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A Composite Research Study

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Abstract

Purpose: Although cloud computing has been heralded as driving the innovation agenda, there is growing evidence that cloud is actually a "slow train coming". The purpose of this paper is to seek to understand the factors that drive and inhibit the adoption of cloud particularly in relation to its use for innovative practices.

Design/methodology/approach: The paper draws on a composite research base including two detailed surveys and interviews with 56 participants in the cloud supply chain undertaken between 2010 and 2013. The insights from this data are presented in relation to set of antecedents to innovation and a cloud sourcing model of collaborative innovation.

Findings: The paper finds that while some features of cloud computing will hasten the adoption of cloud and its use for innovative purposes by the enterprise, there are also clear challenges that need to be addressed before cloud can be successfully adopted. Interestingly, our analysis highlights that many of these challenges arise from the technological nature of cloud computing itself.

Research limitations/implications (if applicable): The research highlights a series of factors that need to be better understood for the maximum benefit from cloud computing to be achieved. Further research is needed to assess the best responses to these challenges.

Practical implications (if applicable): The research suggests that enterprises need to undertake a number of steps for the full benefits of cloud computing to be achieved. It suggests that collaborative innovation is not necessarily an immediate consequence of adopting cloud computing.

Originality/value: The paper draws on an extensive research base to provide empirically informed analysis of the complexities of adopting cloud computing for innovation.

Keywords: cloud computing, innovation, diffusion of innovation, cloud sourcing

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Introduction

Cloud computing is a service–based perspective on the provision of computing through the exploitation of technical innovations such as virtualization, high–performance networks and data–centre automation (Armbrust et al., 2010; Boss et al., 2007; Venters & Whitley, 2012). The topic has exploded with interest in the academic and technical literatures. As early as 2010, Amazon's annual revenue from cloud services was estimated at between $500m and $700m (The Economist, 2010). Similarly, Forrester predicted a global market for cloud computing worth $61bn for 2012 (Kirsker, 2012) and they believe that this will grow to $241bn by 2020 (Dignan, 2011). Such benefits are not restricted to the private sector; the UK government aims to save £1.4bn over four years, in part by

launching its own cloud service (Maude, 2011) and a recent study by CEBR (2011) predicts that the adoption of cloud computing has the potential to generate 763 billion euros of cumulative economic benefits over the period 2010–2015 across five European economies of France, Germany, UK, Italy and Spain. The benefits would come from business development opportunities, business creation, net cost savings and indirect gross value added (GVA). The study also suggests an additional direct and indirect job creation impact of nearly 2.4 million jobs (Centre for Economics and Business Research, 2011).

Despite this widespread interest in potential benefits of cloud, the enterprise impacts of cloud, particularly in terms of innovation rather than cost savings, appear to be emerging more slowly and over a much longer time horizon than many commentators are suggesting. It is widely recognised that diffusion of new technologies rarely takes place at a steady rate (Rogers, 1995). Instead, it tends to follow an S–shaped curve, starting quite slowly, needing to demonstrate many attributes and passing through several phases before being fully adopted.

The developers and users of cloud computing are on this curve and it will take time before the anticipated organisational benefits of cloud actually materialize. What is less clear, however, is the range of antecedent factors that influence the rate of adoption. Is cloud computing a technology whose technological features will enable fairly rapid adoption and innovation or does cloud computing have characteristics of a 'slow train coming' whereby adoption and subsequent innovation will be limited by other factors.

The objective of the paper is to draw on a detailed empirical research base to better understand the drivers and inhibitors of cloud adoption and innovation. It achieves this objective in relation to existing research on the antecedents of innovation, suggesting that there are three main antecedents that must be met for cloud adoption and innovation to succeed. The status of these antecedents is determined from a detailed research base including large scale surveys and extensive interview data. This research base allows us to identify those antecedents that support cloud adoption and those that are currently inhibiting cloud adoption.

Based on this analysis, the paper suggests that the full effects of cloud will not be felt overnight but will, instead, take ten years or so to be felt. The paper makes a number of recommendations about the likely changes in practice that will need to arise for the full potential of cloud computing to be achieved and indicates the likely direction that such innovative practices will take.

The next section therefore introduces the role of cloud in business innovation and highlights the antecedents that will affect its development. This is followed by three different perspectives on cloud innovation which emerged from our research base: innovation through infrastructure and service, executive perspectives on the cloud innovation agenda and the changing role of the IT department. The paper ends with a discussion of the implications of this analysis for the development of the cloud corporation.

