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Intellectual capital and business performance: An exploratory study of the impact of cloud-based accounting and finance infrastructure

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Abstract

Purpose – The purpose of this paper, building on previous studies of intellectual capital (IC) and business performance, is an exploratory study of how the use of cloud-based accounting/finance infrastructure affects the business performance of small and medium-sized enterprises (SMEs). The paper aims to discuss these issues.

Design/methodology/approach – A survey method is used to capture perceptions of how cloud-based accounting/finance infrastructure affects business performance in SMEs. The study assumes that although accounting/finance systems are generally regarded as one element of a firm's structural capital; the introduction of a cloud-based infrastructure in the accounting/finance area has the potential to positively impact on all three elements of a firm's IC. Based on the survey data collected, a conceptual model was formulated to test the relationship between cloud-based accounting/finance infrastructure and business performance through the prism of firms' IC.

Findings – The results indicate that cloud-based accounting/finance infrastructure has a positive and statistically significant impact on human capital and relational capital. On structural capital, although positive, the relationship is not statistically significant. On the relationship between the three components of IC and business performance, all three elements are both positive and statistically significant. Furthermore, the R^2 value generated for the ultimate endogenous construct in the hypothesised conceptual model, i.e. "Business Performance" is 71.3 per cent, indicating significant model explanatory power.

Research limitations/implications – The findings suggest further more in-depth research is needed to explore in detail the effects of cloud-based accounting/finance infrastructure on both the IC and subsequent business performance of SMEs.

Originality/value – Studies on the effects of cloud computing on accounting are scarce. This exploratory research suggests that cloud-based accounting/finance infrastructure can potentially improve the business performance of SMEs. While a valuable finding in itself, more research in this area is to be encouraged.

Keywords Cloud computing, SMEs, Intellectual capital, Business performance, Accounting/finance
Paper type Research paper

1. Introduction

The success of modern firms partially depends upon their ability to invest in new technologies that facilitate the exploitation of new commercial opportunities and/or improved incumbent business processes – in other words, allows a firm to adapt. This paper focuses on adaptions to firms accounting/finance systems infrastructure. According to the accounting literature, drivers of accounting change can be identified

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in three broad categories, namely: increasing globalisation; improved information technologies; and improved methods of production (Burns *et al.*, 1999; Russel and Siegel, 1999; Scapens *et al.*, 2003). Here, the focus of this paper is on improved information technologies and specifically on cloud computing.

Recently, it has been claimed that the technological development that is cloud computing, has the capability to transform how firms and society as a whole operates – as noted by Edvinsson (2013, p. 167) "cloud computing and social media will play a growing power role for the new societal fabric". It could therefore be postulated that the adoption of cloud-based accounting/finance infrastructure is one element of this transformation. As such, it is worthy of research in a similar way the effects of enterprise systems were in the past decade (see e.g. Davenport, 2000; Granlund and Malmi, 2002; Murphy and Simon, 2002; Shang and Seddon, 2002).

The advent of cloud computing has allowed firms of varying sizes to avail of enhanced processing power, storage, hardware and networking capacity, without a corresponding capital investment requirement (Marston *et al.*, 2011). Alongside such potential operational benefits, it has been suggested that the use of cloud computing from a human resources perspective can potentially improve organisational performance, innovativeness and ultimately a firm's intellectual capital (IC) (Afshari, 2014; Bhadani, 2014). IC is defined here as a firm's collection of human capital (e.g. employee knowledge and experience), structural capital (e.g. organisational systems and databases) and relational capital (e.g. internal and external relationships) (Edvinsson and Malone, 1997; Roos *et al.*, 1997; Stewart, 1997; Bontis, 1998; Sveiby, 1998), which through their continual interaction can create value, leading to a potentially positive impact on subsequent business performance (see e.g. Sharabati *et al.,* 2010; Novas *et al.,* 2012; Mention and Bontis, 2013). According to Edvinsson (2013, p. 166), "for more than five centuries, accounting has been an instrument for assessing knowledge, directly or indirectly". However, despite the fact that the use of cloud computing may potentially transform the accounting function to become front-office focused and hence, strategic, it has been suggested that accounting within firms remains predominantly back-office orientated (Young, 2010). However, some recent evidence suggests that small and medium-sized enterprises (SMEs), which collectively generate the vast majority of economic activity within most European countries, are beginning to adopt cloud technologies for their accounting/finance infrastructure and gaining advantages, but less so than other functions such as sales and customer service (see e.g. Quinn *et al.*, 2014).

Prior research has regarded firms' accounting/finance infrastructure as part of their structural capital (Booth, 1998; Lynn, 1999; Roberts, 2003; Novas *et al.*, 2012). The authors argue that if a cloud-based accounting/finance infrastructure is adopted by firms' (i.e. their incumbent accounting/finance systems are based on cloud computing technologies), it has the potential to strengthen all three elements of their IC, which in-turn can positively impact on their subsequent business performance. This currently unfounded proposition is what this paper explores by proposing and testing a model on the effects of cloud-based accounting/finance infrastructure on the IC and business performance of SMEs (see Section 4, later).

The remainder of the paper is organised as follows. Section 2 contains a comprehensive literature review, culminating with an argument for the present study. Section 3 describes the research methodology used, Section 4 outlines the research findings and model, and finally, Section 5 outlines some concluding comments and suggests avenues for future research.

2. Literature review

In this section, a review of the extant literature relevant to this research is conducted. First, the authors detail the general and accounting literature on cloud computing, although the latter is not abundant. Second, a detailed literature review of IC is outlined; with a specific focus on previous studies which examined how IC creates value whilst also examining its impact on business performance in various organisational settings, including SMEs. Third, the potential synergy between cloud computing, accounting/finance, IC and firm performance within SMEs is outlined, to justify the authors rationale for this research study.

2.1 Cloud computing

Cloud computing generally refers to the centralisation of all or part of a firm's computer resources via a shared provider of such services (Mongan, 2011). Access to the cloud is normally through an internet-enabled device and is generally limited to relevant authorised users. The US-based National Institute for Standards and Technology (NIST) (2011, p. 2) defines cloud computing as follows:

> Cloud computing is 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.

The NIST (2011) also outline three basic models of cloud computing. First, Software-as-a-Service allows a cloud user to run software programs on cloud infrastructure. Several accounting software products are currently offering this service (see e.g. Kristandl and Quinn, 2012). In this model, any internet-enabled device (notebooks, personal computers, tablet and smartphones) can use the service. Second, Platform-as-a-Service allows a cloud user to develop or deploy applications/software using tools and infrastructure provided by the cloud service provider. Finally, Infrastructure-as-a-Service is the provision of resources such as storage and other hardware in the cloud. The user in this instance may also deploy various operating systems. This model permits the most control over the use of computing resources.

The potential benefits to a firm of using cloud computing include; lower information technology (IT) costs, lower barriers to innovation, global data/systems availability, the ability to scale IT requirements as required and automatic access to system/software updates (Du and Cong, 2010; Marston *et al.*, 2011; Robinson, 2011). For smaller firms, cloud computing facilitates the utilisation of powerful IT infrastructure and software which was previously the main domain of larger firms due to significant capital investment requirements (Paul, 2010; Drew, 2012). Furthermore, cloud computing has the potential to free up scarce resources in all areas of a firm's business, including accounting/finance (see, e.g. Strauβ *et al.*, 2014). Such resources would otherwise have been expended primarily on IT maintenance rather than being used for more strategic and value-creating purposes (Gill, 2011).

However, rather than focusing on the potential advantages associated with using cloud computing, accountants thus far seem to be more concerned with issues such as data protection, reliability and privacy (Howlett, 2011; Quinn *et al.*, 2014). Other issues associated with the use of cloud computing include data ownership and security (Connolly, 2010; Strauβ *et al.*, 2014). In response; it has been argued by numerous cloud computing service providers that users of cloud-based systems are inherently more secure than similar bespoke organisational systems as they are supported by

more specialised and numerous IT personnel (Du and Cong, 2010). Notwithstanding these reassurances, it has been argued by some accountants that while adopting cloud computing can be advantageous, as yet it cannot fulfil the specific requirements associated with a firm's accounting/finance systems (Cooper, 2011; Quinn *et al.*, 2014).

In a similar vein, doubts about the suitability of using cloud computing for accounting/finance purposes have also emerged from the contention that the accounting function is a primary repository for critical operational data. It therefore may not be suitable for migration to the cloud (Gill, 2011), or may be left until other systems have been tried and tested in the cloud before doing so (Quinn *et al.*, 2014; Strauβ *et al.*, 2014). However, at odds with these assertions, it has also been claimed that from an accounting perspective, the use of cloud computing can potentially increase the flow of information within an organisation by ensuring it becomes more formalised and accessible. By doing so, it can facilitate enhanced organisational decision making at all levels (Young, 2010), which can potentially positively impact upon subsequent organisational performance. Indeed, Quinn *et al.* (2014, p. 55) noted that "the main advantage [of cloud computing] cited was an efficiency improvement in business processes".

