HOW TO KEEP YOUR HEAD ABOVE THE CLOUDS: CHANGING ICT WORKER SKILL SETS IN A CLOUD COMPUTING ENVIRONMENT

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ABSTRACT
Cloud computing represents a potential paradigm shift in how organisations access and use information, communication and technology (ICT) services. Such changes in how ICT services are sourced and delivered will impact on organisational structures and associated management practices. They further question the traditional role of ICT workers. This paper contends that while the technical and potential cost saving aspects of Cloud computing have attracted much attention, far less research has been conducted into the associated human resource management (HRM) impacts of Cloud computing on ICT workers. This paper attempts to fill this gap in the literature by examining HR issues related to managing ICT workers within organisations adopting Cloud computing strategies. It further suggests that the impacts of Cloud computing may differ from previous ‘outsourcing’ strategies that were often linked to large-scale job shedding (Ross, 2002, 2003; Ross & Bamber, 2009), at least in the short- to medium-term. The paper uses transaction costs economics theories and frameworks to support the analysis.

INTRODUCTION
Cloud computing has become one of the most talked about issues in the information communication and technology (ICT) sectors (AGMIO, 2011; Buyya, Yeo, Venugopala, Broberg & Brandic, 2009; Creeger 2009; Grayson 2011; Ryan & Loeffler 2010; Visiongain 2010). Between 2010 and 2015, the global Cloud computing market is forecast to grow from US$37.8 billion to US$121.1 billion (‘Global Cloud Computing Market’, 2010:133). Governments are also conducting investigations into the potential increased efficiencies of this approach for their own ICT requirements (AGIMO, 2011; Guo, 2011a,b). Cloud computing has therefore shifted from a period of ‘speculation and hype to widespread adoption across the ICT community’ (Visiongain, 2010).

This paper begins by outlining the research background for this project before examining and explaining Cloud computing processes and services. It examines the potential impact of Cloud computing on organisational ICT strategies, including how these strategies compare with previous studies on the HRM impacts of outsourcing, including downsizing strategies. It further
considers how Cloud computing approaches have the capacity to change ICT workers’ skill sets. It concludes by synthesising the results of this research and considers future directions for research in this rapidly changing environment.

RESEARCH BACKGROUND
This project forms part of ongoing research into workplaces issues in the ICT sector. Most recently this has included more than 40 interviews with industry and government stakeholders in the Australian ICT sector in 2010 and 2011. While the interviews were initially focused on ICT worker issues more broadly, an analysis of the interview data quickly showed that Cloud computing services were set to have a major impact on the ICT sector in general and ICT workers in particular. Over time the interviews therefore became more focused on this topic. In 2011 interviews were conducted with Queensland and Australian government officials who were developing Cloud computing policies for both the public and private sectors. At the time of writing the researcher was also in discussions with the Queensland Department of Employment, Economic Development and Innovation (DEEDI) on a collaborative research proposal that will examine Cloud computing strategies in Queensland public and private sector organisations. The above qualitative research is further supported by extensive secondary research into the literature. This paper therefore provides an initial analysis on the likely impacts of Cloud computing on organisational strategies and ICT worker practices based on the above research to date.

CLOUD COMPUTING

_We’ve redefined cloud computing to include everything that we already do. I can’t think of anything that isn’t cloud computing with all of these announcements_ (Larry Ellison, Oracle in ‘CBS Interactive Inc.’ 2009)

Earlier research developed the theory of the firm beyond the dualism of organisations and markets and saw networks as offering an efficient alternative (Dunning, 1995; Dyer & Singh, 1998; Kale, Singh & Perlmutter, 2000; Yeom, 1996). Networks can offer loose boundaries and transparent relations between member firms. Such interaction may include information exchanges and problem solving between group members. Long-term reciprocal transactions between group members may also limit short-term opportunism and lead to long-run equilibrium. In such a situation networks of firms can operate more efficiently and cost effectively than individual firms in the market (Yeom, 1996:92). Networks may also share the risk and reduce investment costs for partner firms. Dunning discusses similar issues under the
guise of ‘alliance capitalism’ and suggests that cooperative networks of firms will lead towards:

a flattening out of the organisational structure of decision making of business enterprises, with a pyramidal chain of command being increasingly replaced by a more heterarchical inter-play between participants in decision making (1995:20).

Cloud computing strategies use internet based ICT technologies to further develop the concept of the networked firm.