Innovating with cloud

In this paper, cloud computing is understood in terms of the evolution of two distinct strands that come together to provide cloud computing (Venters & Whitley, 2012). The

first strand emerges from technological innovations such as virtualisation, high performance networks and data–centre automation (Armbrust et al., 2010; Boss et al., 2007). The second strand emerges from a more distinct emphasis on service based perspectives (Etro, 2009; Vouk, 2008) which shifts attention from the management of technology assets to consideration of customer value from the use of technology services (Grönroos, 2011). As a result, the benefits of cloud computing are often presented in financial terms as cloud offers a subscription–based / pay–as–you–drink model that moves IT expenditure from capital expenditure to operational expenditure budgets. The long–term benefits of cloud computing, however, are unlikely to be restricted to (or be driven by) simple cost savings. Instead, this combination of computing trends offers the potential for innovative business practices for the enterprises adopting cloud computing.

Achieving innovation through cloud resources is a two–stage process that first involves an enterprise *adopting* cloud computing and then *innovating* using those cloud resources. Enterprises will seek to achieve (financial) benefits simply from adopting cloud computing but are likely to benefit further from innovation enabled by cloud. Hence, any limitations or delays in either activity will influence the long–term benefits of cloud and so it is important to understand limitations on the adoption of cloud as well as those factors that inhibit innovation through cloud.

There is growing evidence that developments in information technology often move in packs. This seems to be the case with cloud. It is the interactions between base technology developments, technology service improvements and technology process advances that made internet computing and will allow cloud to make radical IT based innovations (Carlo et al., 2011). These characteristics, however, do not determine that cloud technology will be widely adopted.

Indeed, many authors see cloud computing as potentially disruptive. For example, Lacity and Willcocks (2012) see three major disruptive impacts associated with the increasingly rapid development and deployment of cloud technologies. These are: service performance, cloud as a business service and radical changes in the supply industry.

Related research sees the cloud disruptive sequence being

- new delivery models;
- technology disruption;
- restructuring the IT industry; and
- disruption of other industries (Hagel & Seeley Brown, 2010).

Although cloud computing offers technological disruption, the effects of this are likely to be cumulative and on–going. Cloud introduces new delivery models and supply chains that will mature over time (Lindner et al., 2010). This research is particularly interested in what factors will shape these delivery models and how these delivery models will drive innovation through the need to grow the service dimension and produce business services.

The kinds of innovations that cloud computing affords, once adopted, exist at a variety of different levels. These include:

- **IT operational innovations**—technology and IT operational and personnel changes that do not impact firm–specific business processes;

- **business process innovations**—that change the way the business operates in some important ways; and
- **market (business product / service) innovations**—that significantly enhance the firm's product / service offerings for existing customers or enable entry into new markets (Willcocks et al., 2011).

In common with many cases, the innovation trajectory for enterprises using cloud is likely to be cumulative, starting mainly with IT operational innovations then gathering pace over time on business process and market innovations as enterprise capabilities adapt to the new technological environment. For example, Retana et al. (2012) show how the self–service nature of the cloud makes firms both consumers and producers, or co–producers, of cloud services. They suggest that in order to understand the drivers of cloud adoption and usage it is important to pay attention to firms' knowledge, skills and abilities in co–producing the service, which are known to be key determinants of the adoption and usage of other self–service technologies (Xue & Harker, 2002; Xue et al., 2007).

Antecedents to cloud adoption and innovation

Although the potential for innovation through the use of cloud is considerable the speed of such innovation is likely to be shaped by three key antecedent factors that affect the adoption of cloud. The *first* of these is attributes of the technology itself. Greenhalgh et al. (2004) identify a series of important attributes of a novel technology that will affect its diffusion. Does it give relative advantage? Is it compatible with existing ways of operating? What is the risk level? Is it too complex or is it administratively feasible? Is it easily trialable with tangible outcomes? Is technical support given? Is there potential for reinvention? (Rogers, 1995).

It would seem that the technological basis of cloud computing has many attributes that should support the rapid diffusion and adoption of cloud (Venters & Whitley, 2012).

The *second* antecedent factor is that in pursuing the adoption of such novel technologies, organizations, providers and providers' partners will need to become much more collaborative than ever before. Collaboration is here defined as a cooperative, commercial arrangement in which two or more parties work jointly in a common enterprise towards shared goals. Ongoing research in outsourcing has identified a very strong correlation between the levels of collaboration and resulting innovation within and across organizations. Simply put, superior performance through innovation is made feasible by cloud adoption, but this will require a step–change in client–provider and provider–provider relationships in terms of objectives and behaviours. This step–change needs to be towards new forms of collaboration involving mutual flexibility, trust, reciprocity, risk sharing and investment in resources and time and needs to be executive led (Whitley & Willcocks, 2011).