2.2 IC

As suggested in the introduction, for firms to prosper in an increasingly competitive global economy, it is imperative that they harness their limited IC to its fullest potential by whatever means possible (Edvinsson and Sullivan, 1996; Sveiby, 1998; Mouritsen, 2004; Paul, 2010; Dumay, 2013). As stated earlier, it is generally accepted that IC consists of a firm's collection of human capital, structural capital and relational capital (Edvinsson and Malone, 1997; Roos *et al.*, 1997; Stewart, 1997; Sveiby, 1998; Bontis, 1998). Human capital refers to the tacit and explicit knowledge accumulated by a firm's employees through for example their; education, previous employment, mental agility, etc. (Edvinsson and Malone, 1997; Roos *et al.*, 1997; Sveiby, 1997; Ordonez de Pablos, 2004). Structural capital relates to the procedures, routines, rules, norms, etc. that comprise the core of a firm (Roberts, 2003) and which facilitates the flow of organisational knowledge needed to improve operational efficiency (Edvinsson and Malone, 1997; Cabrita and Bontis, 2008). Relational capital includes knowledge embedded in all of the external relationships that a firm develops with its key stakeholders (e.g. customers, suppliers, trading partners) which can support firms' in obtaining and sustaining competitive advantage positions (Bontis, 1998, 1999; Canibano *et al.*, 2000). Underpinning each of these three elements is knowledge; with some commentators arguing that the primary role of firms' is to integrate this knowledge into desirable goods/services, with the responsibility for ensuring that this occurs falling to management (Grant, 1996; Sanchez *et al.*, 2000).

In terms of creating real organisational value (financial or otherwise), each firm's unique collection of IC (i.e. knowledge resources) represents the lever by which this can be facilitated via their continual interaction and interplay (Stewart, 1997; Marr *et al.*, 2004; Dumay, 2013). This dynamic (as opposed to static) view of IC emphasises; knowledge flows, the transformation of processes, rules, routines, connections and relationships between IC and particular outcomes … i.e. the process of value creation (Marr *et al.*, 2004; Cuganesan, 2005; Cuganesan and Dumay, 2009; Giuliani and Marasca, 2011; Giuliani, 2015). This view is supported by Low (2002) who claims that intangible non-physical resources have become the primary value drivers at both the organisational and national levels, while Lev and Daum (2003) state that unless firms' have appropriate organisational control systems (incorporating accounting/finance), it may restrict their capacity to realise the true potential of such assets.

Although, Dumay and Garanina (2013, p. 12) have stated that, "intangible assets are driving value creation in today's global economy", Dumay (2012) cautions against suggesting that the management of IC inevitably leads to superior financial performance owing to the difficulty in determining concrete cause and effect linkages between specific elements of IC and subsequent value creation. Indeed, it has been suggested that value-creating organisational resources exist as bundles (Penrose, 1959) and that it is difficult to consider the impact of a single resource on value creation and subsequent firm performance without also considering its interdependency with other resources (Dierickx and Cool, 1989; Lev, 2001). Furthermore, Cuganesan (2005, p. 360) claims that the interplay between IC resources and their impact upon value creation is in fact "unstable" and "precarious" and ultimately dependent on their use within a particular organisational setting. Nevertheless, to facilitate firms' in realising their potential requires that their unique collection of resources (both tangible and intangible) are capable of being identified and managed appropriately, with accounting having a key role to play in this regard (Petty and Guthrie, 2000; Ricceri, 2008).

On accounting/finance, it has been posited that it most comfortably sits as an element of structural capital (Booth, 1998; Lynn, 1999; Roberts, 2003). Structural capital itself has been defined as "a valuable strategic asset, which is comprised of non-human assets such as information systems, routines, processes and databases. It is the skeleton and the glue of an organisation because it provides the tools and architecture for retaining, packaging and moving knowledge along the value chain" (Cabrita and Bontis, 2008, p. 217). Based on this definition, it is quite apparent that accounting is indeed an element of structural capital; for example, consider literature on accounting information systems or studies which regard accounting as a series of organisational routines (see e.g. Burns and Scapens, 2000; Quinn, 2011, 2014). Indeed, previous research has attempted to explore the relationship between management accounting and IC. For example, Novas *et al.* (2012) reported a positive and statistically significant relationship between structural capital and management accounting systems, although the findings from Cleary (2015) do not support this assertion.

As will be outlined in Section 3, the authors specifically targeted SMEs for their study. Research has demonstrated that management accounting in SMEs is initially narrow and informal, before becoming more formal and extensive as the firm enlarges over time (Davila and Foster, 2007; Giovannoni *et al.*, 2011; Hiebl, 2013). The literature also acknowledges that management accounting (whether formal or informal) is vital for small business growth, performance and survival (Perren and Grant, 2000; Argilés and Slof, 2003; Davila and Foster, 2007; Sandino, 2007). Within SMEs, owner-managers and internal accountants are the primary creators (and sometime enactors) of management accounting routines (see e.g. Hiebl *et al.*, 2012), which over time may become more formalised. Although control is generally maintained over these routines by their creator, they may become harmonised into organisational specific management accounting "rules" as the business continues to grow (Perren and Grant, 2000). Furthermore, it has been suggested that the origin of objectified (or harmonised) management accounting knowledge within SMEs generally consists of a combination of the past personal experiences of owner-managers, external management accounting expertise, accompanying computer software and previously acquired management accounting knowledge by the firm's employees (Perren and Grant, 2000).

As organisational knowledge (including accounting/finance) is created by a firm's employees, a dilemma for firms' is how to extract and transfer such knowledge across

the organisation so as to create value and contribute towards subsequent enhanced organisational performance (Grant, 1997; Bontis, 1998; Bontis *et al.*, 2000; Bontis and Fitz-enz, 2002; Ordonez de Pablos, 2002; Garcia-Ayuso, 2003; Wang and Chang, 2005; Do Rosario Cabrita and Landeiro Vaz, 2006; Cabrita and Bontis, 2008). Put another way, the dilemma is how to embody created knowledge as part of the firm's IC. Empirically testing the relationship between the various elements of IC and business performance is not a simple task as there is no consensus on how best to measure a firm's IC (Clarke *et al.*, 2011).

Despite this, extant studies show a very strong correlation between the three elements of IC, value creation and firm performance. For example, Cabrita and Bontis (2008) and Sharabati *et al.* (2010) found that both relational capital and structural capital had a positive impact on firm performance, whereas Ordonez de Pablos (2002), Jardon and Martos (2009) and Novas *et al.* (2012), reported that structural capital alone had a positive and significant relationship with firm performance. In contrast, Mention and Bontis (2013) found that only human capital had a positive and significant relationship with business performance. Plausible explanations for these contrasting findings include the fact that by its very nature, IC is fluid and hence constantly evolving, along with the realisation that within all firms' the specific composition of IC is unique. Thus, direct comparisons between firms, industries and countries are difficult (Mouritsen, 2006).

A number of studies have also examined the relationship between IC, value creation and business performance within an SME setting and found that the various elements of IC need to continually interact to create economic value and that different IC-based components impact on business performance (Bontis, 1998; Bontis *et al.*, 2000; St-Pierre and Audet, 2011). Similarly, research conducted by Cohen *et al.* (2014) found that amongst their sample of Greek SMEs surveyed during a financial crisis; IC was found to be a strategic enabler requiring continuous and considered investment to yield the expected results. However, owing to the nature of SMEs, various other findings have also emerged from previous research efforts. Examples include that; SMEs compensate for their size by strategically managing their employees to become their primary source of value (Wang and Chang, 2005; Steenkamp and Kashyap, 2010; Henry, 2013; Daou *et al.*, 2014), SMEs who adopt different strategies were found to organise their IC in a particular manner (St-Pierre and Audet, 2011) and despite a general awareness of IC and its importance for the attainment of a competitive advantage (Daou *et al.*, 2014); there is a lack of knowledge amongst management in SMEs about how to harness its potential (Henry, 2013). The potential contribution of cloud computing in this regard is therefore worthy of investigation

2.3 Cloud computing, accounting/finance, IC and business performance

As noted, by adopting cloud computing a firm can potentially utilise their valuable and scarce resources (both tangible and intangible) for more strategic purposes, thereby creating real organisational value. From the accounting/finance perspective, continued use of traditional, custom designed proprietary systems that are expensive and time-consuming to continually maintain and/or upgrade, represents a major reason for firms to consider migrating some/all of their accounting/finance systems to a cloud-based environment (Gill, 2011). Start-up and small-sized firms with little previous IT expenditure have thus far been very proactive in their adoption of cloud computing. Medium-sized firms who have already committed significant sums of capital to their own IT infrastructures, are less willing to migrate to the cloud (Young, 2010). For larger

firms, as the potential benefits of using shared applications are less obvious, they may be more inclined to develop their own private cloud infrastructure (Du and Cong, 2010; Strauβ *et al.*, 2014).

Although previous research has claimed the accounting/finance function as one element of firms' structural capital (Booth, 1998; Lynn, 1999; Roberts, 2003; Novas *et al.*, 2012), the authors contend that if a cloud computing based infrastructure is implemented within the accounting/finance domain, it will have the potential to positively impact on all three elements of firms IC via enhanced knowledge management/sharing practices. The interaction amongst these IC-based elements may then stimulate the process of value creation, ultimately resulting in a positive impact on subsequent business performance (see e.g. Tayles *et al.*, 2002; Sofian *et al.*, 2004; Edwards *et al.*, 2005). Consequently, the objective of this paper is to explore the impact of cloud-based infrastructure in the accounting/finance area on the IC of SMEs, and the subsequent business performance of such firms.

