providers are increasingly providing more simplified interfaces and bundled PaaS and IaaS services for less IT sophisticated users.

Allying fears with hard evidence (security and risks)

Security of cloud computing is one of the most important issues for many businesses (Gartner, 2016). While the potential for such risks are apparent – remote storage of data, reliance on network connections etc. – it will be important that the programme distils the practical implications from the hype. This may include reference to the comparable risks of owning and maintaining IT infrastructure, the rigorous security steps taken by cloud providers and the UK government's own cloud native policy (Government Digital Service, 2017). These factors imply that the SFBBE programme will need to confidently raise awareness of the cloud and its potential role in enabling digital technologies.

6 Annex

Table 6-1 Business processes and illustrative cloud applications

Business processes	Cloud applications
Control	Asset management Materials requirement planning Enterprise Resource Planning
Accounting	Accounting / Bookkeeping Payroll
Sales	CRM Electric point of sales (EPOS) Electronic payment Booking solutions E-Commerce
Marketing	Social media management
Delivery management	Transport management system (TMS) Inventory/Stock control
Purchasing	Purchase Order Software
Human resource	Human Resources Management
R&D and innovation	Project management
Cross-cutting: Communication & collaboration	File sharing Video Conferencing VoIP
Cross-cutting: Security & control	Anti malware Data back up Mobile device management

Source: Adapted from Business Wales (2016)

References

Amazon Web Services, No date. Airbnb Case Study. AWS. https://aws.amazon.com/solutions/case-studies/airbnb/

Assunção, M.D., Calheiros, R.N., Bianchi, S., Netto, M.A.S., Buyya, R., 2015. Big Data computing and clouds: Trends and future directions. Journal of Parallel and Distributed Computing 79–80, 3-15. http://dx.doi.org/10.1016/j.jpdc.2014.08.003

Business Wales, 2016. Superfast Business Wales: Software Directory 2016-2017. Welsh Government. Available at: https://businesswales.gov.wales/superfastbusinesswales/superfast-software-directory

Caldarelli, A., Ferri, L., Maffei, M., 2017. Expected benefits and perceived risks of cloud computing: an investigation within an Italian setting. Technology Analysis & Strategic Management 29, 167-180. http://dx.doi.org/10.1080/09537325.2016.1210786

Carcary, M., Doherty, E., Conway, G., McLaughlin, S., 2014. Cloud Computing Adoption Readiness and Benefit Realization in Irish SMEs—An Exploratory Study. Information Systems Management 31, 313-327. http://dx.doi.org/10.1080/10580530.2014.958028

Carr, N.G., 2003. IT doesn't matter. Harvard Business Review May.

Cristina, L., Silvia, M., Despina, M., 2013. Cloud Computing for Small and Medium-Sized E-Commerce Businesses. An Overall Look on the Benefits and Risks of Cloud Computing in E-Commerce. Ovidius University Annals, Series Economic Sciences 13, 541-544.

Doherty, E., Carcary, M., Conway, G., 2015. Migrating to the cloud: Examining the drivers and barriers to adoption of cloud computing by SMEs in Ireland: an exploratory study. Journal of Small Business and Enterprise Development 22, 512-527. http://dx.doi.org/10.1108/JSBED-05-2013-0069

Gartner, 2015. Gartner says modernization and digital transformation projects are behind growth in enterprise application software market. Gartner Inc., Stamford, Conn.

Gartner, 2016. Gartner says by 2020 Cloud Shift will affect more than $1 Trillion in IT spending. Gartner Inc., Stamford, Con.

Government Digital Service, 2017. Consider cloud solutions before alternatives. Gov.UK.

Izrailevsky, Y., 2016. Completing the Netflix Cloud Migration. Netflix Media Center.

Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D., Buckley, N., 2015. Strategy, not technology, drives digital transformation. MIT Sloan Management Review and Deloitte University Press 14.

KPMG, 2013. The cloud takes shape. KPMG International. Available at: http://www.kpmg-institutes.com/institutes/advisory-institute/articles/2013/02/cloud-takes-shape.html

Mell, P., Grance, T., 2011. The NIST definition of cloud computing. NIST, Gaithersburg. Available at: http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

Microsoft, 2016. Digital transformation: the age of innocence, inertia or innovation? Available at: https://www.microsoft.com/en-gb/about/ent/digital-transformation-report/default.aspx?WT.mc_id=AID522322_QSG_EML_4655600_4705628_13378124

OECD, 2014. Cloud computing: the concept, impacts and the role of government policy. OECD, Paris. Available at: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP(2011)19/FINAL&docLanguage=En

OECD, 2015. OECD Digital Economy Outlook 2015. OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264232440-en

Ofcom, 2016. Connected nations report 2016. Ofcom, London. Available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0035/95876/CN-Report-2016.pdf

Oracle, 2016. Can virtual experiences r eplace reality? Oracle, Redwood Shores, CA. Available at: https://www.oracle.com/webfolder/s/delivery_production/docs/FY16h1/doc35/CXResearchVirtualExperiences.pdf

Teece, D.J., 2010. Business models, business strategy and innovation. Long Range Planning 43, 172-194. http://doi.org/10.1016/j.lrp.2009.07.003

WERU, 2017. Superfast Broadband Business Exploitation Project: Digital Maturity Survey Report 2017. Cardiff University, Cardiff. Available at: http://www.cardiff.ac.uk/superfast-broadband-project/digital-maturity-survey

Zullick, D., Varol, C., 2014. Business Continuity Opportunities in the Cloud, BUSTECH 2014 : The Fourth International Conference on Business Intelligence and Technology, Venice, Italy.