In the context of outsourcing, a study carried out in 2011 of 26 organizations who had moved to 'collaborative innovation' in their outsourcing relationships all experienced IT operational innovation while 21 were getting business process and seven business product/service innovations (Whitley & Willcocks, 2011). Innovation through cloud will also come from an acceleration of such collaborative tendencies, but, as has been found in

more traditional outsourcing arrangements, this will be a challenge to many client and provider organizations alike.

This paper therefore introduces the concept of *Cloud Sourcing* as the situation where an organisation using cloud computing adopts many of the best practices and lessons learned from outsourcing in order to achieve collaborative innovation in the enterprise context.

The *third* antecedent factor is the innovation implementation process. This includes the range of practical factors that support or slow an innovation's progress from design to adoption, diffusion and usage, through to exploitation. Key issues here are:

- sectoral structure, absorptive capacity for new knowledge and sectoral receptiveness to change;
- adopter attributes;
- organizational readiness for innovation
- how easy is the innovation to assimilate—is it a complex, non–linear process, with many 'soft' elements? and
- quality of organization's implementation processes (Greenhalgh et al., 2004).

This factor also includes the speed with which diffusion through informal unplanned communication and influence moves to formal, planned dissemination. The implementation challenge is very real in the context of cloud particularly for large organizations with a large legacy of IT investments, infrastructure and outsourcing contracts. There are also cultural, structural and political legacies that will shape and determine the speed of implementation, exploitation and reinvention.

The next sections present empirical evidence from our research base (see Appendix: Research base) that explores these antecedents. The evidence is presented under three main headings that emerged from the analysis of our empirical data. The analysis began with a large–scale survey, the results of which were interpreted in the context of a series of over fifty interviews and then challenged by a further survey undertaken in 2013. The resulting headings are: innovation through infrastructure and service; executive perspectives on the cloud innovation agenda and the changing role of the IT department. The implications of this research for the development of the cloud corporation of the future are presented in the final section.

Empirical evidence

Executive perspectives on the cloud innovation agenda

Cloud computing is particularly appealing to business and IT executives. In our original survey, around 65% of business executives believed that cloud drives down the overall cost of business applications, 50% believed that it facilitates a virtual / distributed organization and 60% of these executives believed that business applications can be provisioned far more quickly when they are in the cloud (Horses for Sources, 2010).

Whilst the business appeal of cloud might appear to be driven solely by cost and efficiency savings, our survey also provides strong support from business executives for the claim that "cloud enables us to focus on transforming our business and not our IT" (50%). As one of our respondents noted:

these technologies are enabling companies to do things they never could have imagined before. It changes the financial model of the company. It changes the talent model. It changes just about everything [Jimmy Harris, Accenture, November 2010]

Cloud computing allows the business to focus on the tasks it needs and wants to perform, not how they are going to be performed:

they're going to get a form to fill out that says, I want to run this workload, I want to run it at this cost, I need this level of performance, this level of availability [Steve Beck, VMWare, December 2010]

Cloud offers the opportunity for the focus to be truly put back on the business function, not the technology constraints. The executive, as has always really been the case, does not care and does not want to know how the computing is provided.

Some of our interviewees made a comparison to the net generation's use of the internet and smart (phone) mobile devices (Barzilai-Nahon & Mason, 2010):

Now increasingly [devices like] my iPad, are becoming oxygen for how I need to operate. And I've got an expectation that I can access my business information in real time wherever I am. So I think when IT organizations look to the next ten years, they need to look at the consumer trends that are hitting us right now and start to think about, from an IT strategy, how am I going to adapt my business to this trend in consumerisation [Tim Barker, SalesForce, November 2010]

The challenge of consumerisation / Bring(Buy)–your–own–device (BYOD) was introducing particular problems for organisations with legacy systems that they were struggling to integrate with cloud enabled devices, provided by the enterprise as well as their own personal devices.

End–users are now expecting, I think we all expect, that we can use multiple devices during the course of a day to access the information we need to do our jobs, right? I've an iPhone and an iPad, I have got a computer, in fact three or four computers. I can go log into my friend's computer, get online, get my stuff that I need. I can access my information from everywhere. And so older applications and older systems that were very locked into only being accessible through terminals and stuff, is quickly fading away [Mike Dino DiPetrello, VMWare, November 2010]

These users want the high levels of service that they have come to expect but do not know (and do not care) how it is provided. If technology deployment (and the day–to–day management of the IT infrastructure) is moved to the cloud, then it might cause short term disruption for the IT function. However, long term it offers the opportunity for the (remaining) IT function to become increasingly aligned with the business needs of the organization and provide innovative, sustainable advantage to the enterprise.

Indeed, some of our respondents argued that the shorter cycle times offered by cloud enabled, indeed required, the IT function to be more closely aligned with business needs. Even cloud providers recognize that with a service pay–per–drink model of computing they earn their business "every quarter or every month you know, when subscriptions or renewals are due," as Tim Barker of SalesForce puts it. This forces them to align their "entire business to the success of that project and the success of the customer" [Tim Barker, SalesForce, November 2010].