3. Research methodology

Ireland is a leading force in cloud computing implementation and research with some commentators proposing it as the cloud computing capital of Europe[1]. Also, as noted previously, SMEs have the potential to realise numerous benefits from using cloud computing technologies. It was therefore decided to select a sample of Irish-based SMEs for this study. Irish SMEs represented 97 per cent of Irish business in 2012 (Lawless *et al.*, 2012), which is similar to other European countries. Additionally, it is interesting to note that while Irish SMEs accounted for approximately 50 per cent of private-sector economic value added at that time, they provided employment for 70 per cent of private-sector employees (European Commission, 2013). This suggests significantly lower labour productivity than expected within this sector, which could potentially be enhanced by the adoption and use of cloud computing. Thus, choosing Irish SME firms as the sample for this study supports the exploratory nature of it.

Based upon a review of the IC and cloud computing literature, an on-line survey was constructed consisting of a 41 statements (items) in five main areas (constructs). The on-line survey instrument was developed using Qualtrics survey software. The five constructs are: cloud-based accounting/finance infrastructure; human capital; structural capital; relational capital; and business performance.

In relation to the development of the latter construct, a multidimensional perspective was adopted, in recognition of the varying objectives, both financial and non-financial, of the respondent firms. Examples of the non-financial objectives include enhanced; strategic decision making and corporate reputation. Dess and Robinson (1984) and Venkatraman and Ramanujam (1986) have shown that perceptual measures of business performance can be a reasonable substitute for objective measures, and can also have a significant correlation with objective measures of financial performance (Hansen and Wernerfelt, 1989). Furthermore, it has been argued (Van der Stede *et al.*, 2005) that subjective measures of performance may provide a superior type of information in that subjective beliefs represent reality, especially in the eyes of respondents.

Respondents to the on-line survey were requested to provide their perceptual response to a series of statements on a five point scale ranging from "Strongly Disagree" to "Strongly Agree". The Appendix provides full details of the items used in each of the five constructs. Once developed, the survey was piloted with a number of respondents (19 in total). The pilot respondents included; professional accountants,

managers and accounting staff of Irish SMEs, and academic colleagues. Based on feedback received, some minor amendments were made to the survey instrument.

Research by Strauβ *et al.* (2014) on cloud computing usage in German SMEs has shown that in general, 25 per cent of firms adopt cloud computing, with 20 per cent of those using it in accounting and finance, i.e. 5 per cent of their sample. Similarly low usage of cloud computing in accounting and finance was reported by Carcary *et al.* (2013) at 8 per cent of cloud adopters. Thus, in an effort to gather useful data for our study, it was decided to choose a purposive sample drawn from a database held by the Irish Centre for Cloud Computing and Commerce (www.ic4.ie). The Centre maintains close contact with Irish firms who have or are considering migrating some or all of their functions to the cloud. Thus, the authors deliberately selected a sample more likely to use cloud computing in accounting and finance. In June 2014, a predetermined contact within 707 firms was sent an e-mail outlining the purpose of the research study and requesting their participation. A series of further reminder e-mails were sent after two and three weeks, respectively, to encourage involvement. The survey was closed after four weeks. A total of 117 valid responses were received, representing a response rate of 17 per cent which is acceptable in comparison to similar recent surveys in the IC research field (see e.g. Cleary, 2009 (23 per cent); Steenkamp and Kashyap, 2010 (10 per cent); Novas *et al.*, 2012 (17 per cent)). The majority of respondents were service sector SMEs.

Of the 117 responses received, 43 firms use cloud-based accounting and finance applications. This 37 per cent cloud computing adoption rate in accounting and finance is higher than the 8 per cent reported by Carcary *et al.* (2013) and the 5 per cent reported by Strauβ *et al.* (2014). This is to be expected given the purposive sample. While the number of firms adopting cloud computing for accounting and finance is low in absolute terms, the survey instrument specifically asked respondents about their use of cloud-based applications, and instructed respondents to exclude cloud-based e-mail and file sharing. Therefore, it can be reasonably confidently assumed that these respondent firms utilise their cloud-based accounting and finance infrastructure to manage their regular accounting tasks in a similar way to how other firms would use desktop applications. The survey instrument also queried respondents who did not use cloud-based accounting and finance applications if they used the cloud for other business areas. The responses to this show an approximate three-way split between accounting, sales/customer service and other business processes. This is in contrast to Strauβ *et al.* (2014), where 60 per cent of firms used cloud computing for other processes, and 31 per cent for customer relations. Although this study is not directly comparable to Strauβ *et al.* (2014), it nevertheless yielded a more even distribution of the uses of cloud computing technologies.

The data collected from the survey was then transferred to SPSS to begin the analysis process; the outputs of which can be seen in Tables I-IV. Data analysis used a partial least squares (PLS) approach, in-keeping with previous IC research (see e.g. Bontis, 1998, 2002; Bontis and Fitz-enz, 2002; Ordonez de Pablos, 2002; Wang and Chang, 2005; Do Rosario Cabrita and Landeiro Vaz, 2006; Cleary *et al.*, 2007; Cleary, 2009, 2015; Jardon and Martos, 2012; Mention and Bontis, 2013). Within the context of PLS research, the main objective is the explanation of the amount of variance contained within a particular model setting. Therefore, R^2 values and the statistical significance of relationships among constructs provide an excellent indication as to how well a particular model is performing.

As noted above, this paper is based upon the responses of 43 firms (or 37 per cent) who have adopted cloud-based computing in accounting and finance. As the PLS

	Mean	SD	Loading level (0.70)	Item to construct (0.35)
Cloud accounting/finance				
CloAccFin1	2.81	1.052	−0.160	Removed
CloAccFin2	3.72	0.701	0.825	0.751
CloAccFin3	3.74	0.902	0.807	0.741
CloAccFin4	3.70	0.914	0.751	0.677
CloAccFin5	3.60	0.849	0.893	0.853
CloAccFin6	3.30	0.832	0.852	0.788
CloAccFin7	3.33	0.837	0.831	0.748
CloAccFin8	3.72	0.854	0.836	0.763
Human capital				
HumCap1	3.84	0.721	0.794	0.741
HumCap2	3.91	0.750	0.787	0.733
HumCap3	3.81	0.764	0.808	0.753
HumCap4	3.74	0.693	0.825	0.771
HumCap5	3.07	0.704	0.851	0.802
HumCap6	3.05	0.688	0.843	0.793
HumCap7	3.70	0.832	0.844	0.794
HumCap8	3.98	0.636	0.832	0.785
HumCap9	3.77	0.718	0.851	0.804
Structural capital				
StrCap1	3.65	0.923	0.767	0.716
StrCap2	3.70	0.939	0.810	0.754
StrCap3	3.93	0.856	0.895	0.854
StrCap4	3.84	0.898	0.884	0.847
StrCap5	3.81	0.932	0.894	0.858
StrCap6	3.84	0.924	0.886	0.851
StrCap7	3.74	0.928	0.810	0.779
StrCap8	3.93	0.910	0.820	0.734
StrCap9	3.91	0.947	0.669	Removed
Relational capital				
RelCap1	3.74	0.902	0.719	0.573
RelCap2	3.72	0.908	0.643	Removed
RelCap3	3.02	0.913	0.843	0.774
RelCap4	3.72	0.797	0.738	0.627
RelCap5	3.21	0.861	0.735	0.623
RelCap6	3.21	0.861	0.594	Removed
RelCap7	3.00	0.845	0.842	0.755
RelCap8	3.30	0.989	0.780	0.730
RelCap9	3.09	0.971	0.703	0.668
Business performance				
BusPer1	3.91	0.750	0.823	0.747
BusPer2	3.19	0.764	0.921	0.877
BusPer3	3.28	0.854	0.912	0.861
BusPer4	3.19	0.906	0.891	0.838
BusPer5	3.14	0.861	0.802	0.723
BusPer6	3.88	0.731	0.867	0.805

Table I.
Item statistics

approach is recommended for the analysis of small datasets of up to 100 cases (Hoyle, 1999), it is therefore appropriate for use in this instance. Furthermore, with regard to minimum sample size requirements within PLS, the general rule of thumb (Barclay *et al.*, 1995; Chin, 1997) for a study with "reflective" indicators (i.e. the items/measures/