What then do we mean by Cloud computing? As the above quote from the CEO of Oracle suggests, a lot of hype has surrounded this term. A simple definition is that Cloud providers offer a range of ICT services ‘that live in someone else’s data centre’ (Jones, 2010:3). Cloud computing therefore offers firms the ability to source ICT infrastructure and services from external providers via the internet. These services include:

- infrastructure as a service (IaaS) – includes shifting an organisation’s data into externally based data bases;
- Platform as a service (PaaS) – provides organisations with underlying hardware, operating systems, storage and network capacity via the internet (PAAS, 2011); i.e. PaaS providers allow firms to install and run their own applications on external internet-based ICT systems (Jones, 2010:3);
- Software as a service (SaaS) – includes internet based email systems; and
- Business processes as a service (BPaaS) – outsourcing of former in-house services such as payroll or accounting services to internet based providers. (see also Higgins, 2009; Ryan & Loeffler, 2010).

Given that many of the above services and terms have been around for some time, some would suggest that the term Cloud computing is essentially a rebadging of existing services. While there is undoubtedly some truth to this, improvements in ICT technology and internet broadband services have allowed Cloud providers to exploit new and expanding markets with innovative bundles of ICT services. These innovations are in turn pushing firms towards new operational models (Urquhart in Bias 2010).

A major factor which is driving organisations towards new Cloud based operational models is the potential to reduce infrastructure and labour costs (Southam, 2010). But the benefits of Cloud computing go further than simply being able to access low cost external providers. These include the ability of firms to increase or decrease their ICT requirements depending on changing

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2 The term ‘Cloud’ simply reflects how the internet has often been shown in diagrams.
business conditions (Gartner, 2009). Under this scenario, firms can scale up their ICT requirements through external providers during peak business periods and/or when the market is rapidly expanding. Conversely, firms can scale down their requirements during slack periods and/or economic downturns. During interviews, ICT managers at an Australian university advised that their servers usually ran at full capacity during peak periods – for example during enrolments and around exam periods. However, during the end of year summer break these same servers ran at only around 40 per cent of total capacity. However, under the traditional ICT capital investment model the university was required to engage in capital ICT investments that would cover peak capacity usage, even if this only occurred at certain times of the year; at other times of the year 60 per cent of this investment lay idle. They were therefore looking at possible Cloud solutions whereby they only paid for the ICT services they required at any particular time. In this regard Cloud computing offers the potential for ‘scalable and elastic IT-enabled capabilities’ (Gartner, 2009).

A further advantage of this pay-on-demand ICT services model is that it allows small to medium size enterprises (SMEs) to access internet infrastructure and services that would normally be above their capital outlay capabilities (WEF, 2010); this a potentially significant benefit to local Australian owned ICT firms that are often SMEs. Similarly, reports suggest that South American firms see Cloud computing strategies as a tool for them to better compete with their often larger North American rivals (Sperling, 2010). This enhanced ability of firms of all sizes to rapidly access new technologies arguably also drives innovation (CBS Interactive Inc., 2009).

Despite the above benefits, Cloud computing systems are not without their challenges. An international survey of firms found that the two foremost concerns of potential purchasers of Cloud services were data security and data privacy (WEF, 2010). Interviews of Australian ICT firm managers elicited similar sentiments with one manager advising that ‘there are some things that you would not want to put in the Cloud’. Privacy issues are further complicated by the US Patriots Act. Passed by the US Congress following the 9/11 tragedy, this anti-terrorism law technically gives the US government access to any data stored in the country. Given that some of the largest data base centres operated by Cloud providers such as Google and Amazon are located in the US, the Patriots Act has caused some concern amongst potential Cloud computing purchasers (Jaeger, Lin & Grimes, 2008).

Cloud computing models also require firms to enter into contractual arrangements and manage service level agreements (SLAs) with external providers. Vendor-lock in issues may also make it difficult for a firm to transfer
to alternative external providers (WEF, 2010), while integrating external ICT systems with internal legacy systems is an often difficult task (Bozman, 2010). From a macro perspective, Cloud computing systems also require a good underlying ICT infrastructure — such as a high speed broadband network — if they are to reach their full potential (Tindal, 2011).

Such concerns suggest that outsourcing all ICT services will not be an option for most firms, at least in the short- to medium-term. Rather firms will tend to shift towards “Hybrid” Cloud models, whereby some ICT services are kept in-house, while other services are provided by external providers (Ryan & Loeffler, 2010) (see Figure 1). In this regard, Cloud based email services, such as Gmail, are often the first step for firms looking to use Cloud based strategies (CBS Interactive Inc., 2009). Firms may then shift more ICT services into the Cloud environment, after the success of such initial strategies is evaluated.