From a cloud provider perspective, there is also the question of how flexibly they can provide their services, as Jim Spooner of GlassHouse notes:

> whether the billing is down to a day, a week or a month it ultimately kind of defines how mature you are in cloud [Jim Spooner, GlassHouse, November 2010]

From a technology perspective, cloud computing offers distinct advantages that are recognized by IT professionals. Although moving to the cloud may be disruptive to the existing IT function, it does allow the forward–thinking, business–focused CIO to have meaningful answers to board level questions about the current organizational IT environment, including how much it costs and how quickly new services can be provisioned:

> I guess the wise CIOs of today have started to think about how much do their services cost and how can they leverage these models within their business or how they can actually terminate existing models to be able to deliver these kind of levels of services internally. And I think we're seeing that in the kind of commercial sector people are approaching this as a financial thing, wondering about how they can drive costs out of their business and use these services [Jim Spooner, GlassHouse, 2010]

The changing role of the IT department

As noted above, a recurring frustration expressed by many of the executives we interviewed relates to the limitations of the existing, in–house IT function. For most organizations IT is just a means to an end rather than an end to itself (See, e.g. Olson et al., 2003). Some estimates suggest that 70% of the IT function is being devoted to "keeping the lights on". It is therefore unsurprising that the IT function is frequently seen as unresponsive to changing business needs, that it is perceived as performing poorly and, typically, has large backlogs of unimplemented applications.

Cloud computing potentially changes all this, and whilst there will still be 'technical fixer' and 'technical architect' roles in enterprises that adopt cloud computing, there needs to be a much greater emphasis on business skills and business orientation in nearly all roles. Even those two more technical roles need an increasing amount of business understanding and relationship building. More generally, there is a significantly increased requirement for 'soft' skills across all roles. The major shift is toward fewer personnel, but of very high quality.

The recruitment and retention of such a small, high quality group has always been a major human resource challenge. Cloud has just made it that much harder—cloud skills were running at a 20–40% premium throughout 2011—and the skills shortage may well slow client organizations in their ability to adopt cloud technologies, especially where they also have to compete with suppliers. Two potential solutions are upskilling the organization through a human resource policy which provides training to staff and hiring (and retaining) specialised staff through competitive salaries, challenging roles and clear career paths.

Other providers talked of needing to be much sharper on service metrics and transparency, corrective action enable by automation. Speed also requires much greater operational readiness is needed with cloud, and this passes over to client staff, not least

because of internal pressure from business units to perform faster [Kevin Lees of VMWare, November 2010 and Jim Spooner, Glasshouse, November 2010].

> When it comes to cloud we are discovering that all the internal roles have to be faster acting than before. And while organizations have speeded up, they have not necessarily come up to the speed of cloud, which is instant—well almost. You have to automate the bureaucracy. Change management, for example, we used to have weekly meetings. With cloud, fast tracking is almost your everyday. And that means you need to have a robust system that makes assessments and changes really quickly. It means changes in how knowledge and processes are set up, teaming and shared knowledge enabled by automation. On the big picture this is IT coming up to speed on service with other areas and sectors, as it should do [Stephanie Lester, GlassHouse, November 2010]

These changes present new opportunities for IT professionals, if they are willing to take them:

> The Cloud, whether it be private, public, hybrid, is creating positive opportunities for IT professionals. I say to my IT people: you are going to have many more business conversations. You're going to be having more service catalogue conversations, you're talking about solutions, you're not talking about applications and stacks and the things that have traditionally been the IT lingua franca. If you are a systems administrator and you're looking at converged infrastructure today, systems, storage, network and security people will be calling at your door. Cloud requires a breadth of skills. Or you can become a Cloud architect or specialize as a Cloud professional. Alternatively, if you want to specialize, for example as a systems person, opportunities continue because now you have to go deeper into the skill set from a technology point of view and you're no longer provisioning for one application stack, you're provisioning for the Enterprise or for the Cloud. So whether you want to go into the business side of things or you want to do go deeper in technology or you want to go wider with technology, Cloud brings you some incredible new opportunities as an IT professional [Sanjay Merchandini, EMC, November 2010]

Another technological benefit of cloud computing is the more detailed provisioning and planning that managed services can provide. For example, cloud providers can build in detailed performance metrics that can be utilized by clients to optimize their performance. Alternatively, the cloud model allows the enterprise to manage its own service level requirements by building redundancy into its cloud provisioning. Therefore, rather than having to worry about providing 100% uptime capability from its in–house equipment, it can provide this capability by sourcing the same functionality from a variety of independent cloud providers. In so doing, cloud also offers novel disaster recovery solutions that address many of the pressing concerns of the modern IT department.