	CloAccFin	HumCap	StrCap	RelCap	BusPer
CloAccFin2	*0.824*	0.628	0.328	0.593	0.567
CloAccFin3	*0.804*	0.591	0.425	0.468	0.479
CloAccFin4	*0.750*	0.561	0.337	0.479	0.494
CloAccFin5	*0.896*	0.600	0.400	0.565	0.519
CloAccFin6	*0.856*	0.560	0.219	0.426	0.473
CloAccFin7	*0.830*	0.579	0.242	0.500	0.469
CloAccFin8	*0.838*	0.634	0.264	0.520	0.568
HumCap1	0.645	*0.794*	0.451	0.510	0.723
HumCap2	0.608	*0.787*	0.641	0.587	0.752
HumCap3	0.482	*0.808*	0.536	0.525	0.614
HumCap4	0.627	*0.825*	0.400	0.581	0.663
HumCap5	0.680	*0.851*	0.431	0.561	0.640
HumCap6	0.633	*0.843*	0.432	0.602	0.667
HumCap7	0.623	*0.844*	0.413	0.295	0.464
HumCap8	0.574	*0.832*	0.473	0.408	0.614
HumCap9	0.447	*0.851*	0.323	0.404	0.471
StrCap1	0.360	0.437	*0.771*	0.360	0.459
StrCap2	0.407	0.476	*0.804*	0.426	0.503
StrCap3	0.308	0.469	*0.898*	0.335	0.447
StrCap4	0.320	0.433	*0.893*	0.299	0.428
StrCap5	0.354	0.556	*0.900*	0.360	0.490
StrCap6	0.323	0.524	*0.895*	0.330	0.521
StrCap7	0.238	0.396	*0.833*	0.279	0.457
StrCap8	0.290	0.438	*0.796*	0.287	0.650
RelCap1	0.397	0.454	0.257	*0.681*	0.488
RelCap3	0.448	0.429	0.335	*0.853*	0.558
RelCap4	0.423	0.435	0.447	*0.728*	0.576
RelCap5	0.522	0.588	0.263	*0.724*	0.554
RelCap7	0.579	0.559	0.191	*0.834*	0.503
RelCap8	0.555	0.474	0.410	*0.812*	0.661
RelCap9	0.378	0.316	0.225	*0.765*	0.465
BusPer1	0.430	0.555	0.606	0.587	*0.823*
BusPer2	0.581	0.667	0.475	0.557	*0.921*
BusPer3	0.487	0.626	0.446	0.639	*0.912*
BusPer4	0.528	0.663	0.420	0.599	*0.891*
BusPer5	0.520	0.654	0.502	0.623	*0.802*
BusPer6	0.660	0.757	0.589	0.669	*0.867*

Table II.
Matrix of loadings and cross-loadings

	Internal consistency		Convergent validity
	α (0.70)	Fornell and Larcker (0.70)	Fornell and Larcker (0.50)
CloAccFin	0.922	0.9390	0.6878
HumCap	0.941	0.9509	0.6830
StrCap	0.944	0.9542	0.7231
RelCap	0.886	0.9119	0.5980
BusPer	0.934	0.9493	0.7577

Table III.
Internal consistency and convergent validity

statements which comprise each construct "reflect" or are manifestations of the construct) is ten times the largest number of antecedent constructs (i.e. cloud-based accounting/finance infrastructure, human capital, structural capital and relational capital) leading to an endogenous construct (i.e. business performance). Therefore, the

minimum sample size here is 40 (4 antecedent constructs × 10). As this study generated 43 responses, for the purposes of conducting regression analysis the sample size here is acceptable for this exploratory research.

Using a PLS approach, the validity and reliability of the measurement model (constructs and their corresponding items – see the Appendix) must be validated prior to assessing a proposed structural model (i.e. the relationships between the constructs). First, the reliability of each item is statistically assessed – see Table I. Second, the relationship between the item and each construct is reviewed – see Table II. Third, the statistical validity of each construct is assessed – see Table III. And finally, the relationship among constructs is reviewed – see Table IV. The remainder of this section details each step in confirming the validity and reliability of the measurement model. Using PLS, the measurement model is assessed by first investigating individual item (i.e. question/statement) reliability. The normal protocol for items used in previous research is to accept those with loadings of 0.70 or greater (Carmines and Zeller, 1979). As loadings are correlations (i.e. an item's loading squared), this implies that more than 50 per cent of the variance contained within an individual item is shared with the construct (Barclay *et al.*, 1995). Any item that fails to meet this 0.70 loading threshold is generally removed from further statistical analysis, unless a valid reason exists for its retention.

As noted earlier this research is exploratory. Thus, the items used were developed specifically by the researchers and have not been used or tested previously. At such early stages of item development, minimum item loadings of 0.60 or even 0.50 are often deemed acceptable (see e.g. Ford *et al.*, 1986; Hair *et al.*, 1987; Birkinshaw *et al.*, 1995; Chin, 1998; Hulland, 1999). However, a 0.70 item loading threshold is adopted here rather than a lower alternative (0.60, 0.50) normally prescribed for exploratory research as using the 0.70 loading level supports a higher degree of statistical validation for subsequent results. Despite the purposive sampling in this study, a relatively low absolute number of respondents use cloud-based accounting and finance applications. Thus, using the higher 0.70 loading level adds statistical strength to the subsequent analysis. A small number of items failed to reach the 0.70 loading threshold (see Table I – CloAccFin1, StrCap9, RelCap2 and RelCap6) and were subsequently removed from further statistical testing. The remaining items in each construct were then re-evaluated by examining the corrected item-to-total correlation score (see Table I). All items successfully reached the minimum threshold of 0.35 (Saxe and Weitz, 1982).

It is interesting to note that in relation to one of the items removed from further statistical analysis (i.e. CloAccFin1 – it has limited our ability to customise accounting/finance systems to our needs), the loading level generated was −0.160 (see Table I). This "negative" result indicates that the use of a cloud-based accounting/finance infrastructure within the sample of firms who participated in the study actually enables

	CloAccFin	HumCap	StrCap	RelCap	BusPer
CloAccFin	*0.829*				
HumCap	0.716	*0.826*			
StrCap	0.386	0.553	*0.850*		
RelCap	0.608	0.597	0.395	*0.773*	
BusPer	0.612	0.751	0.581	0.706	*0.870*

Table IV. Discriminant validity – correlation of constructs

(and not restricts) these firms to customise their accounting/finance systems to their needs – a finding that is supported by subsequent statistical analysis.

A matrix of loadings of cross-loadings was then constructed (see Table II) to test the discriminant validity of each of the remaining items contained within each construct. To do this, the loading of a particular item within its associated construct is compared with its cross-loadings for each of the other constructs. Here, as all of the remaining items had higher loadings with their corresponding constructs when compared to their cross-loadings, it can be concluded that each item has adequate discriminant validity. Having determined the statistical validity of the survey items (as per Tables I and II), the researchers then focused their attention on the appropriateness of the constructs themselves. Consequently, these were tested for both internal consistency and convergent validity (see Table III). Internal consistency is evaluated using both the Fornell and Larcker (1981) measure and Cronbach's α. All five constructs used in this study easily met the 0.70 threshold for both of these measures. Similarly, with regard to convergent validity, all five constructs met the minimum threshold level (average variance extracted (AVE)) of 0.50 deemed necessary for this test (Fornell and Larcker, 1981).

Finally, discriminant validity at the construct level was tested using the Convergent Validity measure as developed by Fornell and Larcker (1981). In this test, the shared variance between any two constructs should be less than the variance extracted by either of the individual constructs (i.e. values along the diagonal of the correlation matrix (the square root of the AVE for each construct) should be greater than the corresponding values in each row or column). As Table IV illustrates this was the outcome here, thereby validating the existence of adequate discriminant validity at the construct level for all five constructs.

Having confirmed the statistical validity and reliability of the items and constructs (i.e. the "measurement model") used in this study, the results of the PLS statistical testing performed upon the conceptual model (i.e. the "structural model") can now be analysed. For this task, the PLS-Graph version 3.0 software application was used. This application has been used previously in similar IC-based studies (see e.g. Bontis, 1998; Bontis and Fitz-enz, 2002; Ordonez de Pablos, 2002; Wang and Chang, 2005; Do Rosario Cabrita and Landeiro Vaz, 2006; Cleary *et al.*, 2007; Cleary, 2009, 2015). The next section reveals the findings.

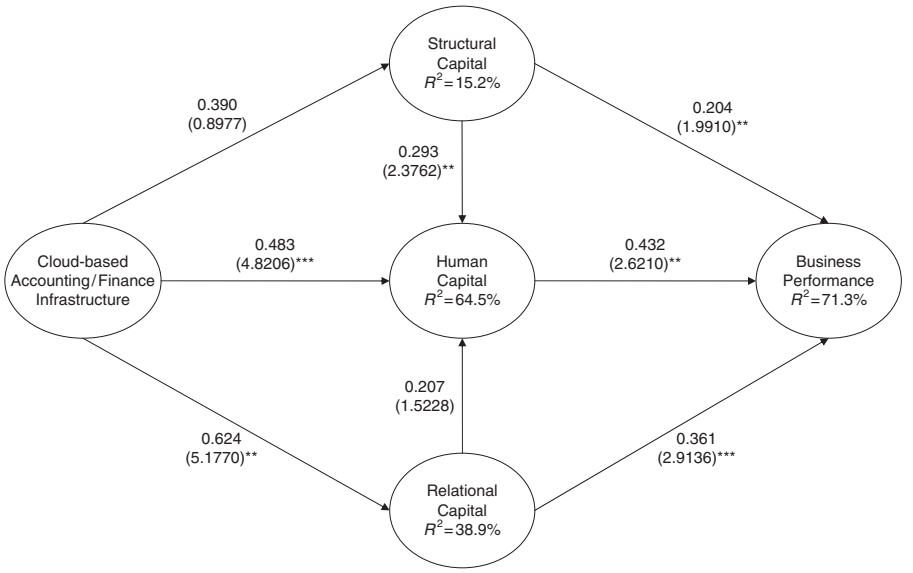
4. Findings

Before detailing the model results, some general findings from the survey are worthy of brief mention. As noted in Section 3, the purposive sample provided a higher proportion of respondents using a cloud-based accounting and finance infrastructure than noted in previous research (Carcary *et al.*, 2013; Strauβ *et al.*, 2014). However, even within this sample, it would seem SMEs are somewhat reluctant to adopt a cloud-based accounting and finance infrastructure. Quinn *et al.* (2014) noted security concerns as a key issue. Here, 37 per cent of respondents not using a cloud-based accounting and finance infrastructure cited security and/or privacy as an issue. Lack of time was cited by 14 per cent, lack of expertise by 15 per cent and a perception of no improvement in accounting processes by 13 per cent. Finally, in contrast to Quinn *et al.* (2014), where 36 per cent of non-cloud adopters cited integration as an issue, only 8 per cent of non-adopters in this survey gave this reason. While these findings are not the primary concern of this research, it does suggest that SMEs who are familiar with and/or using cloud computing in general are more likely to adopt it for accounting purposes too.