**OUTSOURCING AND ORGANISATIONAL CHANGE**

Some reports suggest that Cloud computing is not outsourcing. Bias, for example, advises that in contrast to outsourcing, Cloud computing delivers ‘self-service IT “at scale” through automation’ (2010:3). This paper however contends that such distinctions are somewhat semantic. While the implementation and operation of some Cloud computing practices may differ from traditional outsourcing practices, the fact remains that firms utilising Cloud computing agreements are sourcing ICT services from external providers. However, Cloud computing may lead to the development of
different kinds of outsourcing models, from those seen previously. This section therefore contrasts and compares the potential organisational and staffing impacts of Cloud computing. In this regard the literature on outsourcing, including transaction costs economics (TCE) (Williamson, 1991; 1996), and its impacts on workplace practices and strategies, provide an appropriate tool to analyse Cloud computing and organisation change.

The TCE-based hierarchy versus market model of the firm suggests that outsourcing may generate associated transaction costs related to opportunism and bounded rationality (Williamson, 1991; 1996); data security, contractual issues and the monitoring of SLAs are obvious transaction costs associated with Cloud computing models. Further potential transaction costs include quality control issues and/or the potential loss of firm-specific knowledge to a competitor. Thus the full cost of outsourcing a service or production to the market will include the specified market price plus any associated transaction costs. These costs may increase the total price of a market transaction to the point where it is more economical to produce in-house rather than outsource to the market.

TCE suggests that opportunistic behaviour may be reduced via the asset-specificity of whatever is being contracted out. Should the firm be able to convince a subcontractor or alliance partner to invest in asset-specific equipment pertaining to the goods or services being produced, then the subcontractor or partner would be more likely to continue with the relationship. Inducing supplier firms to invest in co-specific assets creates high sunk costs by these firms, which in turn help to create effective ‘non-legal enforcement mechanisms’ that bind the firms together (Argyres & Liebeskind, 1998, p. 51). Because the firm will find it difficult to find alternative subcontractors or partners willing to make these large investments in asset-specific equipment, it is in the interests of both parties to form long and flexible relationships (Williamson, 1979). Williamson (1983) refers to these kinds of credible commitments as ‘hostage taking’. However, it may be more difficult to build such relationships in a Cloud computing environment. Because Cloud providers will generally supply ICT services to a number of firms, they are more likely to provide generic — ‘off the shelf’— products and services, rather than firm-specific ICT services (Ryan & Loeffler, 2010:23). Interviewees further advised that external ICT contracts were becoming more short-term as organisations continually scan the market for the cheapest external providers. This again reduces the ability to build long-term relationships with Cloud providers.
CLOUD COMPUTING AND DOWNSIZING
Outsourcing former in-house services to the market has often been associated with downsizing. Ross for example documented large-scale job-cuts in the Australian and New Zealand telecommunications industry that were linked to outsourcing strategies (2003). Downsizing was seen as one way towards increased profitability in an increasingly competitive global environment (see Cascio, 1993; Cascio, Young & Morris, 1997; Gerhart & Trevor, 1996; Kane, 1998; Littler, Dunford, Bramble & Hede, 1997). The expected benefits of downsizing included lower labour costs and overheads, less bureaucracy, faster decision making, such as moves towards flat level management; smoother communications; more entrepreneurial behaviour and increases in productivity (Kane, 1998).

Kane (1998) however suggests that in many instances the expected benefits of downsizing were often not achieved. Kane makes the distinction between downsizing and rightsizing, with the former being a relatively unplanned, reactive response to reduce costs in the face of changing markets and the latter being a planned, proactive response to improve the firm’s market competitiveness. In this regard TCE suggests that firms should take a strategic approach to downsizing and workforce restructuring based on the ‘asset specificity’ of their employees, with firms retaining workers with firm-specific skills and a subsequent high degree of asset-specificity (Williamson, 1991; Ross, 2002; 2003).

A TCE approach therefore suggests that ICT workers employed in firm-specific work, such as research and development (R&D), are less likely to have their work outsourced, as this work is linked to the firm’s competitive advantage. Rather, these innovative ICT workers are likely to be able to leverage Cloud services to better support R&D projects. In contrast, a TCE approach suggests that ICT workers employed in support roles in large organisations where ICT is not the primary focus of the organisation — such as in universities — may face a higher risk of redundancy in a Cloud computing environment than the above more specialised ICT workers. Because ICT services are not the primary role of the organisation, these workers provide a more generic support role and such work can be more easily sourced from the market. As discussed above, the fact that Cloud providers ‘offer common solutions to multiple customers’ (Ryan & Loeffler, 2010:23) further reinforces the inference that the potential negative impact of Cloud computing on ICT staff numbers will be felt most by those ICT workers employed in generic support roles.