Innovation through infrastructure and service

Although some commentators suggest that the main benefits of cloud computing are based on the alternative payment / subscription model (Stevens, 2009), two critical cloud streams—flexible infrastructure and service—offer novel opportunities for real innovation.

Indeed, in our survey, over 60% of business executives and 60% of IT executives agreed with the statement that cloud is a business model that "drives innovation in organisations". The claim that cloud can "transform organizational forms" was supported by over 40% of business executives and slightly more strongly by IT executives (Horses for Sources, 2010).

The service–based, infrastructural flexibility of cloud promotes the possibility of "seed and grow" type activities, where the capabilities of the cloud are demonstrated through the rapid development of prototype systems. This can be illustrated by the apocryphal case of the pharmaceutical company where research staff paid for cloud computing resources with a private credit card and obtained the results of their analysis sooner and cheaper than a formal request for internal computing resources could provide.

Some of our respondents talked about this capability in terms of "low friction" activities that were possible once cloud had been adopted, echoing the language of transaction cost economics. Whereas previously a decision to prototype a new system might involve the procurement and installation of new hardware (with the associated checks and delays that conventional purchasing requires), cloud provisioning can be implemented rapidly and at low cost.

Such low friction approaches allow a business to experiment and innovate, according to Accenture's Jimmy Harris:

> because you'll be able to acquire these services, use them where it makes sense and then decommission and get rid of the services when you no longer need them [Jimmy Harris, Accenture, November 2010]

The service flexibility of cloud services changes the risk profile associated with innovation. Projects and processes that would have been too risky to attempt if they required a capital investment (say, hiring two servers on two–year contracts) become worth attempting if unsuccessful experiments can be decommissioned easily. The speed of a project in terms of time to market is also affected if it is implemented in the cloud.

Whilst there are numerous examples of rapid prototypes being used to capture the imagination of a corporate board about cloud services, what is less clear is how the organization makes the transition from experimenting with using the cloud as a demonstrator to using the cloud for 'production' systems that, in many cases, have much more stable demand patterns.

As is the case with IT outsourcing, there will be distinctive skills required from the in–house IT function, from existing system integrators and outsourcing partners to make the most effective use of cloud computing. For example, when specifying their computing requirements, they will be making their requests in terms of "power at this rate, computing at this rate, at this level of security, with this compliance requirement, this level SLA".

Perhaps the most distinctive feature of cloud computing from a service perspective is the possibility for innovation that it offers by, in one way, confirming Nicholas Carr's argument that 'IT doesn't matter' (Carr, 2003). In cloud computing, IT does, of course, matter, but a service perspective allows business to think much more about what it needs (or would like to have) without having to worry about whether their IT function (or

outsourcing partners) have the requisite skills, hardware or resources to deliver them. As Jimmy Harris notes:

> If you take it to its logical conclusion and a place most people, if you describe it to them, would want to be is that the acquisition and deployment of IT would be secondary. What you would acquire and deploy would be a business process or it would have a business services orientation [Jimmy Harris, Accenture, November 2010]

To illustrate this, consider an organization's desire to acquire sales support. That is, the organization recognizes that it needs

> the ability to track contacts, the ability to manage the pipeline, the ability to convert our pipeline into sales, the ability for sales to be recognized as revenue [Jimmy Harris, Accenture, November 2010]

This does not (or perhaps should not) mean that the organization knows it wants to go out and buy a particular package. Instead:

> what you would provision in effect is probably a combination of a salesforce.com, some of the functions from an ERP system or financial management system, etc. and for any given employee they have a certain usage profile, they would have access to certain functions and you would provision that employee with sales support [Jimmy Harris, Accenture, November 2010]

Steve Furminger of RAPP, another of our respondents, made a similar suggestion when discussing how they used cloud services to provide solutions for their own (media) customers:

> It's providing us with the ability to create much more, produce many more solutions without having to worry how are we going to do that. Where four or five years ago, or even two or three years ago, that was a massive concern. Now we can almost forget the technology and just think this is what we're going to do [Steve Furminger, RAPP, December 2010]

The management of cloud services from a cloud provider's perspective also offers opportunities for innovation (Lindner et al., 2010)as there are current shortfalls, as Kevin Lees of VMWare notes, in terms of:

> orchestration, monitoring, performance monitoring, capacity management monitoring and capacity management modeling and capacity planning [Kevin Lees, VMWare, November 2010]

Other interviewees, including Jim Rivera of SalesForce and Russell Marsh of RAPP, see the scope for business process automation and integration and automated marketplaces for provisioning.