In terms of the structural model, Figure 1 depicts a model which suggests that the use of a cloud-based accounting and finance infrastructure (i.e. the delivery of existing accounting and finance systems via a cloud computing platform) can positively impact upon each of the three components of a firms' IC. Based upon the continual interaction of these three elements, organisational value is then created which in-turn positively affects subsequent business performance. The results obtained from the statistical analysis are also shown in Figure 1.

On the assertion that the introduction of a cloud-based accounting/finance infrastructure can positively impact upon firms' IC, the result for structural capital, although positive (0.390) is not statistically significant. This is not necessarily unexpected, as the basic premise behind the use of cloud computing from an accounting/finance perspective is that while the mechanics of the accounting/finance systems themselves may not have changed, their delivery has. Therefore, when considered in isolation, this result should not be viewed as contradicting Novas *et al.* (2012) who reported a positive and statistically significant relationship between structural capital and (management) accounting systems or endorsing Cleary (2015) whose research findings did not support the earlier researchers. Instead, it suggests that the acquisition, access, sharing and use of financial data/knowledge facilitated by the use of cloud computing technologies is likely to have a positive impact elsewhere within the sample of Irish SMEs who participated in the study.

A regularly cited benefit of cloud computing is that it makes information (incorporating accounting/finance) easier to share (Du and Cong, 2010; Marston *et al.*, 2011; Robinson, 2011; Strauβ *et al.*, 2014). This is supported by the results generated here as the paths between cloud-based accounting/finance infrastructure and both human capital (0.483) and relational capital (0.624) are positive and statistically significant at a p-value < 0.01. Internally, this suggests that the use of a cloud



Notes: Top number is path, t-values in parantheses. Significant at $^{**}p<0.05$; $^{***}p<0.01$

Figure 1.
The impact of cloud-based accounting/finance infrastructure on IC and business performance

computing infrastructure in the area of accounting/finance appears to be having a positive impact on how employees (both financial and non-financial) in Irish SMEs are performing their duties (e.g. an increased ability to collaborate, generate/transfer knowledge, etc.). Externally, the results indicate that the use of a cloud-based accounting/finance infrastructure seems to be facilitating an enhanced ability amongst Irish SMEs to acquire and use information about their key stakeholders coupled with increased interaction between both parties. Collectively, these results provide partial support for the suggestion that the implementation of cloud-based accounting/finance infrastructure in Irish SMEs can potentially enhance their IC.

On the relationships between the three components of IC and subsequent business performance, the β path coefficient between relational capital and business performance was found to be both positive (0.361) and statistically significant at a p-value < 0.01. A similar positive and statistically significant result was found between structural capital and business performance (0.204), as well as human capital and business performance (0.432) – albeit at p-values < 0.05. Collectively, these results support the ability of Irish-based SMEs to utilise their IC to create value which positively impacts upon their subsequent business performance. This particular finding strongly supports previous IC-based research (see e.g. Sharabati *et al.*, 2010; Novas *et al.*, 2012; Mention and Bontis, 2013) which was conducted in a variety of industry settings and geographic locations. It also supports previous research conducted within an SME setting (Bontis *et al.*, 2000; St-Pierre and Audet, 2011; Cohen *et al.*, 2014). Taken together, all of the results discussed thus far provide support for the assertions made by both Afshari (2014) and Bhadani (2014) who suggested that the use of cloud computing has the potential to positively impact upon firms' IC and their subsequent overall performance.

The results from the conceptual model also reveal that the β path coefficient between the relational capital construct and the human capital construct while positive (0.207) is not statistically significant. In contrast, the path between the structural capital construct and the human capital construct is both positive (0.293) and statistically significant at a p-value < 0.05. These results suggest that data, information and knowledge obtained from sources including SMEs cloud-based internal accounting and finance systems appear to have a greater influence in supporting employees in carrying out their daily duties than similar information obtained from external sources (Strauβ *et al.*, 2014). How exactly this influence is exerted remains uncertain and is therefore worthy of further investigation.

The R^2 values generated by each of the endogenous constructs used in the conceptual model are; structural capital – 15.2 per cent, relational capital – 38.9 per cent, human capital – 64.5 per cent and business performance – 71.3 per cent. The R^2 value of the business performance construct at 71.3 per cent is highly encouraging, as it suggests strong support for the hypothesis that the use of cloud-based accounting/finance infrastructure in SMEs can positively impact on their subsequent business performance through the prism of their IC. This is so, as within the PLS methodological approach, R^2 values for endogenous constructs (e.g. business performance) provide a measure of the predictive power for a particular conceptual model – i.e. how well a particular model is performing. In this instance, the answer is that the model performs very well, although the exploratory nature of this research coupled with the sample size must be acknowledged. Nevertheless, given the extremely competitive nature within which Irish SMEs compete, any development that can potentially offer them a trading advantage over their rivals must be seriously considered. Based on this research, it appears that the use of a cloud-based accounting/finance infrastructure represents one possible approach.

5. Concluding comments

Cloud computing offers small and medium-sized firms the possibility of realising benefits such as superior technology, enhanced security, cost savings and more efficient business processes (Marston *et al.*, 2011; Strauβ *et al.*, 2014). Some of these advantages were not previously available to SMEs, due primarily to capital investment limitations (Paul, 2010; Drew, 2012). Within the accounting/finance domain, the potential advantages associated with the use of cloud computing technologies include an increase in the flow of information, thereby making it more formalised and accessible and potentially resulting in superior organisational decision making (Young, 2010). If managed appropriately, this may ultimately result in enhanced value creation amongst a firm's collection of unique IC resources and improved overall business performance (Afshari, 2014; Bhadani, 2014).

The results from this exploratory study (see Figure 1) suggest that Irish-based SMEs can potentially enhance their business performance through realising some or all of the potential benefits associated with the implementation and use of a cloud computing based infrastructure in the accounting/finance area. Specifically, the results suggest that each of the three elements of firms' IC can be positively impacted to varying degrees by the use of a cloud-based accounting/finance infrastructure and that the continual interaction amongst all three elements of firms IC (empowered by the use of a cloud-based accounting/finance infrastructure) can create organisational value, resulting in enhanced business performance. This finding on value creation is consistent with prior IC-based research (Marr *et al.*, 2004; Cuganesan, 2005; Cuganesan and Dumay, 2009; Giuliani and Marasca, 2011) – with cloud computing acting as the lever in this instance. Similarly, the positive impact of IC on business performance supports previous IC research in this area (see e.g. Marr *et al.*, 2004; Sharabati *et al.*, 2010; Novas *et al.*, 2012; Dumay, 2013; Mention and Bontis, 2013).

As SMEs increasingly trade on a global basis, where competitiveness and cost control are of paramount importance to both survival and prosperity, the adoption and subsequent realisation of benefits from technologies such as cloud computing are to be welcomed. Indeed, such are the possible advantages associated with cloud computing that it seems likely that SMEs who decide against pursuing it may quickly and irrevocably find themselves at a competitive disadvantage to those that do. This realisation represents an endorsement of the views of Edvinsson (2013) when he suggested that cloud computing had the capability to transform how firms currently operate.

The fact that it has been suggested that Irish-based SMEs currently experience significantly lower labour productivity than other sectors of the Irish economy (European Commission, 2013), indicates that the adoption of cloud computing and other advanced technologies are to be strongly encouraged here. By doing so, it is hoped that Irish-based SMEs can transform their accounting/finance functions to become a key element of their strategic architecture and therefore critical to their future decision making. The fact that the number of SMEs in Ireland comprises the vast majority of firms in existence (Lawless *et al.*, 2012) only compounds the need for such firms to embrace technological developments as and when they emerge. However, to reach this plateau, accountants will need to be both reassured and satisfied that elements of the accounting/finance function (and the data underpinning it) within their respective firms are ready and able to migrate to the cloud. To do so, the previously held reservations concerning the use of cloud computing in the accounting/finance area (e.g. data protection, security, privacy, etc.) will need to be overcome (see e.g. Gill, 2011;

Howlett, 2011; Quinn *et al.*, 2014). It thus seems reasonable to conclude that much work remains to be done in this regard.