Will Cloud computing therefore lead to the extensive downsizing of ICT workers engaged in these more generic support roles? Despite the predictions of TCE, this research suggests that a number of factors may militate against
widespread redundancies amongst ICT support staff, at least in the short- to medium-term. To begin, as discussed, the shift towards a Cloud computing model will generally be an incremental process for most firms, leading to the development of differing ‘hybrid’ models — i.e. a mixture of in-house and external Cloud provided services. This incremental process will slow any worker job losses as many ICT support workers will continue in their current roles, at least in the short-term.

Second, this research suggests that the changing ‘role’ of ICT workers in a Cloud computing environment may further help to reduce the scale of ICT worker layoffs. Under this scenario rather than ICT workers being made redundant per se, some ICT workers will simply shift from a technical to more of a liaison role as they engage with external service providers. One senior ICT manager talked about this in terms of ICT workers shifting to a brokerage role, as they were increasingly required to scan the market for the best Cloud provider options. The term ‘relationship management’ has been used to describe this shift from managing work being performed by in-house employees, to managing work being performed by external providers (Ross, 2003). But this changing role will require new skill sets. In particular ICT worker skill sets will require a greater focus on ‘soft’ or intangible skills including communication and interpersonal skills; attributes that are not always linked to this classification of workers. Many ICT workers may also have had little experience in managing external projects and associated subcontractor arrangements including managed service agreements (MSAs). Therefore redundancies will, to an extent, be linked to the ability of ICT workers to develop new skill sets, as ICT sections shift away from a technical support role towards more of a managed services role. This requires ICT workers to broaden their skill sets in order adopt more strategic and managerial perspectives, including the ability to take risks on behalf of the firm (Modis International, 2011; Schultz, 2011). Some reports suggest that current shortages of ICT professionals with the required skills to manage and innovate in a Cloud environment may induce firms to train and develop the skills of their existing ICT workers, rather than trying to find new workers in the external market (Mottl, 2011).

Despite the above factors, which may limit ICT worker redundancies, the introduction of Cloud computing strategies will introduce more uncertainty into the ICT labour market. While Cloud providers will concurrently generate new jobs, these may be generated in overseas countries, as the external provider firms access overseas data centres and relatively cheaper ICT labour markets. The growth of better international broadband internet services is likely to accentuate this trend. Countering this trend is the rapid growth of the
ICT sector in general and forecast shortages of ICT professionals in general (Modis International, 2011; Mottl, 2011).

CONCLUSION
This paper examined the potential impacts of Cloud computing on the present and future role of ICT workers. It further considered the extent to which Cloud computing strategies would reflect the wide-scale redundancies often associated with outsourcing practices. In line with a TCE analysis this research suggests that the impact of Cloud computing on ICT workers will depend to an extent on the asset-specificity of the job that they perform. In this regard, more generic forms of ICT support work are more likely to be outsourced than firm-specific R&D type work. This implies that ICT workers playing a supporting role in large organisations may be most at risk of becoming redundant, as these types of services are increasingly outsourced to Cloud providers.

The full impact of Cloud computing on ICT worker roles however will depend on the type of hybrid Cloud computing model being adopted. ICT workers in firms which take an incremental approach and opt to initially keep most of their ICT services in-house, may see their roles change very little, at least in the short-term. But the role of these workers may change over time. This includes a de-emphasis in some areas on technical skills, with a concomitant increased need for communication, liaison and subcontractor project management skills. However, managing external service agreements — i.e. monitoring Cloud providers — will still require ICT workers to have a good general technical knowledge of the ICT products and services they are purchasing.

Shortages of ICT workers with these skill sets will induce many organisations to train and retain their existing skilled ICT workers. While this will further militate against redundancies it must be noted that many ICT workers are technically orientated and not all of these workers will be suited to, nor indeed interested in, gaining the kind of ‘soft skills’ outlined above. However the rapidly changing nature of the ICT sector and the increasing importance of ICT technologies for most industries and sectors suggests that new ICT jobs will continue to be created, which will again lessen the chances of widespread job losses across the sector. However the increasing ability of firms to access ICT services from cheaper offshore providers will provide more competition for ICT professionals in developed ‘high-wage’ countries over time.

To conclude, as firms begin to source an increasing percentage of their ICT requirements from external providers, they will begin to more closely resemble Aoki’s ‘nexus of treaties’ (1987). This paper is part of on-going research which will continue to examine the impact of these new technologies.
on organisational and workplace practices and further consider possible future workplace scenarios for ICT employees.

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