Towards the cloud corporation

Although the perceived benefits of cloud computing are apparent, the analysis of our evidence base suggests that widespread adoption of cloud and, more importantly, the use of cloud for innovation beyond IT operational benefits could be more problematic than would appear at first, see Table 1. By focussing on three aspects of our data, this paper has identified a range of factors that affect the antecedents to cloud adoption and innovation.

Some of these factors, such as attributes of cloud computing to support low–friction innovation and the potential for experimentation that the resulting changed risk profile affords, clearly support the ability to use cloud for innovation and are likely to drive the adoption of cloud by suitably prepared organisations.

Other factors, however, are likely to be more problematic. These might cause enterprise to delay / limit their initial adoption of cloud computing to IT operational activities. Others might require the enterprise to develop and retain specialist in–house skills and capabilities. For example, the greater "operational readiness" that cloud requires, whereby the enterprise might need to be responsive on a daily or even hourly basis might not be achievable with existing internal capabilities. Similarly, the changing skill sets required of the internal IT department might take some time to achieve; moreover, retaining this capability is likely to prove a challenge for many traditional IT management functions.

What is particularly interesting from this analysis is the realisation that whilst cloud has obvious technological benefits, there are also a number of important technological (negative) consequences. For example, integrating existing legacy systems with the use of BYOD by employees may be problematic and there are significant management and operational challenges in moving from projects and demonstrator systems to full production systems (where personal credit cards can't be used to provision and maintain mission–critical computing resources).

> Ready when you are … will be more of a function of how the organization absorbs the technology or solution is the gating factor to speed as opposed to the ability to implement the technology itself [Jimmy Harris, Accenture, November 2010]

Our most recent survey in 2013 provided further evidence to support the concerns raised about the assumption of frictionless innovation arising from cloud adoption. The client, advisor and supplier communities were asked to rank the top five business objectives clients seek from cloud services from among nine choices. In contrast to the answers to the opinions about cloud services as a source of innovation, the top rated business objective by all three communities was cost efficiency, followed by scalability, rapid deployment, avoiding the complexity of managing IT and ensuring high security. In 2013 innovation through cloud is low on the corporate agenda. This is partly due to recessionary times driving other more pressing objectives and also because clients feel low on the learning curve with cloud. For example, there were 85 customers in the customer only networking session when the survey was administered and 30 customers chose not to respond. When asked why they did not answer the survey, the customers said they did not know enough about cloud computing to respond. Thus, there is still a large customer education gap about the potential value of cloud services.

	Executive perspectives on the cloud innovation agenda	*The changing role of the IT department*	*Innovation through infrastructure and service*
Attributes of innovation	+ Focus back on business	- Greater "operational	+ "Low–friction" innovation

	requirements	readiness" required	
Collaborative innovation	+ Increased focus on customer needs along supply chain	- Too much emphasis on headcount / cost reduction	+ Changing risk profile supports experimentation
Innovation implementation process	- Requirements for high levels of service	- IT staff need greater business orientation	- Challenge of moving from demonstrators to production systems
	- Challenge of managing BYOD	- Skills shortage / retention problems	+ Automated marketplace for provisioning

Table 1 Evidence relating to cloud innovation (+supports faster cloud innovation, - could result in delays in cloud innovation)

The analysis in this paper suggests that there will need to be significant changes in the IT supply market and in the internal IT function. This suggests a medium term situation in which organizations (and consumers) collaborate and interact through configured business services provided from the cloud. CIOs would then consider cloud based business processes as real services to the business—not assessed as SLAs but against key business performance indicators and profit.

Once in place, these cloud business services would allow third parties to be directly integrated within them—accountants, suppliers, regulators, for example. The traditional role of the systems integrator might thus become, in effect, that of a business integrator—connecting real business services together—rather than worrying about technology.

For most organizations, such a change would improve their processes, free IT staff time to have a business and strategy focus and allow a much easier relationship with suppliers of services. Such a change is an evolution rather than revolution ("incremental innovations" on the existing cloud sourcing path, albeit with certain "architectural innovations" which improve processes and technologically advance the organization's business).

We see glimpses of this today. Avon exploits a Facebook application to allow its Sales Leaders to socially network. Jim Rivera of SalesForce describes the strategy:

> It's these young girls that are on Facebook all day. And they have huge networks of friends … they're not going door–to–door like they use to and selling a product. It's all about just going out through their network. Well, Avon did a fascinating thing where they built a Facebook application on [the SalesForce] platform and on the Facebook platform, you know and largely kind of just plug in external applications quite easily … They built this custom application to help manage their network of Avon Ladies within Facebook. So now as an employee of Avon, as an Avon Lady, all I do is, you sign into Facebook. You get all the promotions coming to you. You're understanding what the new products are, what things you should be pushing and then within the same application, you turn around and you start to push that out into

your network. And it's amazing. So they've actually used that as like their portal for their sales people in Facebook [Jim Rivera, SalesForce, November 2011]

Here Avon's Sales and Marketing business processes extend into Facebook and through that into the social networks of their customers. Their processes have moved outside the traditional organisational boundary to create amorphous collaborations, through sales leaders, with customers and their social networks.