There are of course limitations associated with this study. First, as this research project was conducted solely within the confines of Irish-based SMEs, the results reported here are not generalisable to other sectors of the Irish economy, or to other economies. Second, by using a survey instrument to collect data, the findings are general in nature and thus, do not explain unique organisational nuances associated with the use of a cloud-based accounting/finance infrastructure. Third, although great care has been taken in this exploratory research, the items used in this study were developed specifically for it and thus, have not been previously used elsewhere. Consequently, these items need further testing in other research settings so as to confirm their statistical validity. The exploratory nature of the study also ensures that generalisations cannot be made. Fourth, the cloud-based accounting/finance infrastructure survey items developed and used here (see the Appendix) are of a general disposition, and therefore do not allow the researchers to offer any definitive guidance concerning the specific impact of either management accounting or financial accounting on the IC and subsequent business performance of the respondent firms.

Based upon the findings, there are several avenues available for further research. First, as the use of cloud computing is a relatively new concept for many organisations; research in this area is limited. Therefore, from an accounting/finance perspective, a possible future avenue for research would be to conduct some in-depth case studies to determine how exactly Irish (or other) SMEs are using their cloud-based accounting/finance infrastructure (with a specific focus on both management accounting and financial accounting) to create value and improve their overall business performance. In other words, studies which take the exploratory nature of this study to a more in-depth level are to be welcomed. The adoption of such an approach would be consistent with the calls made by, Mouritsen (2006) and Cuganesan and Dumay (2009) who advocated additional IC-based research at the organisational level to highlight its impact on value creation. Second, the items and constructs used in this study could be replicated in a variety of other organisational sectors (e.g. pharmaceutical, IT, financial services) to determine whether the results generated here are applicable elsewhere. Third, the cloud accounting/finance infrastructure survey items (see the Appendix) used in this study are essentially reflective of underlying organisational routines. More in-depth studies of such routines (see e.g. Pentland *et al.*, 2010) in various organisational settings would provide useful and more comprehensive insights on how cloud technologies affect accounting within SMEs, and other organisation types. Finally, studies using larger samples would be welcomed to expand the exploratory nature of this study.

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Note

1. See for example, www.siliconrepublic.com/enterprise/2012/07/19/can-ireland-be-the-european-capital-of-cloud-computing or www.theidcc.com/html/ecosystem/cloud_computing.html

References

Afshari, M. (2014), "Cloud-based knowledge management", CloudTweaks, available at: http://cloudtweaks.com/2014/06/cloud-based-knowledge-management/ (accessed 25 October 2014).

Argilés, J.M. and Slof, E.J. (2003), "The use of financial accounting information and firm performance: an empirical quantification for farms", *Accounting and Business Research*, Vol. 33 No. 4, pp. 251-273.

Barclay, D., Higgins, C. and Thompson, R. (1995), "The partial least squares (PLS) approach to causal modeling: personal computer adoption and use as an illustration", *Technology Studies*, Vol. 2 No. 2, pp. 285-309.

Bhadani, R. (2014), "A new dimension in HRM: cloud computing", *International Journal of Business and Management Invention*, Vol. 3 No. 7, pp. 13-15.

Birkinshaw, J., Morrison, A. and Hulland, J. (1995), "Structural and competitive determinants of a global integration strategy", *Strategic Management Journal*, Vol. 16 No. 8, pp. 637-655.

Bontis, N. (1998), "Intellectual capital: an exploratory study that develops measures and models", *Management Decision*, Vol. 36 No. 2, pp. 63-76.

Bontis, N. (1999), "Managing an organizational learning system by aligning stocks and flows of knowledge – an empirical examination of intellectual capital, knowledge management and business performance", Doctor of Philosophy dissertation, Richard Ivey School of Business, The University of Western Ontario, Ontario.

Bontis, N. (2002), "Human capital ROI: written report", available at: www.business.mcmaster.ca/mktg/nbontis/ic/publications/BontisHC.pdf (accessed 22 October 2014).

Bontis, N. and Fitz-enz, J. (2002), "Intellectual capital ROI: a causal map of human capital antecedents and consequents", *Journal of Intellectual Capital*, Vol. 3 No. 3, pp. 223-247.

Bontis, N., Chua Chong Keow, W. and Richardson, S. (2000), "Intellectual capital and business performance in Malaysian industries", *Journal of Intellectual Capital*, Vol. 1 No. 1, pp. 85-100.

Booth, R. (1998), "The measurement of intellectual capital", *Management Accounting*, Vol. 76 No. 10, pp. 26-28.

Burns, J. and Scapens, R. (2000), "Conceptualising management accounting change: an institutional framework", *Management Accounting Research*, Vol. 11 No. 1, pp. 3-25.

Burns, J., Ezzamel, M. and Scapens, R. (1999), "Management accounting change in the UK", *Management Accounting*, Vol. 77 No. 3, pp. 28-30.

Cabrita, M.R. and Bontis, N. (2008), "Intellectual capital and business performance in the Portugese banking industry", *International Journal of Technology Management*, Vol. 43 Nos 1/3, pp. 212-237.

Canibano, L., Garcia-Ayuso, M. and Sanchez, P. (2000), "Accounting for intangibles: a literature review", *Journal of Accounting Literature*, Vol. 19, pp. 102-124.

Carmines, E.G. and Zeller, R.A. (1979), *Reliability and Validity Assessment*, Sage Publications, Thousand Oaks, CA.

Carcary, M., Doherty, E. and Conway, G. (2013), "Understanding and supporting cloud computing adoption in Irish small and medium-sized enterprises", white paper, Innovation Value Institute, National University of Ireland Maynooth, Ireland, available at: http://ivi.nuim.ie/sites/ivi.nuim.ie/files/publications/IVI%20Exec%20Briefing%20-%20Cloud%20Adoption%20in%20SME%20Nov13%20v1%200.pdf (accessed 13 November 2014).

Chin, W. (1998), "The partial least squares approach to structural equation modeling", in Marcoulides, G.A. (Eds), *Modern Methods for Business Research*, Lawrence Erlbaum Associates, Mahwah, NJ, pp. 295-366.

Chin, W. (1997), "Overview of the PLS method", available at: http://disc-nt.cba.uh.edu/chin/PLSINTRO.HTM (accessed 15 September 2014).

Clarke, M., Seng, D. and Whiting, R.H. (2011), "Intellectual capital and firm performance in Australia", *Journal of Intellectual Capital*, Vol. 12 No. 4, pp. 505-530.

Cleary, P. (2009), "Exploring the relationship between management accounting and structural capital in a knowledge-intensive sector", *Journal of Intellectual Capital*, Vol. 10 No. 1, pp. 37-52.

Cleary, P. (2015), "An empirical investigation of the impact of management accounting on structural capital and business performance", *Journal of Intellectual Capital*, Vol. 16 No. 3, pp. 566-586.

Cleary, P., Kennedy, T., O'Donnell, D., O'Regan, P. and Bontis, N. (2007), "Positioning management accounting on the intellectual capital agenda", *International Journal of Accounting, Auditing and Performance Evaluation*, Vol. 4 Nos 4/5, pp. 336-359.

Cohen, S., Naoum, V.C. and Vlismas, O. (2014), "Intellectual capital, strategy and financial crisis from a SMEs perspective", *Journal of Intellectual Capital*, Vol. 15 No. 2, pp. 294-315.

Connolly, T. (2010), "Demystifying cloud computing", finance leaders articles, Chartered Accountants Ireland, March, available at: http://archive-ie.com/page/4059548/2014-06-02/http://www.charteredaccountants.ie/en/Members/Technical/Finance-Leaders-Articles/Demystifying-Cloud-Computing—Tony-Connolly-FCA/ (accessed 22 October 2014).

Cooper, T. (2011), "Cloud computing: benefits versus risks", Chartered Institute of Management Accountants, *Insight*, July, available at: www.cimaglobal.com/Thought-leadership/Newsletters/Insight-e-magazine/Insight-2011/Insight-July-2011/Cloud-computing/ (accessed 22 October 2014).

Cuganesan, S. (2005), "Intellectual capital-in-action and value creation", *Journal of Intellectual Capital*, Vol. 6 No. 3, pp. 357-373.

Cuganesan, S. and Dumay, J.C. (2009), "Reflecting on the production of intellectual capital visualisations", *Accounting, Auditing and Accountability Journal*, Vol. 22 No. 8, pp. 1161-1186.

Daou, A., Karuranga, E. and Su, Z. (2014), "Towards a better understanding of intellectual capital in Mexican SMEs", *Journal of Intellectual Capital*, Vol. 15 No. 2, pp. 316-332.

Davenport, T.H. (2000), *Mission Critical: Realising the Promise of Enterprise Systems*, Harvard Business School Press, Boston, MA.

Davila, A. and Foster, G. (2007), "Management control systems in early-stage startup companies", *The Accounting Review*, Vol. 82 No. 4, pp. 907-937.

Dess, G.G. and Robinson, R.B. (1984), "Measuring organizational performance in the absence of objective measures: the case of the privately-held firm and conglomerate business unit", *Strategic Management Journal*, Vol. 5 No. 3, pp. 265-273.

Dierickx, I. and Cool, K. (1989), "Asset stock accumulation and sustainability of competitive advantage", *Management Science*, Vol. 35 No. 12, pp. 1504-1511.

Do Rosario Cabrita, M. and Landeiro Vaz, J. (2006), "Intellectual capital and value creation: evidence from the Portugese banking industry", *The Electronic Journal of Knowledge Management*, Vol. 4 No. 1, pp. 11-20.

Drew, J. (2012), "Heads in the cloud: part 2", *Journal of Accountancy*, March, pp. 34-37.