Such collaborative, innovative relationships, supported by cloud services hint at a new organizational form—amorphous, agile, ambidextrous (in focusing on delivery but also on radical innovation)—the Cloud Corporation. Knowing what such an organization might look like is difficult—few commercial enterprises are yet in the position to collaborate and integrate business services sufficiently. Examples do exist beyond the commercial enterprise, however. One example exists among the particle physicists working at CERN on the Large Hadron Collider (LHC).

In order to analyse the staggering 15 million gigabytes of data that are being produced every year by the LHC's experiments there was a need to create a global organization of over 140 computer centres (each part of a university or research facility) working together to pool their computing into a Grid Computing Infrastructure (Berman & Hey, 2004; Britton et al., 2004). This infrastructure was developed and is run, collectively by this loosely organized group of physicists and their data centres.

Interestingly this new organization connects the computer centres through loose memoranda of understanding and business processes (particularly around support, data–analysis and technology upgrades). Its bureaucratic hierarchies are very limited in scope and power and most work is achieved through collaboration among equals (Zheng et al., 2011). Crucially, technology (in the form of monitoring, support and control dashboards) allows collaborators to implicitly understand the state of the grid, of their collaboration and of their part within it. The technology and the social networking around the technology, is taken for granted, institutionalised and is part of their agility woven within their management practices. For example, when Steve, (a collaborator in the UK), wished to steer other UK collaborators' actions he did so by "mashing–up" a new business process which showed, hour by hour, those elements of the Grid infrastructure that he felt were deficient. Called "Steve's Jobs" they provided an incentive and direction to other collaborators to change their work and innovate around "Steve's Jobs" (Pegasus, 2011). Particle physicsts at CERN are unusual—they have highly collaborative tendencies(Knorr-Cetina, 1999; Traweek, 1992) (which they invented the Web to support); however they also provide a first glimpse of how an agile, innovative global organization can be created when founded upon collaboration and shared cloud–based technology.

Most organizations must, to some extent, be ambidextrous (O'Reilly III & Tushman, 2004). Alongside incremental innovations they must also continually seek to explore new ground. As a radical innovation in technology cloud computing thus offers organizational units a chance to alter radically their business services—most probably through the innovation and collaboration beyond the enterprise as identified earlier. For, as John Seely Brown reminds us (Brown, 2003), Nicholas Carr's pronouncements that "IT doesn't matter" (Carr, 2003) ignored the fact that each new computing facility creates new possibilities and options—that can be exploited for market advantage.

The distinctive features of cloud computing also offer many potential opportunities for business innovation, particularly given its service (and service quality) focus, coupled with the flexibility that new technology delivery mechanisms provide. These features serve to change the risk profile of business innovations to the extent that it is now increasingly possible to specify new business processes and their associated required service levels, experiment with them for a short time and either disband them if they are unsuccessful or rapidly scale those that have potential.

The pattern, therefore, may well follow past diffusions of other potentially powerful technological innovations, including the internet itself. The technology innovations will move in packs covering base technology and technical service and process innovations. With cloud these innovations in combination are likely to be radical and disruptive, if over a longer time period than many are anticipating. From a business perspective, these technology innovations will have a cumulative impact on the possibilities for more business–focused innovations, though these will be through the filter of the three antecedent factors discussed in this paper. From a business executive perspective, the innovation plan then is relatively easy to state, but much more difficult to make the right choices on: navigate the hype, test out the capability, find the useful application, ensure the capability to leverage and learn further how to exploit the innovation for strategic, business purpose. And move from cost gains through incremental, architectural and radical innovation to the cloud–based, agile, ambidextrous organization.

The challenges are larger and there is more friction associated with the adoption of cloud. Cost savings will come through, but the business benefits needing an eight to ten year rather than a five year horizon to come to fruition. We also anticipate initially more process innovation—associated with net job losses—as a result of cloud, before job creating product innovations come through and would therefore predict much smaller net job creation from the cloud, especially in the short term.

Appendix: Research base

This paper draws on a diverse range of sources—an interview base covering 2010–2013, industry and academic reports and two surveys, summarised in Table 2 below.

A distinctive feature of the work reported here is the inclusion of results from a large–scale survey of IT industry practitioners. The survey was undertaken jointly with HfS Research (Horses for Sources, 2013). HfS Research is a research analyst firm and social–networking community that is focused on helping enterprises make complex decisions with their global sourcing strategies. It has 120,000 monthly visitors and 37,000 subscribers and leverages this community of sourcing professionals to deliver rapid insights on the global sourcing industry.