Du, H. and Cong, Yu. (2010), "Cloud computing, accounting, auditing, and beyond", *The CPA Journal*, October, pp. 66-70.

Dumay, J. (2012), "Grand theories as barriers to using IC concepts", *Journal of Intellectual Capital*, Vol. 13 No. 1, pp. 4-15.

Dumay, J. (2013), "The third stage of IC: towards a new IC future and beyond", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 5-9.

Dumay, J. and Garanina, T. (2013), "Intellectual capital research: a critical examination of the third stage", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 10-25.

Edvinsson, L. (2013), "IC 21: reflections from 21 years of IC practice and theory", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 163-172.

Edvinsson, L. and Malone, M. (1997), *Intellectual Capital: Realising Your Company's True Value By Finding its Hidden Brainpower*, Harper Collins Publishers, New York, NY.

Edvinsson, L. and Sullivan, P. (1996), "Developing a model for managing intellectual capital", *European Management Journal*, Vol. 14 No. 4, pp. 356-364.

Edwards, J.S., Collier, P.M. and Shaw, D. (2005), "Knowledge management and its impact on the management accountant", research report, Chartered Institute of Management Accountants (CIMA), London, available at: www.cimaglobal.com/Documents/ImportedDocuments/tech_resrep_knowledge_management_and_its_impact_on_the_management_accountant_2005.pdf (accessed 22 October 2014).

European Commission (2013), "Enterprise and industry – 2013 SBA fact sheet Ireland", available at: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/countries-sheets/2013/ireland_en.pdf (accessed 1 December 2014).

Ford, J.K., MacCallum, R.C. and Tait, M. (1986), "The application of exploratory factor analysis in applied psychology: a critical review and analysis", *Personnel Psychology*, Vol. 39 No. 2, pp. 291-314.

Fornell, C. and Larcker, V.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Garcia-Ayuso, M. (2003), "Intangibles – lessons from the past and a look into the future", *Journal of Intellectual Capital*, Vol. 4 No. 4, pp. 597-604.

Gill, R. (2011), "Why cloud computing matters to finance", *Strategic Finance*, January, pp. 43-47.

Giovannoni, E., Maraghini, P. and Riccaboni, A. (2011), "Transmitting knowledge across generations: the role of management accounting practices", *Family Business Review*, Vol. 24 No. 2, pp. 126-150.

Giuliani, M. (2015), "Rome wasn't built in a day … reflecting on time, intellectual capital and intellectual liabilities", *Journal of Intellectual Capital*, Vol. 16 No. 1, pp. 2-19.

Giuliani, M. and Marasca, S. (2011), "Construction and valuation of intellectual capital: a case study", *Journal of Intellectual Capital*, Vol. 12 No. 3, pp. 377-391.

Granlund, M. and Malmi, T. (2002), "Moderate impact of ERPS on management accounting: a lag or permanent outcome?", *Management Accounting Research*, Vol. 13 No. 3, pp. 299-321.

Grant, R.M. (1997), "Strategy at the leading edge. The knowledge-based view of the firm: implications for management practice", *Long Range Planning*, Vol. 30 No. 3, pp. 450-454.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, Winter Special Issue, pp. 109-122.

Hair, J.F., Anderson, R.E. and Tatham, R.L. (1987), *Multivariate Data Analysis*, Macmillan, New York, NY.

Hansen, G.S. and Wernerfelt, B. (1989), "Determinants of firm performance: the relative importance of economic and organisational factors", *Strategic Management Journal*, Vol. 10 No. 5, pp. 399-411.

Henry, L. (2013), "Intellectual capital in a recession: evidence from UK SMEs", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 84-101.

Hiebl, M.R.W. (2013), "Management accounting in the family business: tipping the balance for survival", *Journal of Business Strategy*, Vol. 34 No. 6, pp. 19-25.

Hiebl, M.R.W., Feldbauer-Durstmüller, B., Duller, C. and Neubauer, H. (2012), "Institutionalisation of management accounting in family businesses: empirical evidence from Austria and Germany", *Journal of Enterprising Culture*, Vol. 20 No. 4, pp. 405-436.

Howlett, D. (2011), "The bright future for cloud accounting", Chartered Institute of Management Accountants, *Insight*, June, available at: www.cimaglobal.com/Thought-leadership/Newsletters/Insight-e-magazine/Insight-2011/Insight-July-2011/The-bright-future-for-cloud-accounting/ (accessed 22 October 2014).

Hoyle, R.H. (1999), *Statistical Strategies for Small Sample Research*, Sage Publications, Thousand Oaks, CA.

Hulland, J. (1999), "Use of partial least squares (PLS) in strategic management research: a review of four recent studies", *Strategic Management Journal*, Vol. 20 No. 2, pp. 195-204.

Jardon, C.M.F. and Martos, M.S. (2009), "Intellectual capital and performance in wood industries of Argentina", *Journal of Intellectual Capital*, Vol. 10 No. 4, pp. 600-616.

Jardon, C.M.F. and Martos, M.S. (2012), "Intellectual capital as competitive advantage in emerging clusters in Latin America", *Journal of Intellectual Capital*, Vol. 13 No. 4, pp. 462-481.

Kristandl, G. and Quinn, M. (2012), "Old wine in new bottles? A preliminary exploration of management accounting in cloud business models", paper presented at the European Accounting Association Annual Conference, Ljubljana, 9-11 May.

Lawless, M., McCann, F. and McIndoe-Calder, T. (2012), "SMEs in Ireland: stylised facts from the real economy and credit market", Central Bank of Ireland Quarterly Bulletin, 2 April, pp. 99-123, available at: www.centralbank.ie/publications/Documents/SMEs%20in%20Ireland%20Stylised%20facts%20from%20the%20real%20economy%20and%20credit%20market.pdf (accessed 12 November 2014).

Lev, B. and Daum, J. (2003), "Intangible assets and the need for a holistic and more future-oriented approach to enterprise management and corporate reporting", paper presented at the Performance Measurement Association Intellectual Capital Symposium, Cranfield University, Cranfield, 1-2 October.

Lev, B. (2001), *Intangibles: Management, Measurement and Reporting*, The Brookings Institution, Washington, DC.

Low, J. (2002), "The invisible advantage: getting a grasp on intangible assets", *Perspectives on Business Innovation*, No. 7, pp. 7-14, available at: www.leader-values.com/article.php?aid=205 (accessed 28 September 2015).

Lynn, B.E. (1999), "The management of intellectual capital: the issues and the practice", *Management Accounting Issues Paper*, Vol. 16, The Society of Management Accountants of Canada, Hamilton, ON, pp. 1-62.

Marr, B., Schiuma, G. and Neely, A. (2004), "The dynamics of value creation: mapping your intellectual performance drives", *Journal of Intellectual Capital*, Vol. 5 No. 2, pp. 312-325.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. and Ghalsasi, A. (2011), "Cloud computing – the business perspective", *Decision Support Systems*, Vol. 51 No. 1, pp. 176-189.

Mention, A.L. and Bontis, N. (2013), "Intellectual capital and performance within the banking sector of Luxembourg and Belgium", *Journal of Intellectual Capital*, Vol. 14 No. 2, pp. 286-309.

Mongan, K. (2011), "Cloud computing – the storm is coming", *Accountancy Ireland*, Vol. 43 No. 3, pp. 58-59.

Mouritsen, J. (2006), "Problematising intellectual capital research: ostensive versus performative IC", *Accounting, Auditing & Accountability Journal*, Vol. 19 No. 6, pp. 820-841.

Mouritsen, J. (2004), "Measuring and intervening: how do we theorise intellectual capital management", *Journal of Intellectual Capital*, Vol. 5 No. 2, pp. 257-267.

Murphy, K. and Simon, S. (2002), "Intangible benefits valuation in ERP projects", *Information Systems Journal*, Vol. 12 No. 4, pp. 301-320.

NIST (2011), *The NIST Definition of Cloud Computing*, Special Publication 800-145, National Institute of Standards and Technology, Gaithersburg, MD, available at: http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf (accessed 9 September 2014).

Novas, J.C., Sousa, A. and Alves, M.C. (2012), "On the relations between management accounting systems and intellectual capital: evidence for Portugese companies", CEFAGE UE working paper series, Evora, available at: www.cefage.uevora.pt/en/producao_cientifica/working_papers_serie_cefage_ue/on_the_relations_between_management_accounting_systems_and_intellectual_capital_evidence_for_portuguese_companies (accessed 22 October 2014).

Ordonez de Pablos, P. (2002), "Direct and indirect effects of intellectual capital on organizational competitive advantage: empirical evidence", paper presented at "The Transparent Enterprise, The Value of Intangibles" Conference, 25-26 November, Madrid.

Ordonez de Pablos, P. (2004), "Measuring and reporting structural capital – lessons from European learning firms", *Journal of Intellectual Capital*, Vol. 5 No. 4, pp. 629-647.

Paul, F. (2010), "Why cloud computing matters to small biz", *Forbes*, 21 January, available at: www.forbes.com/2010/01/21/cloud-computing-3tera-entrepreneurs-technology-informationweek.html (accessed 22 October 2014).

Penrose, E.T. (1959), *The Theory of the Growth of the Firm*, John Wiley, New York, NY.

Pentland, B.T., Haerem, T. and Hillison, D. (2010), "Comparing organizational routines as recurrent patterns of action", *Organization Studies*, Vol. 31 No. 7, pp. 917-940.

Perren, L. and Grant, P. (2000), "The evolution of management accounting routines in small businesses: a social construction perspective", *Management Accounting Research*, Vol. 11 No. 4, pp. 391-411.

Petty, R. and Guthrie, J. (2000), "Intellectual capital literature review: measurement, reporting and management", *Journal of Intellectual Capital*, Vol. 1 No. 2, pp. 155-176.

Quinn, M. (2011), "Routines in management accounting research: further exploration", *Journal of Accounting & Organizational Change*, Vol. 7 No. 4, pp. 337-357.

Quinn, M. (2014), "Stability and change in management accounting over time – a century or so of evidence from Guinness", *Management Accounting Research*, Vol. 25 No. 1, pp. 76-92.

Quinn, M., Strauß, E. and Kristandl, G. (2014), "The effects of cloud technology on management accounting and decision-making", *Financial Management*, August, pp. 54-55.

Ricceri, F. (2008), *Intellectual Capital and Knowledge Management: Strategic Management of Knowledge Resources*, Routledge, Milton Park.

Roberts, H. (2003), "Management accounting and the knowledge production process", in Bhimani, A. (Ed.), *Management Accounting in the Digital Economy*, Oxford University Press, New York, NY, pp. 260-283.

Robinson, L. (2011), "The cloud: bringing permanent changes to business", *Financial Executive*, Vol. 27 No. 10, pp. 71-72.

Roos, J., Roos, G., Edvinsson, L. and Dragonetti, N.C. (1997), *Intellectual Capital – Navigating in the New Business Landscape*, New York University Press, New York, NY.

Russel, K. and Siegel, G. (1999), "Counting more, counting less", *Strategic Finance*, Vol. 81 No. 3, pp. 38-44.

Sanchez, P., Chaminade, C. and Olea, M. (2000), "Management of intangibles – an attempt to build a theory", *Journal of Intellectual Capital*, Vol. 1 No. 1, pp. 312-327.

Sandino, T. (2007), "Introducing the first management control systems: evidence from the retail sector", *The Accounting Review*, Vol. 82 No. 1, pp. 265-293.

Saxe, R. and Weitz, B. (1982), "The SOCO scale: a measure of the customer orientation of salespeople", *Journal of Marketing Research*, Vol. 19 No. 3, pp. 343-351.

Scapens, R., Ezzamel, M., Burns, J. and Baldvinsdottir, G. (2003), *The Future Direction of UK Management Accounting Practice*, CIMA, London.

Shang, S. and Seddon, P.B. (2002), "Assessing and managing the benefits of enterprise systems: the business manager's perspective", *Information Systems Journal*, Vol. 12 No. 4, pp. 271-299.

Sharabati, A.A., Jawad, S.N. and Bontis, N. (2010), "Intellectual capital and business performance in the pharmaceutical sector of Jordan", *Management Decision*, Vol. 48 No. 1, pp. 105-131.

Sofian, S., Tayles, M.E. and Pike, R.H. (2004), "Intellectual capital: an evolutionary change in management accounting practices", paper presented at the 4th Asia Pacific Interdisciplinary Research in Accounting Conference, Singapore Management University, Singapore, 4-6 July.

Steenkamp, N. and Kashyap, V. (2010), "Importance and contribution of intangible assets: SME managers' perceptions", *Journal of Intellectual Capital*, Vol. 11 No. 3, pp. 368-390.

Strauβ, E., Kristandl, G. and Quinn, M. (2014), "The effects of cloud technology on management accounting and decision making", *CIMA Research Executive Summary Series*, Vol. 10 No. 6, pp. 1-12, available at: www.cimaglobal.com/Documents/Thought_leadership_docs/Management%20and%20financial%20accounting/effects-of-cloud-technology-on-management-accounting.pdf (accessed 12 January 2015).

Stewart, T.A. (1997), *Intellectual Capital: The New Wealth of Organisations*, Doubleday-Currency, London.

St-Pierre, J. and Audet, J. (2011), "Intangible assets and performance – analysis on manufacturing SMEs", *Journal of Intellectual Capital*, Vol. 12 No. 2, pp. 202-223.

Sveiby, K.E. (1997), *The New Organizational Wealth: Managing and Measuring Knowledge Based Assets*, Berrett Koehler, San Francisco, CA.

Sveiby, K.E. (1998), "Measuring intangibles and intellectual capital – an emerging first standard", available at: www.sveiby.com/articles/EmergingStandard.html (accessed 24 September 2015).

Tayles, M., Bramley, A., Adshead, N. and Farr, J. (2002), "Dealing with the management of intellectual capital – the potential role of strategic management accounting", *Accounting, Auditing & Accountability Journal*, Vol. 15 No. 2, pp. 251-267.

Van der Stede, W.A., Young, S.M. and Chen, C.X. (2005), "Assessing the quality of evidence in empirical accounting research", *Accounting, Organizations and Society*, Vol. 30 Nos 7/8, pp. 655-684.

Venkatraman, N. and Ramanujam, V. (1986), "Measurement of business performance in strategic research: a comparison of approaches", *Academy of Management Review*, Vol. 11 No. 4, pp. 801-814.

Wang, W.Y. and Chang, C. (2005), "Intellectual capital and performance in causal models – evidence from the information technology industry in Taiwan", *Journal of Intellectual Capital*, Vol. 6 No. 2, pp. 222-236.

Young, R. (2010), "Cloud computing could lead to more adaptive finance function", Chartered Institute of Management Accountants, *Insight*, December, available at: www.cimaglobal.com/Thought-leadership/Newsletters/Insight-e-magazine/Insight-2010/Insight-December-2010/Cloud-computing-could-lead-to-more-adaptive-finance-function/ (accessed 22 October 2014).

Appendix. Survey items

Cloud-based accounting/finance infrastructure

The following statements relate to your perception of the use of cloud-based accounting/finance applications by your organisation in general. Please rate each statement on a scale of strongly disagree to strongly agree.

CloAccFin1: It has limited our ability to customise accounting/finance systems to our needs.
CloAccFin2: It has made our daily accounting tasks more standardised.
CloAccFin3: It has simplified our accounting processes.
CloAccFin4: It has made it easier for any accounting staff member to perform any accounting task.
CloAccFin5: It has made it easier to communicate accounting procedures to new accounting/finance staff.
CloAccFin6: It has made it easier to document accounting procedures.
CloAccFin7: It has made it easier to adapt accounting procedures.
CloAccFin8: It has made it easier to replicate accounting/finance systems to other parts/branches of the organisation.

Human capital

The following statements relate to your perception of the use of cloud-based accounting/finance applications within your organisation has helped your employees (i.e. human capital). Please rate each statement on a scale of strongly disagree to strongly agree.

It has enhanced …

HumCap1: The ability of accounting/finance employees to collaborate within the organisation.
HumCap2: Management decision making.
HumCap3: The ability of accounting/finance staff to generate knowledge.
HumCap4: The ability to transfer organisation knowledge within accounting/finance.
HumCap5: The motivation of accounting/finance employees.
HumCap6: The retention of accounting/finance employees.
HumCap7: The ability of non-accounting staff to utilise accounting/finance knowledge.
HumCap8: The feasibility of cross-functional teamwork across the organisation.
HumCap9: The willingness of accounting and finance staff to embrace further use of cloud technology.

Structural capital

The following statements relate to your perception of the use of cloud-based accounting/finance applications by your organisation from a structural capital perspective (i.e. systems, processes, etc.). Please rate each statement on a scale of strongly disagree to strongly agree.

It has enhanced our ability to …

StrCap1: Acquire relevant data/knowledge.
StrCap2: Acquire relevant data/knowledge from multiple sources.
StrCap3: Access relevant data/knowledge for decision making.
StrCap4: Access relevant data/knowledge for planning/control.
StrCap5: Share relevant data/knowledge for decision making.
StrCap6: Share relevant data/knowledge for planning/control.
StrCap7: Retain relevant data/knowledge.
StrCap8: Use accounting/finance systems within the organisation.
StrCap9: Upgrade accounting/finance systems.

Relational capital

The following statements relate to your perception of the use of cloud-based accounting/finance applications helps you/your organisation interact with others (i.e. relational capital). Please rate each statement on a scale of strongly disagree to strongly agree.

It has enhanced our ability to …

RelCap1: Acquire and use information about customers.
RelCap2: Acquire and use information about suppliers.
RelCap3: Acquire and use information about competitors.
RelCap4: Meet current customer and market needs.
RelCap5: Predict future customer and market trends.
RelCap6: Interact with our employees.
RelCap7: Interact with our shareholders.
RelCap8: Interact with relevant Government agencies (e.g. The Office of the Revenue Commissioners).
RelCap9: Interact with financial institutions (e.g. banks).

Business performance

The following statements relate to your perception of the use of cloud-based accounting/finance applications within your organisation has improved performance. Please rate each statement on a scale of strongly disagree to strongly agree.

The use of cloud-based accounting/finance systems has allowed us to …

BusPer1: Improve our overall business performance.
BusPer2: Outperform our main trading rivals.
BusPer3: Attain a competitive advantage.
BusPer4: Enhance our corporate reputation.
BusPer5: Enhance shareholder/business value.
BusPer6: Enhance our strategic decision making.

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