The survey questions were developed in conjunction ran between October and November 2010 and included questions based on existing research on outsourcing and the potential for cloud sourcing as well as more general indicators about current and future desires in relation to enterprise adoption of cloud computing (Horses for Sources, 2010). The survey was conducted online and disseminated across a broad number of networks and media to collect a random sample of business (non–IT) executives, IT executives and technology vendors, advisors / consultants and service providers of cloud–based services.

The survey was sent in a number of outgoing emails and was also available live on a number of popular websites and blogs. Three separate question sets were developed that were tailored to these three groupings. Each question set was completed via a 12–minute web–based questionnaire. IP addresses were collected to ensure duplicate responses were deleted. Networks were spread across multiple technology blogs and media, largely ZDNet blogs, Global Services Media, Shared Services & Outsourcing Network and the HfS Research subscriber–base (accounting for 75% of respondents). 1035 responses were collected, 214 from IT executives, 414 from business executives 407 from Technology vendors, advisors / consultants and service providers of cloud–based services.

A second survey ran in February 2013 during the World Outsourcing Summit. The survey sample of 133 delegates captured a range of firm sizes as measured by number of employees world–wide. The average size of firm for customer respondents was 50,751 employees, for provider firms was 32,494 employees and of advisor firms was 4,201 employees. The size ranged from a very small advisory firm with only three employees to a very large client firm with over 300,000 employees. We also asked customers to indicate the industry which best describes their organizations. Financial Services (34%) and Insurance (13%) were the most represented industries.

The research also draws on thirty five initial interviews with leading industry players across the cloud supply chain undertaken between 2010 and 2011 and running concurrently with the survey. These were added to during 2011–12, following the same procedures outlined below. By late 2012 we had interviewed a total of 56 providers of cloud infrastructures and services, system integrators, analysts and users of cloud services. In terms of roles, we spoke to CEOs, CIOs, marketing and operational managers, strategists, consultants, analysts and service directors. Interviews were normally undertaken by one person and were typically held over the phone. They normally lasted at least one hour, with some running to over two hours.

Each interview was then transcribed and the transcripts shared amongst the research team. Each interview was then coded using the Atlas ti qualitative analysis software by one member of the team. For the first, exploratory, stage of analysis codes were used to simply classify each element ("quotations") of the interview. For example, some parts of the interviews related to "hybrid clouds" ("and then the you know, the direction that everyone sort of seems to think is going to happen and I believe it will is more towards the hybrid Cloud which is you know, truly being able to extend your private Cloud infrastructure using service provider um, value addition around that to create you know, more of a hybrid Cloud that connects the dots between public and private") others to "lock–in" or "pay–as–you–drink models". As the interviews were being coded, a parallel process of consolidation took place whereby the codes were grouped and classified into what Atlas refers to as code families. For example, the code family on "cloud and innovation" consisted of 89 individual codes and a total of 100 interview extracts, 47 codes and quotations related to the role of the IT department. As the analysis developed and particular themes, such as executive perspectives on the cloud innovation agenda, became important, specific code families were created to cover these higher level themes. In addition, the interview transcripts were reviewed to determine if any extracts might have been missed that related to these higher level themes.

This process of analysis was also based on and contrasted with, themes from the cloud and outsourcing literatures as well as the results of the large–scale survey (Eisenhardt, 1989). The process involved an iterative reading, coding and cycling through the codes. The validity of the coding and analysis was constantly checked by searching for counter examples and nuances in the text and codes.

Each individual code family was then analysed to identify relationships between the different elements. For example, within the code family "Role of IT department" included consideration of end user computing, the relationship between the IT department and the Chief Financial Officer and clearing the IT application backlog.

The resulting codes and associated quotations were then shared with the remainder of the project team. This resulted in further insights and themes to explore. Finally, a selection of the coded quotations was selected for presentation (Golden-Biddle & Locke, 1993). The selection process was guided by the need for a coherent narrative flow in the paper.

Data item	Description	Date collected
Interviews I	35 interviews across the cloud supply chain (CEOs, CIOs, marketing and operational managers, strategists, consultants, analysts and service directors)	2010–2011
Interviews II	21 follow–up interviews across the cloud supply chain (CEOs, CIOs, marketing and operational managers, strategists, consultants, analysts and service directors)	2011–2012
Online survey	1035 respondents (IT executives, business executives, technology vendors and advisors)	October–November 2010
Reports	Academic and vendor literature (160 reports)	2010–2013
Survey	133 attendees of World Outsourcing Summit	February 2013

Table 2 Characteristics of the composite research base

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